

		"20080144705" "20080170130" "20080211906" "20080239064" "20080246656" "20080266118" "20090002491" "20090002556" "20090027499" "20090070820" "20090122142" "20090135007" "20090169068" "20090189981" "20090207252" "20090243794" "20090252486" "20100050734" "20100097221" "20100106707" "20100177193" "20100177891" "20100188201" "20100191411" "20100194885" "20100238009" "20100238262" "20100242076" "20100265331" "20100287473" "20110006151" "20110018998" "20110050904" "20110069151" "20110084820" "20110301971" "20120056722" "20120162436" "20120189286" "20120230540" "20120268259" "20120276954" "20130021153" "20130033610" "20130080836" "20130096731" "20130222640" "20130300563" "20130343571" "20140037262" "20140092299" "20140094992" "20140192194" "20140195105" "20140210625" "20140227671" "20140311215" "20140355951" "20150050345" "20150051502" "20150053776" "20150078727" "20150088335" "20150103246" "20150229630" "4409670" "4789904" "4863130" "4918473" "5027104" "5096287" "5111289" "5289321" "5381155" "5408330" "5446659" "5453939" "5473729" "5479149" "5497419" "5526133" "5585798" "5642285" "5668675" "5689442" "5742336" "5798458" "5815093" "5878283" "5890079" "5926210" "5978017" "5983161" "5996023" "6008841" "6028528" "6052068" "6097429" "6100806" "6121881" "6141609" "6141611" "6163338" "6175300" "6298290" "6310541" "6314364" "6326900" "6333694" "6333759" "6370475" "6389340" "6405112" "6449540" "6452572" "6518881" "6525672").PN.				
S402	65	("6546119" "6560463" "6591242" "6681195" "6690268" "6697103" "6718239" "6727816" "6748792" "6823621" "6831556" "6856873" "6970183" "7012632" "7034683" "7038590" "7088387" "7119832" "7126472" "7147155" "7180407" "7190822" "7363742" "7371021" "7436955" "7448996" "7496140" "7500794" "7508941" "7536457" "7539533" "7561037" "7602301" "7659827" "7680947" "7697035" "7804426" "7806525" "7853944" "7944676" "8121306" "8269617" "8314708" "8373567" "8384539" "8446469" "8456293" "8508353" "8594485" "8606492" "8676428" "8707758" "8725462" "8744642" "8781292" "8805431" "8849501" "8854199" "8896694" "8930072" "8989914" "8996234" "9003474" "9058499" "RE37709").PN.	US-PGPUB; USPAT	OR	OFF	2016/10/17 11:44
S403	8	("20030081934" "20060271287" "20080100705" "20110018998" "20110314401" "20120038689" "20140049636" "20140218544").PN.	US-PGPUB; USPAT	OR	OFF	2016/10/17 12:13
S404	11	14/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:52
S405	5	"14040329"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:52
S406	0	04/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:52
S407	11	14/040329	US-PGPUB; USPAT;	OR	OFF	2016/10/17 13:52

Axon 1002 (Part 2 of 5)

Axon v. Digital Ally

U.S. Pat. No. 9,712,730

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S408	5	"14040329"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:52
S409	51	(Phillips-Steve.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S410	5	(Phillips-Steve.in.) and camera.clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S411	6	(Troxel-Jason-R.in.) and camera.clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S412	1460	(348/373-376.ccls.) and (button same camera)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S413	1263	(348/373-376.ccls.) and (@ad<="20120928") and (button same camera)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S414	2	(348/373-376.ccls.) and (@ad<="20120928") and (button same camera same cloth\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S415	156	((@ad<="20120928") and (button same camera same cloth\$3 same (attach\$3 or attachment\$1 or mount\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S416	9	("224".clas.) and (@ad<="20120928") and (button same camera same pocket\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2016/10/17 13:52

			IBM_TDB			
S417	343	((@ad<="20120928") and (button same camera same pocket\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S418	47	((@ad<="20120928") and (button same camera same pocket\$1 same clip\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S419	5	(348/373-376.ccls.) and (@ad<="20120928") and (cloth\$3 with clip\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S420	132	("348".clas.) and (@ad<="20120928") and (cloth\$3 with clip\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S421	332	("348".clas.) and (@ad<="20120928") and ((mount\$3 or attach\$3) with (user\$1 or person\$1) near3 (cloth\$3 or button or pocket\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S422	6	("348".clas.) and (@ad<="20120928") and ((mount\$3 or attach\$3) with (user\$1 or person\$1) near3 (cloth\$3) with (button or pocket\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S423	3	((@ad<="20120928") and ((mount\$3 or attach\$3) with (user\$1 or person\$1) near3 (cloth\$3) with button with pocket)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S424	5	((@ad<="20120928") and ((mount\$3 or attach\$3) same (user\$1 or person\$1) near3 (cloth\$3) with button with pocket)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S425	46	("6396403").URPN.	USPAT	OR	OFF	2016/10/17 13:52
S426	2	("340".clas.) and (@ad<="20120928") and ((user\$1 or person\$1) near3 (cloth\$3) with button with pocket)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52

S427	23	("340".clas.) and (@ad<="20120928") and ((cloth\$3) with button with pocket)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S428	0	(340/194,230.ccls.) and (@ad<="20120928") and (button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S429	0	(340/194,230.ccls.) and (@ad<="20120928")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S430	19	(224/194,230.ccls.) and (@ad<="20120928") and (button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S431	140	"348".clas. and (@ad<="20120928") and (pocket\$1 same button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S432	502	("224".clas.) and (@ad<="20120928") and (pocket\$1 same button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S433	262	("224".clas.) and (@ad<="20120928") and (pocket\$1 with button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S434	7	("224".clas.) and (@ad<="20120928") and (pocket\$1 with button\$1 with shirt)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S435	0	("224".clas.) and (@ad<="20120928") and (pocket\$1 with button\$1 with slot with shirt)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S436	6	((@ad<="20120928") and (pocket\$1 with button\$1 with slot with shirt)	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2016/10/17 13:52

			EPO; JPO; DERWENT; IBM_TDB			
S437	0	((@ad<="20120928") and (pocket\$1 same button\$1 same slot same shirt same camera)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S438	2	((@ad<="20120928") and (pocket\$1 same button\$1 same slot same (clothing\$1 or shirt\$1) same camera)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S439	44	((@ad<="20120928") and (pocket\$1 same button\$1 same slot same (clothing\$1 or shirt\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S440	24	("224".clas.) and (@ad<="20120928") and (button\$1 with shirt)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S441	2	10/386892	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:52
S442	26	(US-20110248060-\$ or US-20050231356-\$ or US-20050200750-\$ or US-20120019641-\$ or US-20090213204-\$ or US-20090027499-\$ or US-20100001170-\$ or US-20090193693-\$ or US-20130043144-\$ or US-20040155079-\$ or US-20100171021-\$ or US-20050035161-\$ or US-20050023316-\$ or US-20030215010-).did. or (US-8079501-\$ or US-8077029-\$ or US-6563532-\$ or US-8264558-\$ or US-6934461-\$ or US-7978263-\$ or US-7456875-\$ or US-6396403-\$ or US-D473152-\$ or US-5067642-\$ or US-8073131-\$ or US-8408513-).did.	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:52
S443	12	S442 and (button same (shirt or pocket))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:52
S444	0	("2005/0023316").URPN.	USPAT	OR	OFF	2016/10/17 13:52
S445	11799	((attach\$3 or secur\$3 or slid\$3) with button with slot)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S446	116	("224".clas.) and ((attach\$3 or secur\$3 or slid\$3) with button with slot)	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2016/10/17 13:52

			EPO; JPO; DERWENT; IBM_TDB			
S447	1	("2009/0108037").URPN.	USPAT	OR	OFF	2016/10/17 13:52
S448	1812	("224".clas.) and ((attach\$3 or secur\$3 or slid\$3 or mount\$3) with button)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S449	168	("224".clas.) and ((attach\$3 or secur\$3 or slid\$3 or mount\$3) with button same (shirt or cloth\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S450	883	((attach\$3 or secur\$3 or slid\$3 or mount\$3) with button same (shirt or cloth\$3)) and (camera or pda)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S451	9	S442 and (gps)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:52
S452	19	("2003/0215010").URPN.	USPAT	OR	OFF	2016/10/17 13:52
S453	1157	(button near2 clip) and (camera or pda)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S454	103	("348".clas.) and (@ad<="20120928") and (button near2 clip)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S455	9	("348".clas.) and (@ad<="20120928") and (button adj clip)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S456	41	("348".clas.) and (@ad<="20120928") and (button near1 clip)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S457	4	("20080030580" "5726660" "5886739" "7483485").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:52

S458	1	12/176977	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:52
S459	42	("1932581" "20020030071" "20040069823" "20080078792" "20080164291" "20080237282" "20080305840" "20100018015" "20100270345" "2085184" "2505551" "2616985" "3586798" "3604069" "3808642" "4040547" "4100653" "4700397" "5163093" "5268965" "5752632" "5771303" "5806146" "5831198" "5850613" "6149043" "6201877" "6283348" "6333984" "6757401" "7013492" "7784157").PN. OR ("8175314").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:52
S460	18	"5752632"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:52
S461	12	("5752632").URPN.	USPAT	OR	OFF	2016/10/17 13:52
S462	19	("2003/0215010").URPN.	USPAT	OR	OFF	2016/10/17 13:52
S463	19	("20030174773" "5014079" "5689442" "5808663" "6104705" "6201562" "6360003" "6681120" "6934461" "7133537").PN. OR ("7456875").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:52
S464	25	("20030081935" "20040015467" "20040091111" "3542457" "4051534" "4398799" "4425586" "4516157" "4797736" "5091719" "5189512" "5886739" "6563532" "6988144").PN. OR ("7483485").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:52
S465	872	(348/143-158.ccls.) and (@ad<="20120928") and (trigger\$3 with event\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S466	269	(348/143-158.ccls.) and (@ad<="20120928") and ((trigger\$3 with event\$1) same (automat\$3 or auto or automatical\$2))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S467	32	(348/158.ccls.) and (@ad<="20120928") and (trigger\$3 with event\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S468	87	(348/158.ccls.) and (@ad<="20120928") and (police or officer)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S469	2	11/948020	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	OFF	2016/10/17 13:52

			DERWENT; IBM_TDB			
S470	44	(US-20110248060-\$ or US-20050231356-\$ or US-20050200750-\$ or US-20120019641-\$ or US-20090213204-\$ or US-20090027499-\$ or US-20100001170-\$ or US-20090193693-\$ or US-20130043144-\$ or US-20040155079-\$ or US-20100171021-\$ or US-20050023316-\$ or US-20030215010-\$ or US-20090108037-\$ or US-20130320055-\$ or US-20130175309-\$ or US-20080030580-\$ or US-20080078792-\$ or US-20090141129-\$).did. or (US-8079501-\$ or US-8077029-\$ or US-6563532-\$ or US-8264558-\$ or US-6934461-\$ or US-7978263-\$ or US-7456875-\$ or US-6396403-\$ or US-D473152-\$ or US-5067642-\$ or US-8073131-\$ or US-8408513-\$ or US-8579172-\$ or US-5857601-\$ or US-8652038-\$ or US-6667771-\$ or US-5726660-\$ or US-5886739-\$ or US-7483485-\$ or US-8175314-\$ or US-1932581-\$ or US-2085184-\$ or US-2505551-\$ or US-5752632-\$ or US-8489065-\$).did.	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:52
S471	1	S470 and ((auto or automat\$3 or automatically) with (captur\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S472	11	14/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:52
S473	11	14/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:52
S474	11	14/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:52
S475	11	14/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:52
S476	9	("2014/0092299").URPN.	USPAT	OR	OFF	2016/10/17 13:52
S477	51	(Phillips-Steve.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:52
S478	9	(Phillips-Steve.in.) and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:52

S479	9	("2014/0092299").URPN.	USPAT	OR	OFF	2016/10/17 13:52
S480	9	(Troxel-Jason-R.in.) and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S481	1	(Troxel-Jason.in.) and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S482	96	"5886739"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S483	89	("3542457" "4051534" "4398799" "4516157" "4797736" "5091719" "5189512").PN. OR ("5886739").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:52
S484	67	"6396403"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S485	46	("6396403").URPN.	USPAT	OR	OFF	2016/10/17 13:52
S486	2	"20030106917"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S487	25	("2003/0106917").URPN.	USPAT	OR	OFF	2016/10/17 13:52
S488	6	"20120063736"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S489	11	"7714704"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S490	96	"5886739"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S491	2	"20030106917"	US-PGPUB;	OR	ON	2016/10/17

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			13:52
S492	28	"8503972"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S493	75	"8520069"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S494	6	"20070064108"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S495	0	(Jochen-Kalka.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S496	0	(Kalka-Jochen.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S497	0	(Pioch-Ralf.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S498	0	(Ralf-Pioch.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S499	100	((224/197,587,194.ccls.) and (@ad<="20120928") and (button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S500	584	("340".clas.) and (@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2016/10/17 13:52

			DERWENT; IBM_TDB			
S501	289	("340".clas.) and (@ad<="20120928") and ((button\$1) with (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S502	84	("340".clas.) and (@ad<="20120928") and ((button\$1) with (shirt\$1 or cloth\$4 or pant\$1)) and (camera\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S503	20	(348/77,82,114-115,143,149,151,158,211.99-211.4,211.14,373-376.ccls.) and (@ad<="20120928") and ((button\$1) with (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S504	45	(348/77,82,114-115,143,149,151,158,211.99-211.4,211.14,373-376.ccls.) and (@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S505	9	("2014/0092299").URPN.	USPAT	OR	OFF	2016/10/17 13:52
S506	9	(Troxel-Jason-R.in.) and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S507	1	(Troxel-Jason.in.) and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S508	96	"5886739"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S509	89	("3542457" "4051534" "4398799" "4516157" "4797736" "5091719" "5189512").PN. OR ("5886739").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:52
S510	67	"6396403"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S511	46	("6396403").URPN.	USPAT	OR	OFF	2016/10/17 13:52
S512	2	"20030106917"	US-PGPUB;	OR	ON	2016/10/17

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			13:52
S513	25	("2003/0106917").URPN.	USPAT	OR	OFF	2016/10/17 13:52
S514	6	"20120063736"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S515	11	"7714704"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S516	96	"5886739"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S517	2	"20030106917"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S518	28	"8503972"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S519	75	"8520069"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S520	6	"20070064108"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S521	0	(Jochen-Kalka.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S522	0	(Kalka-Jochen.in.)	US-PGPUB; USPAT;	OR	ON	2016/10/17 13:52

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S523	0	(Picoch-Ralf.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S524	0	(Ralf-Pioch.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S525	100	((224/197,587,194.ccls.) and (@ad<="20120928") and (button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S526	584	("340".clas.) and (@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S527	289	("340".clas.) and (@ad<="20120928") and ((button\$1) with (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S528	84	("340".clas.) and (@ad<="20120928") and ((button\$1) with (shirt\$1 or cloth\$4 or pant\$1)) and (camera\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:52
S529	20	((348/77,82,114-115,143,149,151,158,211.99-211.4,211.14,373-376.ccls.) and (@ad<="20120928") and ((button\$1) with (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S530	45	((348/77,82,114-115,143,149,151,158,211.99-211.4,211.14,373-376.ccls.) and (@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S531	12	((224/230.ccls.) and (@ad<="20120928") and (button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2016/10/17 13:53

			IBM_TDB			
S532	71	(206/316.1-316.3.ccls.) and (@ad<="20120928") and (button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S533	249	("206".clas.) and (@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S534	17	("206".clas.) and (@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1) same (slit or slot\$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S535	1314	((@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1) same (slit or slot\$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S536	98	((@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1) same (slit or slot\$4)) and (camera\$1 or microphone\$1 or (micro adj phone\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S537	14	("0652891" "1010763" "2099029" "2767902" "4100653" "4408706" "4757927" "4790461" "5100037" "5450994").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53
S538	10	(slot\$5 with open with lower with end with button\$1 with plate\$1.clm.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S539	42	("1932581" "20020030071" "20040069823" "20080078792" "20080164291" "20080237282" "20080305840" "20100018015" "20100270345" "2085184" "2505551" "2616985" "3586798" "3604069" "3808642" "4040547" "4100653" "4700397" "5163093" "5268965" "5752632" "5771303" "5806146" "5831198" "5850613" "6149043" "6201877" "6283348" "6333984" "6757401" "7013492" "7784157").PN. OR ("8175314").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53
S540	45	(381/301,306,333,364,388.ccls.) and (@ad<="20120928") and ((button\$1) same (camera\$1 or imager or microphone\$1 or (micro adj phone\$1)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S541	604	((@ad<="20120928") and ((attach\$3 or attachment\$1 or mount\$3 or secur\$3 or cling\$3 or hang\$3 or hung or sliding or slidable or slot\$4) near2 button\$1 same (camera\$1 or microphone\$1 or (micro adj phone\$1))) and (cloth\$3 or shirt\$1 or pant\$1 or collar\$1 or shoe\$1 or helmet\$1 or cap\$1 or hat\$1 or sleeve\$1 or cuff\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2016/10/17 13:53

			DERWENT; IBM_TDB			
S542	134	((@ad<="20120928") and (((attach\$3 or attachment\$1 or mount\$3 or secur\$3 or cling\$3 or hang\$3 or hung or sliding or slidable or slot\$4) near2 button\$1 same (camera\$1 or microphone\$1 or (micro adj phone\$1))) same (cloth\$3 or shirt\$1 or pant\$1 or collar\$1 or shoe\$1 or helmet\$1 or cap\$1 or hat\$1 or sleeve\$1 or cuff\$1)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S543	11	(2/69-157.ccls.) and (@ad<="20120928") and ((attach\$3 or attachment\$1 or mount\$3 or secur\$3 or cling\$3 or hang\$3 or hung or sliding or slidable or slot\$4) with button\$1 same (camera\$1 or microphone\$1 or (micro adj phone\$1)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S544	17	(2/69-157.ccls.) and (@ad<="20120928") and ((attach\$3 or attachment\$1 or mount\$3 or secur\$3 or cling\$3 or hang\$3 or hung or sliding or slidable or slot\$4) same button\$1 same (camera\$1 or microphone\$1 or (micro adj phone\$1)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S545	11	14/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S546	3	14/575433	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S547	1	("2015/0103246").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S548	11	14/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S549	11	14/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S550	5	"14040329"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S551	0	04/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	OFF	2016/10/17 13:53

			IBM_TDB			
S552	11	14/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S553	5	"14040329"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S554	51	(Phillips-Steve.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S555	5	(Phillips-Steve.in.) and camera.clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S556	6	(Troxel-Jason-R.in.) and camera.clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S557	1460	(348/373-376.ccls.) and (button same camera)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S558	1263	(348/373-376.ccls.) and (@ad<="20120928") and (button same camera)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S559	2	(348/373-376.ccls.) and (@ad<="20120928") and (button same camera same cloth\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S560	156	((@ad<="20120928") and (button same camera same cloth\$3 same attach\$3 or attachment\$1 or mount\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S561	9	("224".clas.) and (@ad<="20120928") and (button same camera same pocket\$1)	US-PGPUB; USPAT;	OR	ON	2016/10/17 13:53

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S562	343	((@ad<="20120928") and (button same camera same pocket\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S563	47	((@ad<="20120928") and (button same camera same pocket\$1 same clip\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S564	5	((348/373-376.ccls.) and (@ad<="20120928") and (cloth\$3 with clip\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S565	132	("348".clas.) and (@ad<="20120928") and (cloth\$3 with clip\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S566	332	("348".clas.) and (@ad<="20120928") and ((mount\$3 or attach\$3) with (user\$1 or person\$1) near3 (cloth\$3 or button or pocket\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S567	6	("348".clas.) and (@ad<="20120928") and ((mount\$3 or attach\$3) with (user\$1 or person\$1) near3 (cloth\$3) with (button or pocket\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S568	3	((@ad<="20120928") and ((mount\$3 or attach\$3) with (user\$1 or person\$1) near3 (cloth\$3) with button with pocket)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S569	5	((@ad<="20120928") and ((mount\$3 or attach\$3) same (user\$1 or person\$1) near3 (cloth\$3) with button with pocket)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S570	46	("6396403").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S571	2	("340".clas.) and (@ad<="20120928") and ((user\$1 or person\$1) near3 (cloth\$3) with button with pocket)	US-PGPUB; USPAT; USOCR;	OR	ON	2016/10/17 13:53

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S572	23	("340".clas.) and (@ad<="20120928") and ((cloth\$3) with button with pocket)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S573	0	(340/194,230.ccls.) and (@ad<="20120928") and (button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S574	0	(340/194,230.ccls.) and (@ad<="20120928")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S575	19	(224/194,230.ccls.) and (@ad<="20120928") and (button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S576	140	"348".clas. and (@ad<="20120928") and (pocket\$1 same button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S577	502	("224".clas.) and (@ad<="20120928") and (pocket\$1 same button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S578	262	("224".clas.) and (@ad<="20120928") and (pocket\$1 with button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S579	7	("224".clas.) and (@ad<="20120928") and (pocket\$1 with button\$1 with shirt)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S580	0	("224".clas.) and (@ad<="20120928") and (pocket\$1 with button\$1 with slot with shirt)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53

S581	6	((@ad<="20120928") and (pocket\$1 with button\$1 with slot with shirt)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S582	0	((@ad<="20120928") and (pocket\$1 same button\$1 same slot same shirt same camera)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S583	2	((@ad<="20120928") and (pocket\$1 same button\$1 same slot same (clothing\$1 or shirt\$1) same camera)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S584	44	((@ad<="20120928") and (pocket\$1 same button\$1 same slot same (clothing\$1 or shirt\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S585	24	("224".clas.) and (@ad<="20120928") and (button\$1 with shirt)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S586	2	10/386892	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S587	26	(US-20110248060-\$ or US-20050231356-\$ or US-20050200750-\$ or US-20120019641-\$ or US-20090213204-\$ or US-20090027499-\$ or US-20100001170-\$ or US-20090193693-\$ or US-20130043144-\$ or US-20040155079-\$ or US-20100171021-\$ or US-20050035161-\$ or US-20050023316-\$ or US-20030215010-\$).did. or (US-8079501-\$ or US-8077029-\$ or US-6563532-\$ or US-8264558-\$ or US-6934461-\$ or US-7978263-\$ or US-7456875-\$ or US-6396403-\$ or US-D473152-\$ or US-5067642-\$ or US-8073131-\$ or US-8408513-\$).did.	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:53
S588	12	S587 and (button same (shirt or pocket))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S589	0	("2005/0023316").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S590	116	("224".clas.) and ((attach\$3 or secur\$3 or slid\$3) with button with slot)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53

S591	1	("2009/0108037").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S592	1812	("224".clas.) and ((attach\$3 or secur\$3 or slid\$3 or mount\$3) with button)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S593	168	("224".clas.) and ((attach\$3 or secur\$3 or slid\$3 or mount\$3) with button same (shirt or cloth\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S594	883	((attach\$3 or secur\$3 or slid\$3 or mount\$3) with button same (shirt or cloth\$3)) and (camera or pda)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S595	9	S587 and (gps)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S596	19	("2003/0215010").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S597	1157	(button near2 clip) and (camera or pda)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S598	103	("348".clas.) and (@ad<="20120928") and (button near2 clip)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S599	9	("348".clas.) and (@ad<="20120928") and (button adj clip)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S600	41	("348".clas.) and (@ad<="20120928") and (button near1 clip)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S601	4	("20080030580" "5726660" "5886739" "7483485").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53
S602	1	12/176977	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S603	42	("1932581" "20020030071" "20040069823" "20080078792" "20080164291" "20080237282" "20080305840" "20100018015" "20100270345" "2085184" "2505551" "2616985" "3586798" "3604069" "3808642" "4040547" "4100653" "4700397" "5163093" "5268965" "5752632" "5771303" "5806146" "5831198" "5850613" "6149043" "6201877" "6283348" "6333984" "6757401" "7013492" "7784157").PN. OR ("8175314").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53
S604	18	"5752632"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S605	12	("5752632").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S606	19	("2003/0215010").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S607	19	("20030174773" "5014079" "5689442" "5808663" "6104705" "6201562" "6360003" "6681120" "6934461" "7133537").PN. OR ("7456875").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53
S608	25	("20030081935" "20040015467" "20040091111" "3542457" "4051534" "4398799" "4425586" "4516157" "4797736" "5091719" "5189512" "5886739" "6563532" "6988144").PN. OR ("7483485").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53
S609	872	(348/143-158.ccls.) and (@ad<="20120928") and (trigger\$3 with event\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S610	269	(348/143-158.ccls.) and (@ad<="20120928") and ((trigger\$3 with event\$1) same (automat\$3 or auto or automatical\$2))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S611	32	(348/158.ccls.) and (@ad<="20120928") and (trigger\$3 with event\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S612	87	(348/158.ccls.) and (@ad<="20120928") and (police or officer)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S613	2	11/948020	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S614	44	(US-20110248060-\$ or US-20050231356-\$ or US-20050200750-\$ or	US-PGPUB;	OR	OFF	2016/10/17

		US-20120019641-\$ or US-20090213204-\$ or US-20090027499-\$ or US-20100001170-\$ or US-20090193693-\$ or US-20130043144-\$ or US-20040155079-\$ or US-20100171021-\$ or US-20050023316-\$ or US-20030215010-\$ or US-20090108037-\$ or US-20130320055-\$ or US-20130175309-\$ or US-20080030580-\$ or US-20080078792-\$ or US-20090141129-\$.did. or (US-8079501-\$ or US-8077029-\$ or US-6563532-\$ or US-8264558-\$ or US-6934461-\$ or US-7978263-\$ or US-7456875-\$ or US-6396403-\$ or US-D473152-\$ or US-5067642-\$ or US-8073131-\$ or US-8408513-\$ or US-8579172-\$ or US-5857601-\$ or US-8652038-\$ or US-6667771-\$ or US-5726660-\$ or US-5886739-\$ or US-7483485-\$ or US-8175314-\$ or US-1932581-\$ or US-2085184-\$ or US-2505551-\$ or US-5752632-\$ or US-8489065-\$.did.	USPAT			13:53
S615	1	S614 and ((auto or automat\$3 or automatically) with (captur\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S616	11	14/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S617	11	14/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S618	11	14/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S619	11	14/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S620	9	("2014/0092299").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S621	51	(Phillips-Steve.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S622	9	(Phillips-Steve.in.) and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S623	9	("2014/0092299").URPN.	USPAT	OR	OFF	2016/10/17 13:53

S624	9	(Troxel-Jason-R.in.) and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S625	1	(Troxel-Jason.in.) and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S626	96	"5886739"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S627	89	("3542457" "4051534" "4398799" "4516157" "4797736" "5091719" "5189512").PN. OR ("5886739").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53
S628	67	"6396403"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S629	46	("6396403").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S630	2	"20030106917"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S631	25	("2003/0106917").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S632	6	"20120063736"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S633	11	"7714704"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S634	96	"5886739"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S635	2	"20030106917"	US-PGPUB; USPAT; USOCR;	OR	ON	2016/10/17 13:53

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S636	28	"8503972"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S637	75	"8520069"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S638	6	"20070064108"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S639	0	(Jochen-Kalka.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S640	0	(Kalka-Jochen.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S641	0	(Picoch-Ralf.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S642	0	(Ralf-Pioch.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S643	100	((224/197,587,194.ccls.) and (@ad<="20120928") and (button\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S644	584	("340".clas.) and (@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53

S645	289	("340".clas.) and (@ad<="20120928") and ((button\$1) with (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S646	84	("340".clas.) and (@ad<="20120928") and ((button\$1) with (shirt\$1 or cloth\$4 or pant\$1)) and (camera\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S647	20	(348/77,82,114-115,143,149,151,158,211.99-211.4,211.14,373-376.ccls.) and (@ad<="20120928") and ((button\$1) with (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S648	45	(348/77,82,114-115,143,149,151,158,211.99-211.4,211.14,373-376.ccls.) and (@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S649	9	("2014/0092299").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S650	9	(Troxel-Jason-R.in.) and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S651	1	(Troxel-Jason.in.) and camera	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S652	96	"5886739"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S653	89	("3542457" "4051534" "4398799" "4516157" "4797736" "5091719" "5189512").PN. OR ("5886739").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53
S654	67	"6396403"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S655	46	("6396403").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S656	2	"20030106917"	US-PGPUB; USPAT; USOCR;	OR	ON	2016/10/17 13:53

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S657	25	("2003/0106917").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S658	6	"20120063736"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S659	11	"7714704"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S660	96	"5886739"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S661	2	"20030106917"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S662	28	"8503972"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S663	75	"8520069"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S664	6	"20070064108"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S665	0	(Jochen-Kalka.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S666	0	(Kalka-Jochen.in.)	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2016/10/17 13:53

			EPO; JPO; DERWENT; IBM_TDB			
S667	0	(PicoH-Ralf.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S668	0	(Ralf-Ploch.in.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S669	100	((224/197,587,194.ccls.) and (@ad<="20120928") and (button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S670	584	("340".clas.) and (@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S671	289	("340".clas.) and (@ad<="20120928") and ((button\$1) with (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S672	84	("340".clas.) and (@ad<="20120928") and ((button\$1) with (shirt\$1 or cloth\$4 or pant\$1)) and (camera\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S673	20	((348/77,82,114-115,143,149,151,158,211.99-211.4,211.14,373-376.ccls.) and (@ad<="20120928") and ((button\$1) with (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S674	45	((348/77,82,114-115,143,149,151,158,211.99-211.4,211.14,373-376.ccls.) and (@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S675	12	((224/230.ccls.) and (@ad<="20120928") and (button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53

S676	71	(206/316.1-316.3.ccls.) and (@ad<="20120928") and (button\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S677	249	("206".clas.) and (@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S678	17	("206".clas.) and (@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1) same (slit or slot\$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S679	1314	((@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1) same (slit or slot\$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S680	98	((@ad<="20120928") and ((button\$1) same (shirt\$1 or cloth\$4 or pant\$1) same (slit or slot\$4)) and (camera\$1 or microphone\$1 or (micro adj phone\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S681	14	("0652891" "1010763" "2099029" "2767902" "4100653" "4408706" "4757927" "4790461" "5100037" "5450994").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53
S682	10	(slot\$5 with open with lower with end with button\$1 with plate\$1.clm.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S683	42	("1932581" "20020030071" "20040069823" "20080078792" "20080164291" "20080237282" "20080305840" "20100018015" "20100270345" "2085184" "2505551" "2616985" "3586798" "3604069" "3808642" "4040547" "4100653" "4700397" "5163093" "5268965" "5752632" "5771303" "5806146" "5831198" "5850613" "6149043" "6201877" "6283348" "6333984" "6757401" "7013492" "7784157").PN. OR ("8175314").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53
S684	45	(381/301,306,333,364,388.ccls.) and (@ad<="20120928") and ((button\$1) same (camera\$1 or imager or microphone\$1 or (micro adj phone\$1)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S685	2314	((@ad<="20120928") and ((attach\$3 or attachment\$1 or mount\$3 or secur\$3 or cling\$3 or hang\$3 or hung) near2 button\$1 same (camera\$1 or microphone\$1 or (micro adj phone\$1)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53

S686	604	((@ad<="20120928") and ((attach\$3 or attachment\$1 or mount\$3 or secur\$3 or cling\$3 or hang\$3 or hung or sliding or slidable or slot\$4) near2 button\$1 same (camera\$1 or microphone\$1 or (micro adj phone\$1))) and (cloth\$3 or shirt\$1 or pant\$1 or collar\$1 or shoe\$1 or helmet\$1 or cap\$1 or hat\$1 or sleeve\$1 or cuff\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S687	134	((@ad<="20120928") and (((attach\$3 or attachment\$1 or mount\$3 or secur\$3 or cling\$3 or hang\$3 or hung or sliding or slidable or slot\$4) near2 button\$1 same (camera\$1 or microphone\$1 or (micro adj phone\$1))) same (cloth\$3 or shirt\$1 or pant\$1 or collar\$1 or shoe\$1 or helmet\$1 or cap\$1 or hat\$1 or sleeve\$1 or cuff\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S688	11	(2/69-157.ccls.) and (@ad<="20120928") and ((attach\$3 or attachment\$1 or mount\$3 or secur\$3 or cling\$3 or hang\$3 or hung or sliding or slidable or slot\$4) with button\$1 same (camera\$1 or microphone\$1 or (micro adj phone\$1)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S689	17	(2/69-157.ccls.) and (@ad<="20120928") and ((attach\$3 or attachment\$1 or mount\$3 or secur\$3 or cling\$3 or hang\$3 or hung or sliding or slidable or slot\$4) same button\$1 same (camera\$1 or microphone\$1 or (micro adj phone\$1)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S690	11	14/040329	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S691	270	((H04N5/2252,2251,77,907,765,775,781,782,85.cpc.) or (H04N7/142,14,183,185.cpc.) or (A61B5/0024,7275,0402,0476,1112,1117,14542,681,7214,7465.cpc.) or (A61B7/04.cpc.) or (G08B21/02.cpc.) or (H04M1/15,05.cpc.) or (F41C33/02,048,041,0209.cpc.) or (H04R1/028,083.cpc.) or (G08B13/19621,19669.cpc.) or (H04N9/7921,8042,8205.cpc.) or (A45C3/001.cpc.) or (A45F5/02,021,04.cpc.) or (H04M1/0214,0283,18.cpc.) or (G06F1/1628.cpc.) or (A41B1/08.cpc.) or (A41D27/20.cpc.) or (A45F2200/0516.cpc.) or (G08B25/007.cpc.) or (A41D1/002.cpc.) or (A41C33/045.cpc.) or (A61M5/1417,14244.cpc.) or (G02B21/0294,0288.cpc.)) and (@ad<="20120928") and (camera same (hang\$3 or mount\$3 or attach\$3 or pinning or clip\$4) same (pant\$1 or shirt\$1 or cloth\$3 or collar or sweater or jacket\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S692	7	(Phillips-Steve.in.) and (body.clm.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S693	4	(Phillips-Steve.in.) and (camera with body.clm.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S694	0	(Phillips-Steve.in.) and (camera with body.clm.) and ((interchang\$3 or interchang\$4).clm.)	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2016/10/17 13:53

			EPO; JPO; DERWENT; IBM_TDB			
S695	0	(Phillips-Steve.in.) and((interchang\$3 or interchang\$4).clm.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S696	0	(Phillips-Steve.in.) and((interchang\$3 or interchangab\$2).clm.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S697	3	(Phillips-Steve.in.) and((interchang\$3 or interchangab\$2 or interchangeab\$2).clm.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S698	3	(Phillips-Steve.in.) and ((interchang\$3 or interchangab\$2 or interchangeab\$2).clm.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S699	3	(Troxel-Jason-R.in.) and ((interchang\$3 or interchangab\$2 or interchangeab\$2).clm.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S700	2	(Phillips-Steve.in.) and (camera with body.clm.) and ((interchang\$3 or interchangab\$2 or interchangeab\$2).clm.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S701	4215	((H04N5/2252,2251,77,907,765,775,781,782,85.cpc.) or (H04N7/142,14,183,185.cpc.) or (A61B5/0024,7275,0402,0476,1112,1117,14542,681,7214,7465.cpc.) or (A61B7/04.cpc.) or (G08B21/02.cpc.) or (H04M1/15,05.cpc.) or (F41C33/02,048,041,0209.cpc.) or (H04R1/028,083.cpc.) or (G08B13/19621,19669.cpc.) or (H04N9/7921,8042,8205.cpc.) or (A45C3/001.cpc.) or (A45F5/02,021,04.cpc.) or (H04M1/0214,0283,18.cpc.) or (G06F1/1628.cpc.) or (A41B1/08.cpc.) or (A41D27/20.cpc.) or (A45F2200/0516.cpc.) or (G08B25/007.cpc.) or (A41D1/002.cpc.) or (A41C33/045.cpc.) or (A61M5/1417,14244.cpc.) or (G02B21/0294,0288.cpc.)) and (@ad<="20120928") and (button\$1 same camera same (user or body or sleeve or collar or shirt or cloth\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S702	185	((H04N5/2252,2251,77,907,765,775,781,782,85.cpc.) or (H04N7/142,14,183,185.cpc.) or (A61B5/0024,7275,0402,0476,1112,1117,14542,681,7214,7465.cpc.) or (A61B7/04.cpc.) or (G08B21/02.cpc.) or (H04M1/15,05.cpc.) or (F41C33/02,048,041,0209.cpc.) or (H04R1/028,083.cpc.) or (G08B13/19621,19669.cpc.) or (H04N9/7921,8042,8205.cpc.) or (A45C3/001.cpc.) or (A45F5/02,021,04.cpc.) or (H04M1/0214,0283,18.cpc.) or (G06F1/1628.cpc.) or (A41B1/08.cpc.) or (A41D27/20.cpc.) or (A45F2200/0516.cpc.) or	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53

		(G08B25/007.cpc.) or (A41D1/002.cpc.) or (A41C33/045.cpc.) or (A61M5/1417,14244.cpc.) or (G02B21/0294,0288.cpc.) and (@ad<="20120928") and (camera same (hang\$3 or mount\$3 or attach\$3 or pinning or clip\$4) same (pant\$1 or shirt\$1 or cloth\$3 or collar or sweater or jacket\$1)) and (batter\$3 or power\$3)				
S703	39	("20020142633" "20020177357" "20030151510" "20060225253" "20070091557" "20070277352" "20080025524" "20080222849" "20090104945" "20090301761" "20100005632" "20100104126" "20100122435" "20100133306" "20100158453" "20120295462" "3165804" "4908607" "5119419" "5406809" "5655270" "6419135" "6427374" "6493910" "6860049" "6883694" "7178205" "7458238" "7594305" "7909651" "8376239" "D253676" "D292543" "D292750" "D388729" "D418774" "D520738").PN. OR ("9164543").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53
S704	5	("2013/0148295").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S705	46	("20020044214" "20020047906" "20020131781" "20040179107" "20040201695" "20050078195" "20050113135" "20050233708" "20050250562" "20060019614" "20060061660" "20060082657" "20060098119" "20060197843" "20060203124" "20060262274" "20070041721" "20070052832" "20070281740" "20080205696" "20080218436" "20090039734" "20090058227" "20090075692" "20090172530" "20090286575" "20090296331" "20100004038" "20100159984" "20100277617" "20110029107" "20110086681" "5107287" "5682199" "6356437" "6466232" "6522531" "6770880" "7212231" "7274131" "7812507" "7893958" "8179007" "8265793" "8332000").PN. OR ("8780205").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53
S706	6	("2012/0120258").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S707	8	("20080030580" "5726660" "5886739" "7483485").PN. OR ("8077029").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53
S708	96	"5886739"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S709	2	"20030106917"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S710	6	"20120063736"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S711	18	("20030106917" "20030215010" "20050035161" "20070064108" "20080030580" "20090141129" "20090213204" "20110094003" "20120063736" "5752632" "5850613" "5886739" "6396403" "7456875" "8077029" "8175314" "8503972" "8520069").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53
S712	9	("2014/0092299").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S713	1	14/991607	US-PGPUB; USPAT; USOCR; FPRS;	OR	OFF	2016/10/17 13:53

			EPO; JPO; DERWENT; IBM_TDB			
S714	185	((H04N5/2252,2251,77,907,765,775,781,782,85.cpc.) or (H04N7/142,14,183,185.cpc.) or (A61B5/0024,7275,0402,0476,1112,1117,14542,681,7214,7465.cpc.) or (A61B7/04.cpc.) or (G08B21/02.cpc.) or (H04M1/15,05.cpc.) or (F41C33/02,048,041,0209.cpc.) or (H04R1/028,083.cpc.) or (G08B13/19621,19669.cpc.) or (H04N9/7921,8042,8205.cpc.) or (A45C3/001.cpc.) or (A45F5/02,021,04.cpc.) or (H04M1/0214,0283,18.cpc.) or (G06F1/1628.cpc.) or (A41B1/08.cpc.) or (A41D27/20.cpc.) or (A45F2200/0516.cpc.) or (G08B25/007.cpc.) or (A41D1/002.cpc.) or (A41C33/045.cpc.) or (A61M5/1417,14244.cpc.) or (G02B21/0294,0288.cpc.)) and (@ad<="20120928") and (camera same (hang\$3 or mount\$3 or attach\$3 or pinning or clip\$4) same (pant\$1 or shirt\$1 or cloth\$3 or collar or sweater or jacket\$1)) and (batter\$3 or power\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S715	588	((H04N5/2252,2251,77,907,765,775,781,782,85.cpc.) or (H04N7/142,14,183,185,188.cpc.) or (A61B5/0024,7275,0402,0476,1112,1117,14542,681,7214,7465.cpc.) or (A61B7/04.cpc.) or (G08B21/02.cpc.) or (H04M1/15,05.cpc.) or (F41C33/02,048,041,0209.cpc.) or (H04R1/028,083.cpc.) or (G08B13/19621,19669.cpc.) or (H04N9/7921,8042,8205.cpc.) or (A45C3/001.cpc.) or (A45F5/02,021,04.cpc.) or (H04M1/0214,0283,18.cpc.) or (G06F1/1628.cpc.) or (A41B1/08.cpc.) or (A41D27/20.cpc.) or (A45F2200/0516.cpc.) or (G08B25/007.cpc.) or (A41D1/002.cpc.) or (A41C33/045.cpc.) or (A61M5/1417,14244.cpc.) or (G02B21/0294,0288.cpc.) or (G11B27/102,11,34.cpc.)) and (@ad<="20120928") and (trigger\$3 same (imag\$3 or captur\$3)) and (GPS or (global\$2 near2 position\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S716	360	((H04N5/2252,2251,77,907,765,775,781,782,85.cpc.) or (H04N7/142,14,183,185,188.cpc.) or (A61B5/0024,7275,0402,0476,1112,1117,14542,681,7214,7465.cpc.) or (A61B7/04.cpc.) or (G08B21/02.cpc.) or (H04M1/15,05.cpc.) or (F41C33/02,048,041,0209.cpc.) or (H04R1/028,083.cpc.) or (G08B13/19621,19669.cpc.) or (H04N9/7921,8042,8205.cpc.) or (A45C3/001.cpc.) or (A45F5/02,021,04.cpc.) or (H04M1/0214,0283,18.cpc.) or (G06F1/1628.cpc.) or (A41B1/08.cpc.) or (A41D27/20.cpc.) or (A45F2200/0516.cpc.) or (G08B25/007.cpc.) or (A41D1/002.cpc.) or (A41C33/045.cpc.) or (A61M5/1417,14244.cpc.) or (G02B21/0294,0288.cpc.) or (G11B27/102,11,34.cpc.)) and (@ad<="20120928") and (trigger\$3 with (imag\$3 or captur\$3)) and (GPS or (global\$2 near2 position\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S717	110	((H04N5/2252,2251,77,907,765,775,781,782,85.cpc.) or (H04N7/142,14,183,185,188.cpc.) or (A61B5/0024,7275,0402,0476,1112,1117,14542,681,7214,7465.cpc.) or (A61B7/04.cpc.) or (G08B21/02.cpc.) or (H04M1/15,05.cpc.) or (F41C33/02,048,041,0209.cpc.) or (H04R1/028,083.cpc.) or (G08B13/19621,19669.cpc.) or (H04N9/7921,8042,8205.cpc.) or (A45C3/001.cpc.) or (A45F5/02,021,04.cpc.) or (H04M1/0214,0283,18.cpc.) or (G06F1/1628.cpc.) or (A41B1/08.cpc.) or (A41D27/20.cpc.) or (A45F2200/0516.cpc.) or (G08B25/007.cpc.) or (A41D1/002.cpc.) or (A41C33/045.cpc.) or (A61M5/1417,14244.cpc.) or (G02B21/0294,0288.cpc.) or (G11B27/102,11,34.cpc.)) and (@ad<="20120928") and (trigger\$3 with (imag\$3 or captur\$3)) and (GPS or (global\$2 near2 position\$3)) and (police\$1 or (law near2 enforc\$5))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S718	7	("2010/0118147").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S719	108	((@ad<="20120928") and (trigger\$3 with (imag\$3 or captur\$3) with camera) and (GPS or (global\$2 near2 position\$3)) and (view\$3 with (display or lcd) same stream\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53

S720	1	((@ad<="20120928") and (trigger\$3 with (imag\$3 or captur\$3) with camera same (policeman or police or officer)) and (GPS or (global\$2 near2 position\$3)) and (view\$3 same (display or lcd) same stream\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S721	1	((@ad<="20120928") and (trigger\$3 with (imag\$3 or captur\$3) same camera\$1 same (policeman or police or officer)) and (GPS or (global\$2 near2 position\$3)) and (view\$3 same (display or lcd) same stream\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S722	5	((@ad<="20120928") and (trigger\$3 with (imag\$3 or captur\$3) same camera\$1 same (policeman or police or officer)) and (view\$3 same (display or lcd) same stream\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S723	5	((@ad<="20120928") and (trigger\$3 with (imag\$3 or captur\$3) same camera\$1 same (policeman or police or officer)) and (view\$3 same (display or lcd) same stream\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S724	61	((@ad<="20120928") and ((imag\$3 or captur\$3) same camera\$1 same (policeman or police or officer)) and (GPS or (global\$2 near2 position\$3)) and (view\$3 same (display or lcd) same stream\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S725	103	((@ad<="20120928") and ((imag\$3 or captur\$3) same camera\$1 same (policeman or police or officer)) and (GPS or (global\$2 near2 position\$3)) and (view\$3 same (display or lcd) same (broadcast\$3 or stream\$3)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S726	96	(US-20110248060-\$ or US-20050231356-\$ or US-20050200750-\$ or US-20120019641-\$ or US-20090213204-\$ or US-20090027499-\$ or US-20100001170-\$ or US-20090193693-\$ or US-20130043144-\$ or US-20040155079-\$ or US-20100171021-\$ or US-20050035161-\$ or US-20050023316-\$ or US-20030215010-\$ or US-20090108037-\$ or US-20130320055-\$ or US-20130175309-\$ or US-20080030580-\$ or US-20080078792-\$ or US-20090141129-\$ or US-20130208938-\$ or US-20110094003-\$ or US-20050008183-\$ or US-20100270345-\$ or US-20080305840-\$ or US-20050148890-).did. or (US-20070067889-\$ or US-20090052714-\$ or US-20130148295-\$ or US-20100122435-\$ or US-20080222849-\$ or US-20070277352-\$ or US-20070091557-\$ or US-20060225253-\$ or US-20030151510-\$ or US-20120120258-\$ or US-20110261176-\$ or US-20110240493-\$ or US-20080203127-\$ or US-20060171539-\$ or US-20040119816-\$ or US-20030106917-\$ or US-20120063736-\$ or US-20080316314-\$ or US-20080169929-\$ or US-20080084473-\$ or US-20070219686-\$ or US-20050277421-\$ or US-20030080713-\$ or US-20110092248-\$ or US-20100118147-\$ or US-20120188345-\$ or US-20110281547-).did. or (US-20110018998-\$ or US-20100274816-).did. or (US-8079501-\$ or US-8077029-\$ or US-6563532-\$ or US-8264558-\$ or US-6934461-\$ or US-7978263-\$ or US-7456875-\$ or US-6396403-\$ or US-D473152-\$ or US-5067642-\$ or US-8073131-\$ or US-8408513-\$ or US-8579172-\$ or US-5857601-\$ or US-8652038-\$ or US-6667771-\$ or US-5726660-\$ or US-5886739-\$ or US-7483485-\$ or US-8175314-\$ or US-1932581-\$ or US-2085184-\$ or US-2505551-\$ or US-5752632-\$ or US-8489065-\$ or US-8531526-).did. or (US-8239146-\$ or US-	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:53

		7714704-\$ or US-5450994-\$ or US-5850613-\$ or US-9019431-\$ or US-9122082-\$ or US-9164543-\$ or US-7594305-\$ or US-7458238-\$ or US-6883694-\$ or US-4908607-\$ or US-8780205-\$ or US-6324053-\$ or US-5926210-\$ or US-8918230-\$).did.				
S727	8	("20080030580" "5726660" "5886739" "7483485").PN. OR ("8077029").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/10/17 13:53
S728	43	S726 and (identi\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S729	96	(US-20110248060-\$ or US-20050231356-\$ or US-20050200750-\$ or US-20120019641-\$ or US-20090213204-\$ or US-20090027499-\$ or US-20100001170-\$ or US-20090193693-\$ or US-20130043144-\$ or US-20040155079-\$ or US-20100171021-\$ or US-20050035161-\$ or US-20050023316-\$ or US-20030215010-\$ or US-20090108037-\$ or US-20130320055-\$ or US-20130175309-\$ or US-20080030580-\$ or US-20080078792-\$ or US-20090141129-\$ or US-20130208938-\$ or US-20110094003-\$ or US-20050008183-\$ or US-20100270345-\$ or US-20080305840-\$ or US-20050148890-\$).did. or (US-20070067889-\$ or US-20090052714-\$ or US-20130148295-\$ or US-20100122435-\$ or US-20080222849-\$ or US-20070277352-\$ or US-20070091557-\$ or US-20060225253-\$ or US-20030151510-\$ or US-20120120258-\$ or US-20110261176-\$ or US-20110240493-\$ or US-20080203127-\$ or US-20060171539-\$ or US-20040119816-\$ or US-20030106917-\$ or US-20120063736-\$ or US-20080316314-\$ or US-20080169929-\$ or US-20080084473-\$ or US-20070219686-\$ or US-20050277421-\$ or US-20030080713-\$ or US-20110092248-\$ or US-20100118147-\$ or US-20120188345-\$ or US-20110281547-\$).did. or (US-20110018998-\$ or US-20100274816-\$).did. or (US-8079501-\$ or US-8077029-\$ or US-6563532-\$ or US-8264558-\$ or US-6934461-\$ or US-7978263-\$ or US-7456875-\$ or US-6396403-\$ or US-D473152-\$ or US-5067642-\$ or US-8073131-\$ or US-8408513-\$ or US-8579172-\$ or US-5857601-\$ or US-8652038-\$ or US-6667771-\$ or US-5726660-\$ or US-5886739-\$ or US-7483485-\$ or US-8175314-\$ or US-1932581-\$ or US-2085184-\$ or US-2505551-\$ or US-5752632-\$ or US-8489065-\$ or US-8531526-\$).did. or (US-8239146-\$ or US-7714704-\$ or US-5450994-\$ or US-5850613-\$ or US-9019431-\$ or US-9122082-\$ or US-9164543-\$ or US-7594305-\$ or US-7458238-\$ or US-6883694-\$ or US-4908607-\$ or US-8780205-\$ or US-6324053-\$ or US-5926210-\$ or US-8918230-\$).did.	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:53
S730	20	S729 and (inch\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S731	2	14/221804	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S732	96	(US-20110248060-\$ or US-20050231356-\$ or US-20050200750-\$ or US-20120019641-\$ or US-20090213204-\$ or US-20090027499-\$ or US-20100001170-\$ or US-20090193693-\$ or US-20130043144-\$ or US-20040155079-\$ or US-20100171021-\$ or US-20050035161-\$ or US-20050023316-\$ or US-20030215010-\$ or US-20090108037-\$ or US-20130320055-\$ or US-20130175309-\$ or US-20080030580-\$ or US-20080078792-\$ or US-20090141129-\$ or US-20130208938-\$ or US-20110094003-\$ or US-20050008183-\$ or US-20100270345-\$ or US-20080305840-\$ or US-20050148890-\$).did. or (US-20070067889-\$ or US-20090052714-\$ or US-20130148295-\$ or US-20100122435-\$	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:53

		or US-20080222849-\$ or US-20070277352-\$ or US-20070091557-\$ or US-20060225253-\$ or US-20030151510-\$ or US-20120120258-\$ or US-20110261176-\$ or US-20110240493-\$ or US-20080203127-\$ or US-20060171539-\$ or US-20040119816-\$ or US-20030106917-\$ or US-20120063736-\$ or US-20080316314-\$ or US-20080169929-\$ or US-20080084473-\$ or US-20070219686-\$ or US-20050277421-\$ or US-20030080713-\$ or US-20110092248-\$ or US-20100118147-\$ or US-20120188345-\$ or US-20110281547-\$).did. or (US-20110018998-\$ or US-20100274816-\$).did. or (US-8079501-\$ or US-8077029-\$ or US-6563532-\$ or US-8264558-\$ or US-6934461-\$ or US-7978263-\$ or US-7456875-\$ or US-6396403-\$ or US-D473152-\$ or US-5067642-\$ or US-8073131-\$ or US-8408513-\$ or US-8579172-\$ or US-5857601-\$ or US-8652038-\$ or US-6667771-\$ or US-5726660-\$ or US-5886739-\$ or US-7483485-\$ or US-8175314-\$ or US-1932581-\$ or US-2085184-\$ or US-2505551-\$ or US-5752632-\$ or US-8489065-\$ or US-8531526-\$).did. or (US-8239146-\$ or US-7714704-\$ or US-5450994-\$ or US-5850613-\$ or US-9019431-\$ or US-9122082-\$ or US-9164543-\$ or US-7594305-\$ or US-7458238-\$ or US-6883694-\$ or US-4908607-\$ or US-8780205-\$ or US-6324053-\$ or US-5926210-\$ or US-8918230-\$).did.				
S733	3	S732 and (standby)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S734	96	(US-20110248060-\$ or US-20050231356-\$ or US-20050200750-\$ or US-20120019641-\$ or US-20090213204-\$ or US-20090027499-\$ or US-20100001170-\$ or US-20090193693-\$ or US-20130043144-\$ or US-20040155079-\$ or US-20100171021-\$ or US-20050035161-\$ or US-20050023316-\$ or US-20030215010-\$ or US-20090108037-\$ or US-20130320055-\$ or US-20130175309-\$ or US-20080030580-\$ or US-20080078792-\$ or US-20090141129-\$ or US-20130208938-\$ or US-20110094003-\$ or US-20050008183-\$ or US-20100270345-\$ or US-20080305840-\$ or US-20050148890-\$).did. or (US-20070067889-\$ or US-20090052714-\$ or US-20130148295-\$ or US-20100122435-\$ or US-20080222849-\$ or US-20070277352-\$ or US-20070091557-\$ or US-20060225253-\$ or US-20030151510-\$ or US-20120120258-\$ or US-20110261176-\$ or US-20110240493-\$ or US-20080203127-\$ or US-20060171539-\$ or US-20040119816-\$ or US-20030106917-\$ or US-20120063736-\$ or US-20080316314-\$ or US-20080169929-\$ or US-20080084473-\$ or US-20070219686-\$ or US-20050277421-\$ or US-20030080713-\$ or US-20110092248-\$ or US-20100118147-\$ or US-20120188345-\$ or US-20110281547-\$).did. or (US-20110018998-\$ or US-20100274816-\$).did. or (US-8079501-\$ or US-8077029-\$ or US-6563532-\$ or US-8264558-\$ or US-6934461-\$ or US-7978263-\$ or US-7456875-\$ or US-6396403-\$ or US-D473152-\$ or US-5067642-\$ or US-8073131-\$ or US-8408513-\$ or US-8579172-\$ or US-5857601-\$ or US-8652038-\$ or US-6667771-\$ or US-5726660-\$ or US-5886739-\$ or US-7483485-\$ or US-8175314-\$ or US-1932581-\$ or US-2085184-\$ or US-2505551-\$ or US-5752632-\$ or US-8489065-\$ or US-8531526-\$).did. or (US-8239146-\$ or US-7714704-\$ or US-5450994-\$ or US-5850613-\$ or US-9019431-\$ or US-9122082-\$ or US-9164543-\$ or US-7594305-\$ or US-7458238-\$ or US-6883694-\$ or US-4908607-\$ or US-8780205-\$ or US-6324053-\$ or US-5926210-\$ or US-8918230-\$).did.	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:53
S735	3	S734 and (mount\$3 same (body or bodie\$1) same vehicle\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S736	9	S734 and (mount\$3 same (body or bodie\$1 or user\$1) same vehicle\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2016/10/17 13:53

			DERWENT; IBM_TDB			
S737	9	S734 and (mount\$3 same (body or bodie\$1 or user\$1 or person) same vehicle\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S738	9	S734 and (mount\$3 same (body or bodie\$1 or user\$1 or person\$1) same vehicle\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S739	2	14/734010	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/10/17 13:53
S740	96	(US-20110248060-\$ or US-20050231356-\$ or US-20050200750-\$ or US-20120019641-\$ or US-20090213204-\$ or US-20090027499-\$ or US-20100001170-\$ or US-20090193693-\$ or US-20130043144-\$ or US-20040155079-\$ or US-20100171021-\$ or US-20050035161-\$ or US-20050023316-\$ or US-20030215010-\$ or US-20090108037-\$ or US-20130320055-\$ or US-20130175309-\$ or US-20080030580-\$ or US-20080078792-\$ or US-20090141129-\$ or US-20130208938-\$ or US-20110094003-\$ or US-20050008183-\$ or US-20100270345-\$ or US-20080305840-\$ or US-20050148890-\$).did. or (US-20070067889-\$ or US-20090052714-\$ or US-20130148295-\$ or US-20100122435-\$ or US-20080222849-\$ or US-20070277352-\$ or US-20070091557-\$ or US-20060225253-\$ or US-20030151510-\$ or US-20120120258-\$ or US-20110261176-\$ or US-20110240493-\$ or US-20080203127-\$ or US-20060171539-\$ or US-20040119816-\$ or US-20030106917-\$ or US-20120063736-\$ or US-20080316314-\$ or US-20080169929-\$ or US-20080084473-\$ or US-20070219686-\$ or US-20050277421-\$ or US-20030080713-\$ or US-20110092248-\$ or US-20100118147-\$ or US-20120188345-\$ or US-20110281547-\$).did. or (US-20110018998-\$ or US-20100274816-\$).did. or (US-8079501-\$ or US-8077029-\$ or US-6563532-\$ or US-8264558-\$ or US-6934461-\$ or US-7978263-\$ or US-7456875-\$ or US-6396403-\$ or US-D473152-\$ or US-5067642-\$ or US-8073131-\$ or US-8408513-\$ or US-8579172-\$ or US-5857601-\$ or US-8652038-\$ or US-6667771-\$ or US-5726660-\$ or US-5886739-\$ or US-7483485-\$ or US-8175314-\$ or US-1932581-\$ or US-2085184-\$ or US-2505551-\$ or US-5752632-\$ or US-8489065-\$ or US-8531526-\$).did. or (US-8239146-\$ or US-7714704-\$ or US-5450994-\$ or US-5850613-\$ or US-9019431-\$ or US-9122082-\$ or US-9164543-\$ or US-7594305-\$ or US-7458238-\$ or US-6883694-\$ or US-4908607-\$ or US-8780205-\$ or US-6324053-\$ or US-5926210-\$ or US-8918230-\$).did.	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:53
S741	15	S740 and (remote\$2 with (view\$3 or display\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S742	45	S740 and (identification or identify\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S743	46	S740 and (identification or identify\$3 or identit\$3)	US-PGPUB;	OR	ON	2016/10/17

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			13:53
S744	534	((@ad<="20120928") and (camera same mount\$3 same (body or bodie\$1 or user\$1 or person\$1) same inch\$2)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S745	55	((@ad<="20120928") and (camera same mount\$3 same (body or bodie\$1 or user\$1 or person\$1) same inch\$2) and (police or officer)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S746	55	((@ad<="20120928") and (portabl\$1 same camera same mount\$3 same (body or bodie\$1 or user\$1 or person\$1) same inch\$2)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S747	55	((@ad<="20120928") and (portabl\$1 same camera same mount\$3 same (body or bodie\$1 or user\$1 or person\$1 or police or officer) same inch\$2)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S748	274	((@ad<="20120928") and (camera same (attach\$3 or attachment or mount\$3 or mountabl\$1) with (body or bodie\$1 or user\$1 or person\$1 or police or officer) same inch\$2)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S749	96	(US-20110248060-\$ or US-20050231356-\$ or US-20050200750-\$ or US-20120019641-\$ or US-20090213204-\$ or US-20090027499-\$ or US-20100001170-\$ or US-20090193693-\$ or US-20130043144-\$ or US-20040155079-\$ or US-20100171021-\$ or US-20050035161-\$ or US-20050023316-\$ or US-20030215010-\$ or US-20090108037-\$ or US-20130320055-\$ or US-20130175309-\$ or US-20080030580-\$ or US-20080078792-\$ or US-20090141129-\$ or US-20130208938-\$ or US-20110094003-\$ or US-20050008183-\$ or US-20100270345-\$ or US-20080305840-\$ or US-20050148890-\$).did. or (US-20070067889-\$ or US-20090052714-\$ or US-20130148295-\$ or US-20100122435-\$ or US-20080222849-\$ or US-20070277352-\$ or US-20070091557-\$ or US-20060225253-\$ or US-20030151510-\$ or US-20120120258-\$ or US-20110261176-\$ or US-20110240493-\$ or US-20080203127-\$ or US-20060171539-\$ or US-20040119816-\$ or US-20030106917-\$ or US-20120063736-\$ or US-20080316314-\$ or US-20080169929-\$ or US-20080084473-\$ or US-20070219686-\$ or US-20050277421-\$ or US-20030080713-\$ or US-20110092248-\$ or US-20100118147-\$ or US-20120188345-\$ or US-20110281547-\$).did. or (US-20110018998-\$ or US-20100274816-\$).did. or (US-8079501-\$ or US-8077029-\$ or US-6563532-\$ or US-8264558-\$ or US-6934461-\$ or US-7978263-\$ or US-7456875-\$ or US-6396403-\$ or US-D473152-\$ or US-5067642-\$ or US-8073131-\$ or US-8408513-\$ or US-8579172-\$ or US-5857601-\$ or US-8652038-\$ or US-6667771-\$ or US-5726660-\$ or US-5886739-\$ or US-7483485-\$ or US-8175314-\$ or US-1932581-\$ or US-2085184-\$ or US-2505551-\$ or US-5752632-\$ or US-8489065-\$ or US-8531526-\$).did. or (US-8239146-\$ or US-7714704-\$ or US-5450994-\$ or US-5850613-\$ or US-9019431-\$ or	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:53

		US-9122082-\$ or US-9164543-\$ or US-7594305-\$ or US-7458238-\$ or US-6883694-\$ or US-4908607-\$ or US-8780205-\$ or US-6324053-\$ or US-5926210-\$ or US-8918230-\$).did.				
S750	20	S749 and inch\$2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S751	8	((@ad<="20120928") and (camera same housing with width\$1 with inch\$2 same ("5" or five))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S752	19	((@ad<="20120928") and (camera same (carrier or housing) same width\$1 with inch\$2 same ("5" or five))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S753	87	((@ad<="20120928") and (camera same (carrier or housing) same width\$1 with inch\$2)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S754	41	S749 and (dimension\$1 or inch\$2)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S755	238	((@ad<="20120928") and (camera with cas\$3 with inch\$2)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S756	49	((@ad<="20120928") and (camera near2 cas\$3 with inch\$2)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S757	4	((@ad<="20120928") and (camera with cas\$3 with inch\$2 with (lock\$3 or attach\$3 or attachment\$1 or interlock\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S758	164	((@ad<="20120928") and (camera with inch\$2 with (lock\$3 or attach\$3 or attachment\$1 or interlock\$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53

S759	52	((@ad<="20120928") and (camera same (housing or bracket) with width\$1 same inch\$2)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S760	1	(Phillips-Steve.in.) and(activation with mark\$3.clm.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S761	1	(Phillips-Steve.in.) and (activation with mark\$3.clm.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S762	0	(Troxel-Jason.in.) and (activation with mark\$3.clm.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S763	1	14/991607	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 13:53
S764	215	("20020013517" "20020019696" "20020032510" "20020044065" "20020049881" "20020084130" "20020131768" "20020135336" "20020159434" "20020191952" "20030040917" "20030080878" "20030081121" "20030081935" "20030081942" "20030095688" "20030133018" "20030185417" "20030215114" "20030222982" "20040008255" "20040043765" "20040143373" "20040145457" "20040150717" "20040168002" "20040199785" "20040223054" "20040243734" "20040267419" "20050030151" "20050046583" "20050050266" "20050068169" "20050083404" "20050094966" "20050100329" "20050101334" "20050132200" "20050134966" "20050151852" "20050185438" "20050206532" "20050206741" "20050228234" "20050232469" "20050243171" "20060009238" "20060028811" "20060055786" "20060158968" "20060164220" "20060164534" "20060170770" "20060176149" "20060183505" "20060193749" "20060203090" "20060220826" "20060244601" "20060256822" "20060270465" "20060274166" "20060274828" "20060276200" "20060282021" "20060287821" "20060293571" "20070021134" "20070067079" "20070102508" "20070117083" "20070132567" "20070152811" "20070172053" "20070177023" "20070199076" "20070229350" "20070257781" "20070257782" "20070257804" "20070257815" "20070260361" "20070268158" "20070271105" "20070285222" "20070287425" "20070297320" "20080001735" "20080002599" "20080030580" "20080042825" "20080043736" "20080049830" "20080063252" "20080122603" "20080129518" "20080143481" "20080144705" "20080170130" "20080211906" "20080239064" "20080246656" "20080266118" "20090002491" "20090002556" "20090027499" "20090070820" "20090122142" "20090135007" "20090169068" "20090189981" "20090207252" "20090243794" "20090252486" "20100050734"	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:53

		"20100097221" "20100106707" "20100177193" "20100177891" "20100188201" "20100191411" "20100194885" "20100238009" "20100238262" "20100242076" "20100265331" "20100287473" "20110006151" "20110018998" "20110050904" "20110069151" "20110084820" "20110301971" "20120056722" "20120162436" "20120189286" "20120230540" "20120268259" "20120276954" "20130021153" "20130033610" "20130080836" "20130096731" "20130222640" "20130300563" "20130343571" "20140037262" "20140092299" "20140094992" "20140192194" "20140195105" "20140210625" "20140227671" "20140311215" "20140355951" "20150050345" "20150051502" "20150053776" "20150078727" "20150088335" "20150103246" "20150229630" "4409670" "4789904" "4863130" "4918473" "5027104" "5096287" "5111289" "5289321" "5381155" "5408330" "5446659" "5453939" "5473729" "5479149" "5497419" "5526133" "5585798" "5642285" "5668675" "5689442" "5742336" "5798458" "5815093" "5878283" "5890079" "5926210" "5978017" "5983161" "5996023" "6008841" "6028528" "6052068" "6097429" "6100806" "6121881" "6141609" "6141611" "6163338" "6175300" "6298290" "6310541" "6314364" "6326900" "6333694" "6333759" "6370475" "6389340" "6405112" "6449540" "6452572" "6518881" "6525672").PN.				
S765	65	("6546119" "6560463" "6591242" "6681195" "6690268" "6697103" "6718239" "6727816" "6748792" "6823621" "6831556" "6856873" "6970183" "7012632" "7034683" "7038590" "7088387" "7119832" "7126472" "7147155" "7180407" "7190822" "7363742" "7371021" "7436955" "7448996" "7496140" "7500794" "7508941" "7536457" "7539533" "7561037" "7602301" "7659827" "7680947" "7697035" "7804426" "7806525" "7853944" "7944676" "8121306" "8269617" "8314708" "8373567" "8384539" "8446469" "8456293" "8508353" "8594485" "8606492" "8676428" "8707758" "8725462" "8744642" "8781292" "8805431" "8849501" "8854199" "8896694" "8930072" "8989914" "8996234" "9003474" "9058499" "RE37709").PN.	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:53
S766	8	("20030081934" "20060271287" "20080100705" "20110018998" "20110314401" "20120038689" "20140049636" "20140218544").PN.	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:53
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S769	7	S768 and ((automatic\$4) same advanc\$3 with (video or footage))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 14:50
S770	14	S768 and ((automatic\$4) same (forward\$3 or advanc\$3) with (video or footage or point\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 14:51
S771	14	S768 and ((automatic\$4) same (forward\$3 or advanc\$3) with (video or footage or point\$1 or frame\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 14:51
S772	22	S768 and ((automatic\$4) same (forward\$3 or advanc\$3 or identify\$3) with (video or footage or point\$1 or frame\$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/10/17 14:52

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S56	54	(attach\$3 with (camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	OFF	2014/02/19 15:41
S57	32	("1932581" "20020030071" "20040069823" "20080078792"	US-	OR	OFF	2014/02/19

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S58	30	((secur\$3 or mount\$3 or slid\$3) with (camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	OFF	2014/02/19 15:48
S59	0	("8175314").URPN.	USPAT	OR	OFF	2014/02/19 15:49
S60	179	((camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	OFF	2014/02/19 16:07
S61	274	((camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	ON	2014/02/19 16:07
S62	47	((secur\$3 or mount\$3 or slid\$3) with (camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	ON	2014/02/19 16:07
S74	1	("2005/0035161").URPN.	USPAT	OR	OFF	2014/02/20 09:25
S78	1	"Term Removed"	US-PGPUB	OR	OFF	2014/02/24 15:28
S146	2	(slot\$5 with open with lower with end with button\$1 with plate\$1 with material.clm.)	US-PGPUB; USPAT	OR	ON	2014/09/03 14:13
S147	1	(slot\$5 with open with lower with end with button\$1 with plate\$1 with material with user\$2.clm.)	US-PGPUB; USPAT	OR	ON	2014/09/03 14:14
S148	1	(348/77,82,114-115,143-149,151,158,211.99-211.4,211.14,373-376.ccls.) and (mount\$3 with bracket with button\$1 with longitudinal\$2.clm.)	US-PGPUB; USPAT	OR	ON	2014/09/03 14:15
S149	0	(224/197,587,194,230.ccls.) and (mount\$3 with bracket with button\$1 with longitudinal\$2.clm)	US-PGPUB; USPAT	OR	ON	2014/09/03 14:16
S150	0	("340".clas.) and (mount\$3 with bracket with button\$1 with longitudinal\$2.clm)	US-PGPUB; USPAT	OR	ON	2014/09/03 14:17
S151	0	(mount\$3 with bracket with button\$1 with longitudinal\$2.clm)	US-PGPUB; USPAT	OR	ON	2014/09/03 14:17
S306	56	(attach\$3 with (camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	OFF	2015/10/28 14:00
S307	35	("1932581" "20020030071" "20040069823" "20080078792" "20080164291" "20080237282" "20080305840" "20100018015" "20100270345" "2085184" "2505551" "2616985" "3586798" "3604069" "3808642" "4040547" "4100653" "4700397" "5163093" "5268965" "5752632" "5771303" "5806146" "5831198" "5850613" "6149043" "6201877" "6283348" "6333984" "6757401" "7013492" "7784157").PN. OR ("8175314").URPN.	US-PGPUB; USPAT	OR	OFF	2015/10/28 14:00
S308	36	((secur\$3 or mount\$3 or slid\$3) with (camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	OFF	2015/10/28 14:00
S309	3	("8175314").URPN.	USPAT	OR	OFF	2015/10/28 14:00
S310	218	((camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	OFF	2015/10/28 14:00
S311	355	((camera or device or pda) with shirt with button)	US-	OR	ON	2015/10/28

			PGPUB; USPAT			14:00
S312	53	((secur\$3 or mount\$3 or slid\$3) with (camera or device or pda) with shirt with button)	US- PGPUB; USPAT	OR	ON	2015/10/28 14:00
S313	5	("2005/0035161").URPN.	USPAT	OR	OFF	2015/10/28 14:00
S314	1	"Term Removed"	US- PGPUB	OR	OFF	2015/10/28 14:00
S315	3	(slot\$5 with open with lower with end with button\$1 with plate\$1 with material.clm.)	US- PGPUB; USPAT	OR	ON	2015/10/28 14:00
S316	2	(slot\$5 with open with lower with end with button\$1 with plate\$1 with material with user\$2.clm.)	US- PGPUB; USPAT	OR	ON	2015/10/28 14:00
S317	3	(348/77,82,114-115,143-149,151,158,211.99-211.4,211.14,373-376.ccls.) and (mount\$3 with bracket with button\$1 with longitudinal\$2.clm.)	US- PGPUB; USPAT	OR	ON	2015/10/28 14:00
S318	0	(224/197,587,194,230.ccls.) and (mount\$3 with bracket with button\$1 with longitudinal\$2.clm)	US- PGPUB; USPAT	OR	ON	2015/10/28 14:00
S319	0	("340".clas.) and (mount\$3 with bracket with button\$1 with longitudinal\$2.clm)	US- PGPUB; USPAT	OR	ON	2015/10/28 14:00
S320	0	(mount\$3 with bracket with button\$1 with longitudinal\$2.clm)	US- PGPUB; USPAT	OR	ON	2015/10/28 14:00
S332	42	((H04N5/2252,2251,77,907,765,775,781,782,85.cpc.) or (H04N7/142,14,183,185.cpc.) or (A61B5/0024,7275,0402,0476,1112,1117,14542,681,7214,7465.cpc.) or (A61B7/04.cpc.) or (G08B21/02.cpc.) or (H04M1/15,05.cpc.) or (F41C33/02,048,041,0209.cpc.) or (H04R1/028,083.cpc.) or (G08B13/19621,19669.cpc.) or (H04N9/7921,8042,8205.cpc.) or (A45C3/001.cpc.) or (A45F5/02,021,04.cpc.) or (H04M1/0214,0283,18.cpc.) or (G06F1/1628.cpc.) or (A41B1/08.cpc.) or (A41D27/20.cpc.) or (A45F2200/0516.cpc.) or (G08B25/007.cpc.) or (A41D1/002.cpc.) or (A41C33/045.cpc.) or (A61M5/1417,14244.cpc.) or (G02B21/0294,0288.cpc.)) and (camera with body.clm.) and ((interchang\$3 or interchangab\$2 or interchangeab\$2).clm.)	US- PGPUB; USPAT	OR	ON	2015/10/28 22:55
S333	11	((H04N5/2252,2251,77,907,765,775,781,782,85.cpc.) or (H04N7/142,14,183,185.cpc.) or (A61B5/0024,7275,0402,0476,1112,1117,14542,681,7214,7465.cpc.) or (A61B7/04.cpc.) or (G08B21/02.cpc.) or (H04M1/15,05.cpc.) or (F41C33/02,048,041,0209.cpc.) or (H04R1/028,083.cpc.) or (G08B13/19621,19669.cpc.) or (H04N9/7921,8042,8205.cpc.) or (A45C3/001.cpc.) or (A45F5/02,021,04.cpc.) or (H04M1/0214,0283,18.cpc.) or (G06F1/1628.cpc.) or (A41B1/08.cpc.) or (A41D27/20.cpc.) or (A45F2200/0516.cpc.) or (G08B25/007.cpc.) or (A41D1/002.cpc.) or (A41C33/045.cpc.) or (A61M5/1417,14244.cpc.) or (G02B21/0294,0288.cpc.)) and (camera with body.clm.) and ((interchang\$3 or interchangab\$2 or interchangeab\$2) with mount\$3.clm.)	US- PGPUB; USPAT	OR	ON	2015/10/28 22:55
S334	2	((H04N5/2252,2251,77,907,765,775,781,782,85.cpc.) or (H04N7/142,14,183,185.cpc.) or (A61B5/0024,7275,0402,0476,1112,1117,14542,681,7214,7465.cpc.) or (A61B7/04.cpc.) or (G08B21/02.cpc.) or (H04M1/15,05.cpc.) or (F41C33/02,048,041,0209.cpc.) or (H04R1/028,083.cpc.) or (G08B13/19621,19669.cpc.) or (H04N9/7921,8042,8205.cpc.) or (A45C3/001.cpc.) or (A45F5/02,021,04.cpc.) or (H04M1/0214,0283,18.cpc.) or (G06F1/1628.cpc.) or (A41B1/08.cpc.) or (A41D27/20.cpc.) or (A45F2200/0516.cpc.) or (G08B25/007.cpc.) or (A41D1/002.cpc.) or (A41C33/045.cpc.) or (A61M5/1417,14244.cpc.) or (G02B21/0294,0288.cpc.)) and (camera with body with user\$2.clm.) and ((interchang\$3 or interchangab\$2 or interchangeab\$2) with mount\$3.clm.)	US- PGPUB; USPAT	OR	ON	2015/10/28 22:57

S335	1	((H04N5/2252,2251,77,907,765,775,781,782,85.cpc.) or (H04N7/142,14,183,185.cpc.) or (A61B5/0024,7275,0402,0476,1112,1117,14542,681,7214,7465.cpc.) or (A61B7/04.cpc.) or (G08B21/02.cpc.) or (H04M1/15,05.cpc.) or (F41C33/02,048,041,0209.cpc.) or (H04R1/028,083.cpc.) or (G08B13/19621,19669.cpc.) or (H04N9/7921,8042,8205.cpc.) or (A45C3/001.cpc.) or (A45F5/02,021,04.cpc.) or (H04M1/0214,0283,18.cpc.) or (G06F1/1628.cpc.) or (A41B1/08.cpc.) or (A41D27/20.cpc.) or (A45F2200/0516.cpc.) or (G08B25/007.cpc.) or (A41D1/002.cpc.) or (A41C33/045.cpc.) or (A61M5/1417,14244.cpc.) or (G02B21/0294,0288.cpc.)) and (camera with body with user\$2.clm.) and ((interchang\$3 or interchangab\$2 or interchangeab\$2) with mount\$3 with siz\$3.clm.)	US-PGPUB; USPAT	OR	ON	2015/10/28 22:57
S336	1	(camera with body with user\$2.clm.) and ((interchang\$3 or interchangab\$2 or interchangeab\$2) with mount\$3 with siz\$3.clm.)	US-PGPUB; USPAT	OR	ON	2015/10/28 22:58
S773	65	(attach\$3 with (camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:52
S774	38	("1932581" "20020030071" "20040069823" "20080078792" "20080164291" "20080237282" "20080305840" "20100018015" "20100270345" "2085184" "2505551" "2616985" "3586798" "3604069" "3808642" "4040547" "4100653" "4700397" "5163093" "5268965" "5752632" "5771303" "5806146" "5831198" "5850613" "6149043" "6201877" "6283348" "6333984" "6757401" "7013492" "7784157").PN. OR ("8175314").URPN.	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:52
S775	45	((secur\$3 or mount\$3 or slid\$3) with (camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:52
S776	6	("8175314").URPN.	USPAT	OR	OFF	2016/10/17 13:52
S777	263	((camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:52
S778	425	((camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:52
S779	62	((secur\$3 or mount\$3 or slid\$3) with (camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:52
S780	8	("2005/0035161").URPN.	USPAT	OR	OFF	2016/10/17 13:52
S781	1	"Term Removed"	US-PGPUB	OR	OFF	2016/10/17 13:52
S782	3	(slot\$5 with open with lower with end with button\$1 with plate\$1 with material.clm.)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S783	2	(slot\$5 with open with lower with end with button\$1 with plate\$1 with material with user\$2.clm.)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S784	3	(348/77,82,114-115,143-149,151,158,211.99-211.4,211.14,373-376.ccls.) and (mount\$3 with bracket with button\$1 with longitudinal\$2.clm.)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S785	0	(224/197,587,194,230.ccls.) and (mount\$3 with bracket with button\$1 with longitudinal\$2.clm)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S786	0	("340".clas.) and (mount\$3 with bracket with button\$1 with longitudinal\$2.clm)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S787	0	(mount\$3 with bracket with button\$1 with longitudinal\$2.clm)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53

S788	65	(attach\$3 with (camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:53
S789	38	("1932581" "20020030071" "20040069823" "20080078792" "20080164291" "20080237282" "20080305840" "20100018015" "20100270345" "2085184" "2505551" "2616985" "3586798" "3604069" "3808642" "4040547" "4100653" "4700397" "5163093" "5268965" "5752632" "5771303" "5806146" "5831198" "5850613" "6149043" "6201877" "6283348" "6333984" "6757401" "7013492" "7784157").PN. OR ("8175314").URPN.	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:53
S790	45	((secur\$3 or mount\$3 or slid\$3) with (camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:53
S791	6	("8175314").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S792	263	((camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	OFF	2016/10/17 13:53
S793	425	((camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S794	62	((secur\$3 or mount\$3 or slid\$3) with (camera or device or pda) with shirt with button)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S795	8	("2005/0035161").URPN.	USPAT	OR	OFF	2016/10/17 13:53
S796	1	"Term Removed"	US-PGPUB	OR	OFF	2016/10/17 13:53
S797	3	(slot\$5 with open with lower with end with button\$1 with plate\$1 with material.clm.)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S798	2	(slot\$5 with open with lower with end with button\$1 with plate\$1 with material with user\$2.clm.)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S799	3	(348/77,82,114-115,143-149,151,158,211.99-211.4,211.14,373-376.ccls.) and (mount\$3 with bracket with button\$1 with longitudinal\$2.clm.)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S800	0	(224/197,587,194,230.ccls.) and (mount\$3 with bracket with button\$1 with longitudinal\$2.clm)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S801	0	("340".clas.) and (mount\$3 with bracket with button\$1 with longitudinal\$2.clm)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S802	0	(mount\$3 with bracket with button\$1 with longitudinal\$2.clm)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S803	53	((H04N5/2252,2251,77,907,765,775,781,782,85.cpc.) or (H04N7/142,14,183,185.cpc.) or (A61B5/0024,7275,0402,0476,1112,1117,14542,681,7214,7465.cpc.) or (A61B7/04.cpc.) or (G08B21/02.cpc.) or (H04M1/15,05.cpc.) or (F41C33/02,048,041,0209.cpc.) or (H04R1/028,083.cpc.) or (G08B13/19621,19669.cpc.) or (H04N9/7921,8042,8205.cpc.) or (A45C3/001.cpc.) or (A45F5/02,021,04.cpc.) or (H04M1/0214,0283,18.cpc.) or (G06F1/1628.cpc.) or (A41B1/08.cpc.) or (A41D27/20.cpc.) or (A45F2200/0516.cpc.) or (G08B25/007.cpc.) or (A41D1/002.cpc.) or (A41C33/045.cpc.) or (A61M5/1417,14244.cpc.) or (G02B21/0294,0288.cpc.)) and (camera with body.clm.) and ((interchang\$3 or interchangeab\$2 or interchangeab\$2).clm.)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S804	19	((H04N5/2252,2251,77,907,765,775,781,782,85.cpc.) or (H04N7/142,14,183,185.cpc.) or (A61B5/0024,7275,0402,0476,1112,1117,14542,681,7214,7465.cpc.) or (A61B7/04.cpc.) or (G08B21/02.cpc.) or (H04M1/15,05.cpc.) or	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53

		(F41C33/02,048,041,0209.cpc.) or (H04R1/028,083.cpc.) or (G08B13/19621,19669.cpc.) or (H04N9/7921,8042,8205.cpc.) or (A45C3/001.cpc.) or (A45F5/02,021,04.cpc.) or (H04M1/0214,0283,18.cpc.) or (G06F1/1628.cpc.) or (A41B1/08.cpc.) or (A41D27/20.cpc.) or (A45F2200/0516.cpc.) or (G08B25/007.cpc.) or (A41D1/002.cpc.) or (A41C33/045.cpc.) or (A61M5/1417,14244.cpc.) or (G02B21/0294,0288.cpc.)) and (camera with body.clm.) and ((interchang\$3 or interchangeab\$2 or interchangeab\$2) with mount\$3.clm.)				
S805	4	((H04N5/2252,2251,77,907,765,775,781,782,85.cpc.) or (H04N7/142,14,183,185.cpc.) or (A61B5/0024,7275,0402,0476,1112,1117,14542,681,7214,7465.cpc.) or (A61B7/04.cpc.) or (G08B21/02.cpc.) or (H04M1/15,05.cpc.) or (F41C33/02,048,041,0209.cpc.) or (H04R1/028,083.cpc.) or (G08B13/19621,19669.cpc.) or (H04N9/7921,8042,8205.cpc.) or (A45C3/001.cpc.) or (A45F5/02,021,04.cpc.) or (H04M1/0214,0283,18.cpc.) or (G06F1/1628.cpc.) or (A41B1/08.cpc.) or (A41D27/20.cpc.) or (A45F2200/0516.cpc.) or (G08B25/007.cpc.) or (A41D1/002.cpc.) or (A41C33/045.cpc.) or (A61M5/1417,14244.cpc.) or (G02B21/0294,0288.cpc.)) and (camera with body with user\$2.clm.) and ((interchang\$3 or interchangeab\$2 or interchangeab\$2) with mount\$3.clm.)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S806	2	((H04N5/2252,2251,77,907,765,775,781,782,85.cpc.) or (H04N7/142,14,183,185.cpc.) or (A61B5/0024,7275,0402,0476,1112,1117,14542,681,7214,7465.cpc.) or (A61B7/04.cpc.) or (G08B21/02.cpc.) or (H04M1/15,05.cpc.) or (F41C33/02,048,041,0209.cpc.) or (H04R1/028,083.cpc.) or (G08B13/19621,19669.cpc.) or (H04N9/7921,8042,8205.cpc.) or (A45C3/001.cpc.) or (A45F5/02,021,04.cpc.) or (H04M1/0214,0283,18.cpc.) or (G06F1/1628.cpc.) or (A41B1/08.cpc.) or (A41D27/20.cpc.) or (A45F2200/0516.cpc.) or (G08B25/007.cpc.) or (A41D1/002.cpc.) or (A41C33/045.cpc.) or (A61M5/1417,14244.cpc.) or (G02B21/0294,0288.cpc.)) and (camera with body with user\$2.clm.) and ((interchang\$3 or interchangeab\$2 or interchangeab\$2) with mount\$3 with siz\$3.clm.)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53
S807	2	(camera with body with user\$2.clm.) and ((interchang\$3 or interchangeab\$2 or interchangeab\$2) with mount\$3 with siz\$3.clm.)	US-PGPUB; USPAT	OR	ON	2016/10/17 13:53

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Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (03-15)

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	Filing Date	2016-01-08
	First Named Inventor	Steve Phillips
	Art Unit	2662
	Examiner Name	Pritham David Prabhakher
	Attorney Docket Number	2539-10.04

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	1	20030081934	A1	2003-05-01	Kirmuss	
	2	20060271287	A1	2006-11-30	Gold, et al.	
	3	20080100705	A1	2008-05-01	Kister, et al.	
	4	20110018998	A1	2011-01-27	Guzik	
	5	20110314401	A1	2011-12-22	Salisbury, et al.	

/Pritham Prabhakher/

10/17/2016

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Attorney Docket Number	2539-10.04

6	20120038689	A1	2012-02-16	shii
7	20140049636	A1	2014-02-20	O'Donnell, et al.
8	20140218544	A1	2014-08-07	Senot, et al.

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FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ² i	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	2012120083	WO	A1	2012-09-13	Alca-Tel Lucent, et al.		

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NON-PATENT LITERATURE DOCUMENTS

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	1	US Patent Application 15/011,132 Office Action dated April 18, 2016, 19 pages.	

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EXAMINER SIGNATURE

Examiner Signature	/Pritham Prabhakher/	Date Considered	10/17/2016
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**INFORMATION DISCLOSURE
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Art Unit	2662
Examiner Name	Pritham David Prabhakher
Attorney Docket Number	2539-10.04

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

/Pritham Prabhakher/

10/17/2016

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
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Art Unit	2662
Examiner Name	Pritham David Prabhakher
Attorney Docket Number	2539-10.04

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).



See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Jennifer C. Bailey/	Date (YYYY-MM-DD)	2016-05-06
Name/Print	Jennifer C. Bailey	Registration Number	52583

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

/Pritham Prabhakher/

10/17/2016

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/Pritham Prabhakher/

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(21) Application No 9226174.2

(22) Date of Filing 16.12.1992

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(58) Field of Search
 UK CL (Edition L) **H4F FAA FDC**
 INT CL⁵ **H04N 7/18**
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(54) Vehicle data recorder.

(57) A vehicle data recorder comprises a video camera (6) for detecting images external to the vehicle and a compression means (13) for compressing the video data to provide a compressed video data signal. A status data collection means (2) detects the status (e.g. speed, control settings) of the vehicle, and a recording means (3) receives the compressed video data signal and the status signal in synchronisation with each other for recording in a non volatile impact protected memory (4). This allows video images of views external to the system to be recorded, to assist in the analysis of incidents involving the vehicle.

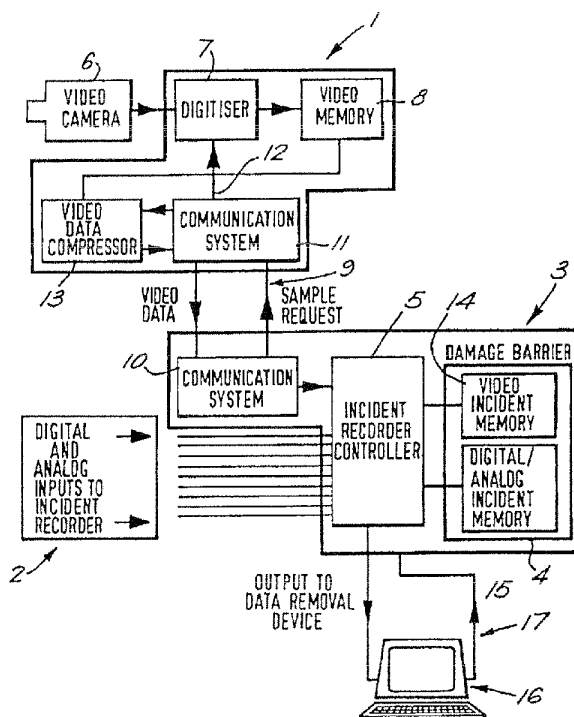


FIG.1.

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

1/2

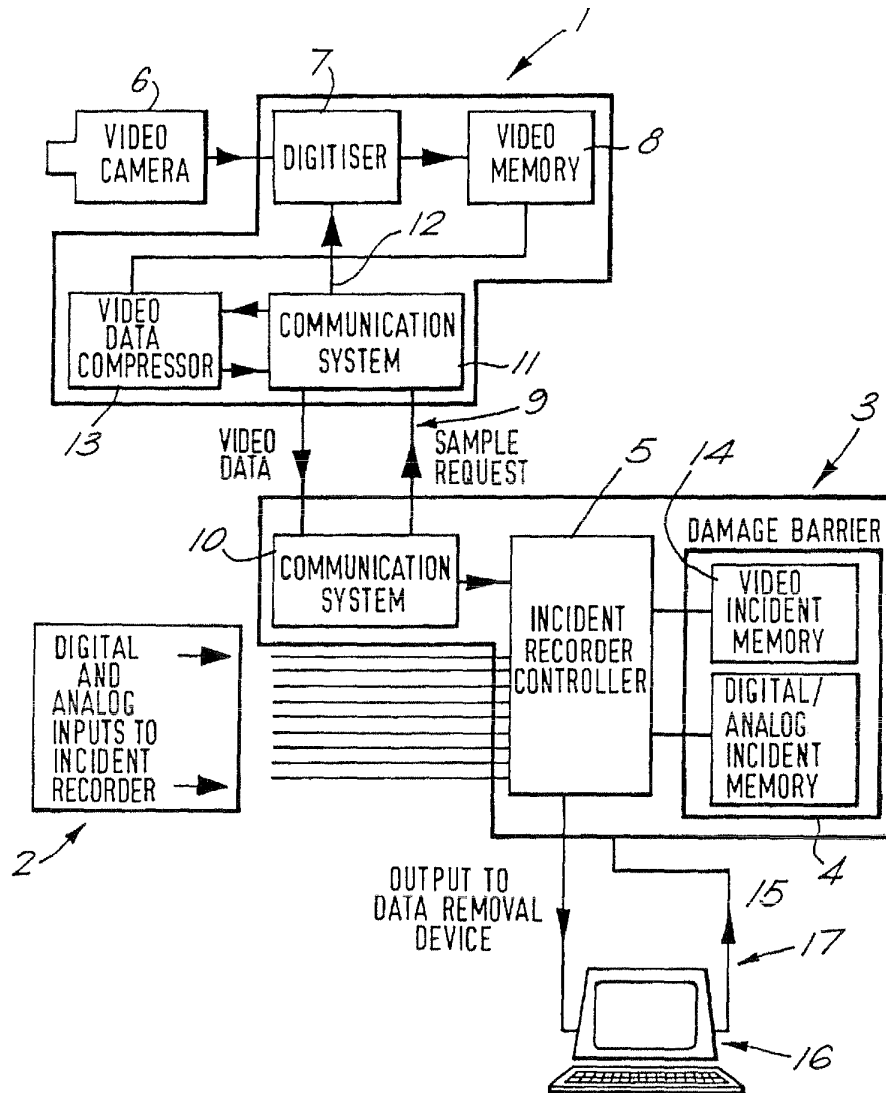
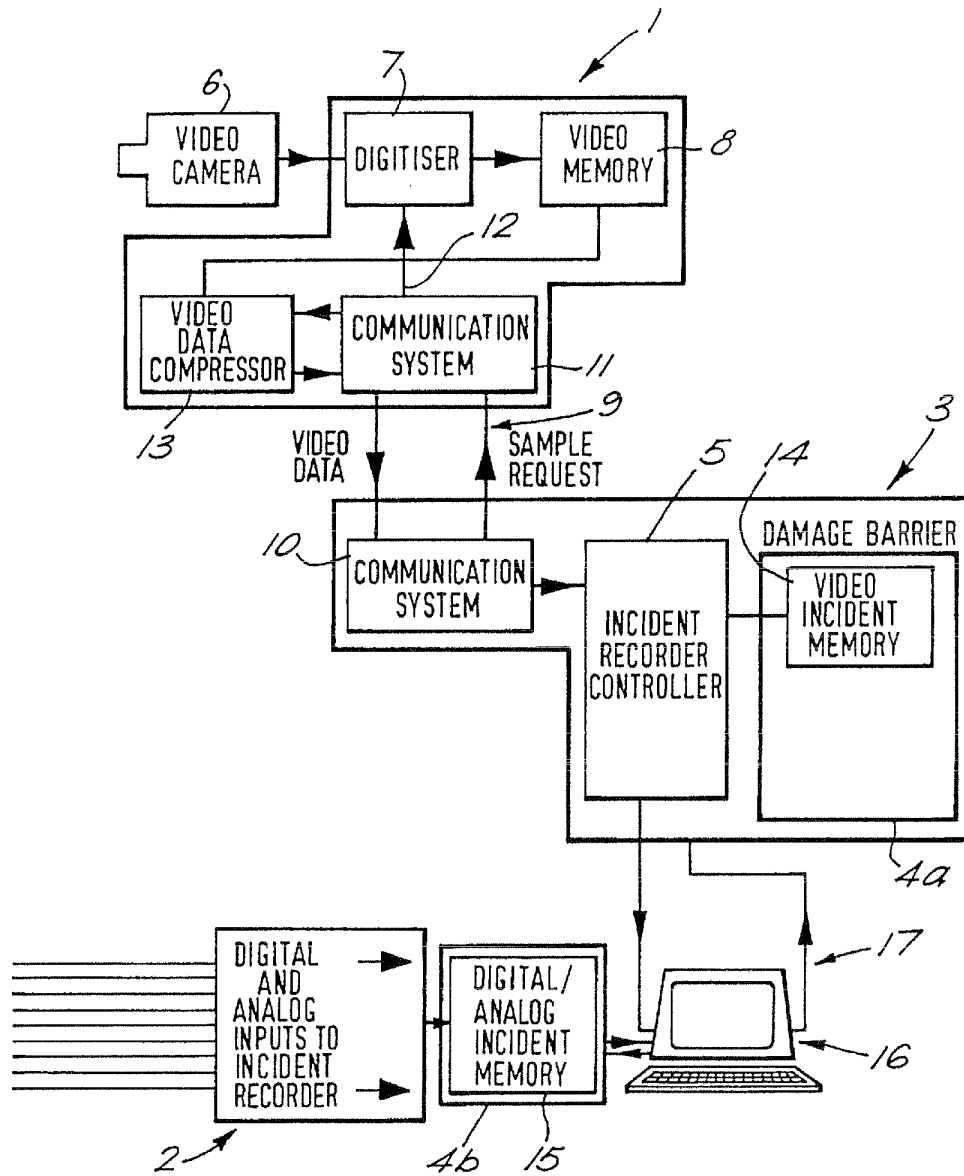


FIG.1.



A DATA RECORDER

The present invention relates to a data recorder, in particular a data recorder suitable for monitoring a vehicle (in particular a railway vehicle) to record data
5 concerning vehicle-related incidents, such as crashes.

Data recorders (or "incident recorders") are known which record data concerning the status of a system, such as a vehicle, for use in routine maintenance of the system or for determining the cause of an incident involving the
10 system, such as a vehicle crash. However, many incidents are caused not by faults in the system but by external factors. For example, accidents to railway trains may be caused by faulty railway tracks, obstructions on the tracks, or by a train's driver responding incorrectly to
15 external signals - by driving the train past a "stop" signal, for instance. These are not recorded by conventional data recorders.

According to the present invention there is provided a data recorder for recording data, the data recorder
20 comprising: video data collection means including a video camera for detecting images and providing a video signal containing video data defining those images, and compression means for compressing the video data to provide a compressed video data signal; status data
25 collection means for sensing the status of a system and providing a status signal containing status data defining that status; and recording means for receiving the compressed video data signal and the status signal and including an impact- and thermal-protected non-volatile
30 memory for recording the compressed video data and the status data in synchronisation with each other.

This data recorder allows video images of views outside the system, including views of the external factors which may cause incidents, to be recorded.

The video signals and the status signals are suitably recorded in synchronisation so that the video data defining the image or images detected at any time and the status data detected at that time may be identified.

5 This may conveniently be done by the video data and the status data being recorded in a predetermined order. Alternatively, the recording means may comprise clock means for generating a synchronisation signal (or "time code") which is recorded in the memory to allow the video

10 data and status data recorded at or around any one time to be located.

The video camera suitably detects individual image frames, in which case the video data suitably comprises a series of data relating to individual frames. More

15 than one video camera may be provided, in which case the cameras may each operate alternately or continuously; suitably each video camera detects video frames of views external to the system.

The video data and/or the compressed video data may

20 suitably be in the form of digital signals. The video data collection means may suitably include a buffer memory for storing the video data, from which the compressed video data may be transmitted intermittently to the recording means, suitably in a response to a video

25 request signal generated by control means in the recording means.

The memory of the recording means may suitably include a first non-volatile memory for recording the compressed video data and a second non-volatile memory for recording

30 the status data.

The system is suitably a railway train or vehicle, in which case the data recorder may suitably include a first video camera for detecting a view ahead of the railway train or vehicle and a second video camera for detecting

35 a view behind the railway train or vehicle.

The present invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of a first embodiment
5 of a data recorder; and

Figure 2 is a schematic view of a second embodiment
of a data recorder.

The data recorder shown in Figure 1 comprises a video
data collector 1 and a status data collector 2 which
10 transmit video data signals and status data signals
respectively to a recorder unit 3. The recorder unit
records the data in a non-volatile memory 4, from which
the data can be downloaded for analysis, for example to
determine the cause of an accident. The recorder unit 3
15 comprises an data recorder controller 5. This controls
the passage of data from the data collector means 1,2 to
the memory 4 when the data is to be recorded, and from
the memory 4 when the data is to be downloaded.

Whilst the data recorder is recording data, for example
20 during the operation of the system it is to monitor, the
status data collector 2 collects digital and/or analog
status data concerning the status of the system. For
example, if the system is a railway train, the status
data collection means may receive data from sensors for
25 detecting the speed of the train and the settings of its
controls. This data is transmitted to the controller 5
which passes it to the memory 4 for recordal. To save
memory, the controller 5 may filter the status data so
that only the changes in the system's status (as
30 represented by variations in the status data) are
recorded in the memory 4.

At the same time, the video data collector 1 collects
signals representing video images frame by frame from a
video camera 6. These are digitised by video digitiser
35 7 and then stored in a video memory buffer 8. At
suitable intervals, the controller 5 transmits a video

sample request signal (on line 9) to the video data collector 1 via communication units 10 and 11. In response to this signal the communication unit 11 transmits a signal on line 12 to the digitiser 7 to
5 command it to temporarily suspend the passing of signals to the buffer 8. Meanwhile, the contents of the buffer 8 are compressed by a video data compressor unit 13 and the compressed video data is then transmitted via communication units 11 and 10 to the controller 5. This
10 passes the data to the memory 4 for recordal. The buffer 8 is then emptied and the digitiser 7 begins passing signals to it again.

To allow the data to be analysed when it has been downloaded, the video data and the status data are stored
15 in synchronisation so that the video data representing an image or images collected at any time and the status data collected at or around the same time may be identified. This may be achieved by storing the data in a predetermined order or by recording synchronisation data
20 together with items of status data or video data which are to be recorded. The synchronisation data may represent a time, as generated by a clock in the controller 5.

The memory 4 has two separate memory units 14,15 for
25 storing, respectively, the video data and the status data. These can suitably hold at least one hour's data. So that the data is not lost in the event of, for example, a crash of a railway vehicle in which the unit is installed, the memory units 14,15 are non-volatile:
30 they are protected suitably from heat and impact or shock.

After a crash or during routine maintenance the recorded data may be analysed by a computer 16. In response to a
35 data request signal (on line 17) from the computer 16 the incident recorder transmits (downloads) the contents of the memory to the computer. When the data have been

downloaded in this way the video data is decompressed by the computer and the video images displayed. The status of the system and the video images can be displayed together on the same screen of the computer, the status
5 being displayed graphically if appropriate. Because the video and status data are stored in synchronisation they can be displayed in synchronisation so that the status of the system at any time, as indicated by the status data, and the external conditions then, as indicated by the
10 video images, can be examined.

To save memory, the video frames may be captured by the video data collector 1 from the camera 6 at small intervals rather than continuously.

More than one video camera may be used to detect the
15 images. For example, on a railway train one camera may be provided to detect images of the view ahead of the train and another to detect images of the view behind the train. These may collect data continuously or alternately, under the control of the controller 5.

20 Figure 2 shows an alternative embodiment of a data recorder in which the memory 4 is configured in two discrete portions 4a and 4b which hold the video data memory 14 and the status data memory 15 respectively. The data stored in the memories are synchronised by the
25 storage of time codes identifying the times at which the data are stored. When the recorded data is to be analysed it may be downloaded to the computer 16 from memories 4a and 4b.

CLAIMS

1. A data recorder for recording data, the data recorder comprising:

video data collection means including a video camera for detecting images and providing a video signal containing video data defining those images, and compression means for compressing the video data to provide a compressed video data signal;

status data collection means for sensing the status of a system and providing a status signal containing status data defining that status; and

recording means for receiving the compressed video data signal and the status signal and including an impact- and thermal-protected non-volatile memory for recording the compressed video data and the status data in synchronisation with each other.

2. A data recorder as claimed in claim 1, wherein the video camera detects individual image frames and the video data comprises a series of data relating to individual frames.

3. A data recorder as claimed in claim 2, wherein the recording means comprises clock means for generating synchronisation data, the synchronisation data being recorded in the memory to indicate the synchronisation of each one of the frames with the recorded status data.

4. A data recorder as claimed in any preceding claim, wherein the video data is in digital form.

5. A data recorder as claimed in any preceding claim, wherein the video data collection means comprises a video memory for storing the video data.

6. A data recorder as claimed in claim 5, wherein the recording means includes control means for generating a video request signal and wherein in response to the video

request signal the video data collection means transmits to the recording means video data stored in the video memory.

5 7. A data recorder as claimed in any preceding claim, wherein the recording means includes a first non-volatile memory for recording the video signals and a second non-volatile memory for recording the status signals.

10 8. A data recorder as claimed in any preceding claim, wherein the recording means records variations in the status data.

9. A data recorder as claimed in any preceding claim, wherein the video camera detects video frames of views external to the system.

15 10. A data recorder as claimed in any preceding claim, wherein the system is a railway train or vehicle.

20 11. A data recorder as claimed in claim 10 as dependent on claim 9 including a first video camera for detecting a view ahead of the railway train or vehicle and a second video camera for detecting a view behind the railway train or vehicle.

12. A data recorder as claimed in claim 11, wherein views are detected alternately by the first and second video cameras.

25 13. A data recorder substantially as herein described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under
Section 17 (The Search Report)

Application number

GB 9226174.2

Relevant Technical fields

(i) UK Cl (Edition L) H4F - FAA, FDC

(ii) Int Cl (Edition 5) H04N - 7/18

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI

Search Examiner

D H JONES

Date of Search

3 MARCH 1993

Documents considered relevant following a search in respect of claims 1-12

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	US 4843463 A (MICHETTI) see whole document	1-12
X	WO 88/09023 A1 (SZABO) see Figure 1	1-12

Category	Identity of document and relevant passages - 9 -	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

IE 2009/0923

ABSTRACT

This invention relates to a miniature, weather resistant proximity reader of the type used for reading an RFID proximity tag to permit entry or exit from a building. The proximity reader has a compact housing with a pair of screw posts that extend through the housing to enable the proximity reader to be secured to a wall or other structure. The screw posts allow the screws to be inserted through the casing without exposing the interior of the proximity reader. A speaker is mounted in the casing and is front facing and a plurality of speaker holes are formed in the casing adjacent and surrounding the screw post. These speaker holes are in turn covered by a screw cap. In this way, the miniature speaker will be more audible while at the same time less prone to damage during installation. This is achieved without comprising the weather resistance of the proximity reader. <Figure 6>

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INT CL (2009)
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- 1 -

"A proximity reader"

OPEN TO PUBLIC INSPECTION
UNDER SECTION 22 AND RULE 23
JNL No. 2160 of 29/9/2010

Introduction

IE 090923

- 5 This invention relates to a proximity reader of the type used to identify radio frequency identification (RFID) cards in an access control system. More specifically, this invention relates to a miniature, weather resistant proximity reader and does not relate to larger multifunctional intercoms systems.
- 10 Proximity readers are commonly used in access control systems. Typically, proximity readers are mounted on a wall adjacent an entrance of a building monitored by the access control system. The proximity reader detects the presence of an RFID tag in the vicinity of the reader and communicates with a control module which in turn decides whether or not to permit access to the holder of the RFID tag
- 15 to the building. Usually, the proximity reader is provided with a miniature speaker that provides an audible indicator to the individual attempting to gain access when their access request has been successful and the locking mechanism on the entrance has been temporarily released.
- 20 There are however numerous problems with the known types of proximity readers. First of all, the miniature speaker is often very difficult to hear, particularly when operating in an area with a high level of ambient noise or in windy conditions. Secondly, the miniature speaker is prone to damage by ingress of dirt and moisture into the proximity reader and furthermore is susceptible to damage when the
- 25 proximity reader is being mounted onto a wall. It is an object of the present invention to overcome at least one of these problems.

- US2007/0188299, in the name of Immotec Security Systems Limited, describes an interphone panel for a multiple dwelling building having a speaker and an RFID
- 30 reader. This device is not a miniature weather resistant proximity reader within the meaning of the present invention but rather is a large scale device in which space, internal positioning of the speaker and weather resistance are of no particular concern. This is illustrated by the fact that the casing is relatively large and has a plurality of apertures in the front of the casing where ingress of dirt and moisture is

likely. As the front of the device is not sealed, the ability to hear the speaker through the casing and the relative placement of the speaker would be of no particular concern.

5 **Statements of Invention**

According to the invention there is provided a miniature, weather resistant proximity reader comprising a wall mountable ruggedised housing having a front, back and sides, a pair of screw posts extending through the housing from the front to the
10 back each for reception of a fixing screw therein to fix the proximity reader to a wall, a pair of screw caps each having housing engaging arms for reception in complimentary receiving slots on the housing to secure the screw caps in position on the housing covering the screw posts, the proximity reader comprising an electronics unit including an RFID reader and a speaker mounted in the housing,
15 the speaker facing forwards in the housing towards the front of the housing and in which there are provided a plurality of speaker holes in the front of the housing adjacent the screw post and covered in use by one of the screw caps.

The known types of miniature proximity readers have rearward facing speakers
20 located at the rear of the device. As a consequence, the audible indication from the speaker is often difficult to hear and is also prone to both water ingress and damage caused by uneven surfaces upon which it is mounted crushing the speaker. By having the arrangement according to the present invention, it will be possible to hear the audio indicators more clearly, even if operating in an area with
25 a high level of ambient noise or in windy conditions. The plurality of speaker holes towards the front of the housing allows the speaker to be heard even though it is mounted front facing in the casing and the provision of the screw cap over the speaker holes prevents ingress of moisture and dirt through these holes, keeping the proximity reader weather resistant. In addition to this, by having the screw cap
30 over the speaker holes, the screw cap or the area of the screw cap around the holes can be thinner than the remainder of the casing, thereby improving the audio quality further. Furthermore, the miniature speaker will be less prone to damage by ingress of dirt and moisture into the proximity reader and less susceptible to damage when the proximity reader is being mounted onto a wall due to the fact that

the speaker will now be housed internal the housing and front facing rather than being exposed at the rear of the housing.

5 In another embodiment of the invention there is provided proximity reader in which the electronics are potted in the housing.

10 In a further embodiment of the invention there is provided proximity reader in which the back of the housing is sealed. This is seen as particularly advantageous as the electronics circuit and in particular the speaker will be sealed watertight in the housing thereby preventing damage to the speaker due to ingress of dirt and moisture.

15 In one embodiment of the invention there is provided a proximity reader in which there is provided an annular gasket surrounding the holes.

In another embodiment of the invention there is provided a proximity reader in which the screw caps housing engaging arms are releasably secured in the complimentary receiving slots on the housing. Preferably, the arms form a snap fit in the slots.

20 In a further embodiment of the invention there is provided a process of manufacturing a miniature, weather resistant proximity reader comprising the steps of:

25 moulding a housing having a front, back and sides with a pair of screw posts extending through the housing from the front to the back, the housing having a plurality of speaker holes formed in the front of the housing adjacent one of the screw posts;

30 mounting an electronics unit comprising an RFID reader and a speaker in the housing with the speaker facing forwards in the housing towards the front of the housing adjacent the screw post; and

sealing the back of the housing thereby sealing the electronics unit therein.

In one embodiment of the invention there is provided a process in which the step of sealing the back of the housing further comprises potting the electronics unit.

- 5 In another embodiment of the invention there is provided a process comprising the intermediate step of placing a gasket in the housing surrounding the speaker holes prior to mounting the electronics unit.

Detailed Description of the Invention

10

The invention will now be more clearly understood from the following description of some embodiments thereof given by way of example only with reference to the accompanying drawings in which:

- 15 Fig. 1 is a front view of a miniature, weather resistant proximity reader according to the invention;

Fig. 2 is a right hand side view of the proximity reader;

- 20 Fig. 3 is a cross-sectional view of the proximity reader along the lines A-A in Fig. 1;

Fig. 4 is a left hand side view of the proximity reader;

- 25 Fig. 5 is a rear view of the proximity reader without the electronic unit in the housing;

Fig. 6 is an enlarged view of the circled portion in Fig. 5;

- 30 Fig. 7 is a front view of a screw cap which forms part of the proximity reader;

Fig. 8 is a right hand side view of the screw cap of Figure 7;

Fig. 9 is another front view of the screw cap;

Fig. 10 is a cross-sectional view of the screw cap along the lines A-A of Fig 9;

5

Fig. 11 is a left hand side view of the screw cap of Figure 7;

Fig. 12 is an isometric view of a gasket which forms part of the proximity reader.

10

Referring to Figures 1 to 6 inclusive there is shown a miniature, weather resistant proximity reader, indicated generally by the reference numeral 1 comprising a housing 3 having a front 5, back 7 and sides 9, 11, 13, 15. The housing 3 has a pair of screw posts 17, 19 extending through the housing from the front 5 to the back 7, each for reception of a fixing screw (not shown) therein to fix the miniature proximity reader to a wall.

15

Referring specifically to Figure 6, there are provided a plurality of speaker holes 21 in the front 5 of the housing adjacent the screw post 17. These speaker holes 21 are covered in use by a screw cap (not shown) and are surrounded internal the housing by a gasket 23. There are further provided a plurality of slots 25 adjacent each of the screw posts for reception of a housing engaging arm (not shown) of a screw cap. The housing engaging arms are snap fit into the slots 25 and the screw cap covers both the screw post 17 and the holes 21. The position of the gasket 23 is also shown in Figure 1 for illustrative purposes only and it will be understood that the gasket would not normally be visible from the front of the device.

20

25

Referring specifically to Figure 3, the proximity reader 1 comprises an electronics unit 27 having a RFID reader 28 and a speaker 29 located in the housing. The speaker 29 is mounted facing forwards towards the front 5 of the housing 3 and is located adjacent the plurality of speaker holes 21 in the front of the housing.

30

Referring to Figures 7 to 11 inclusive, there is shown a screw cap, indicated generally by the reference numeral 31, for a proximity reader according to the

invention. The screw cap shown is not to scale and has been enlarged for clarity. The screw cap 31 comprises a plurality of housing engaging arms 33 for reception in the complimentary slots of the housing. Each of the housing engaging arms 33 forms a snap fit or push fit in the respective complimentary slot 25 of the housing.

5 When in position with its arms 33 engaged in the slots 25, the screw cap covers a screw in the screw post 17, 19 and the screw cap also covers the holes 21. Each screw post has a screw cap associated therewith.

Referring to Figure 12, there is shown an isometric view of a gasket 23 used in the proximity reader according to the present invention. The gasket comprises a

10 substantially figure-of-eight shaped body with a first circular portion 37 and a second elliptical portion 39 connected to the first circular portion. The first circular portion surrounds the holes 21 and limits ingress of moisture into the interior of the proximity reader. The second elliptical portion 39 is slightly offset to one side of the

15 first portion and surrounds an aperture for a light emitting diode (LED) that is used as a visual indicator for the person attempting to gain entry into the building.

Throughout this specification, the term building has been used but it will be understood that other structures could be envisaged where the proximity reader of the access control system could be located. Furthermore, reference has been

20 made to entrance throughout but this will also be understood to also incorporate an exit and the term entrance has been used for simplicity throughout. Finally, the proximity reader has been described as being outside a building but it will be understood that the proximity reader could be used internal the building and could

25 be used on doors other than entrances and exits such as an internal door or the like.

In the specification the terms "comprise", "comprises", "comprised" and "comprising" and the terms "include", "includes", "included" and "including" are

30 deemed totally interchangeable and should be afforded the widest possible interpretation.

The invention is in no way limited to the embodiment hereinbefore described but may be varied in both construction and detail within the scope of the claims.

Claims:

- 5 (1) A miniature, weather resistant proximity reader comprising a wall mountable ruggedised housing having a front, back and sides, a pair of screw posts extending through the housing from the front to the back each for reception of a fixing screw therein to fix the proximity reader to a wall, a pair of screw caps each having housing engaging arms for reception in complimentary receiving slots on the housing to secure the screw caps in position on the housing covering the screw posts, the proximity reader comprising an

10 electronics unit including an RFID reader and a speaker mounted in the housing, the speaker facing forwards in the housing towards the front of the housing and in which there are provided a plurality of speaker holes in the front of the housing adjacent the screw post and covered in use by one of the screw caps.

15
- (2) A miniature, weather resistant proximity reader as claimed in claim 1 in which the electronics are potted in the housing.
- 20 (3) A miniature, weather resistant proximity reader as claimed in claim 1 or 2 in which the back of the housing is sealed.
- (4) A miniature, weather resistant proximity reader as claimed in any preceding claim in which there is provided an annular gasket surrounding the speaker holes.

25
- (5) A miniature, weather resistant proximity reader as claimed in any preceding claim in which the screw caps housing engaging arms are releasably secured in the complimentary receiving slots on the housing.
- 30 (6) A miniature, weather resistant proximity reader as claimed in any preceding claim in which the thickness of the screw cap is reduced adjacent the speaker holes.
- (7) A process of manufacturing a miniature, weather resistant proximity reader

comprising the steps of:

5 moulding a housing having a front, back and sides with a pair of screw posts extending through the housing from the front to the back, the housing having a plurality of holes formed in the front of the housing adjacent one of the screw posts;

10 mounting an electronics unit comprising an RFID reader and a speaker in the housing with the speaker facing forwards in the housing towards the front of the housing adjacent the screw post; and

sealing the back of the housing thereby sealing the electronics unit therein.

15 (8) A process as claimed in claim 7 in which the step of sealing the back of the housing further comprises potting the electronics unit.

20 (9) A process as claimed in claim 7 or 8 in which the process comprises the intermediate step of placing a gasket in the housing surrounding the holes prior to mounting the electronics unit.

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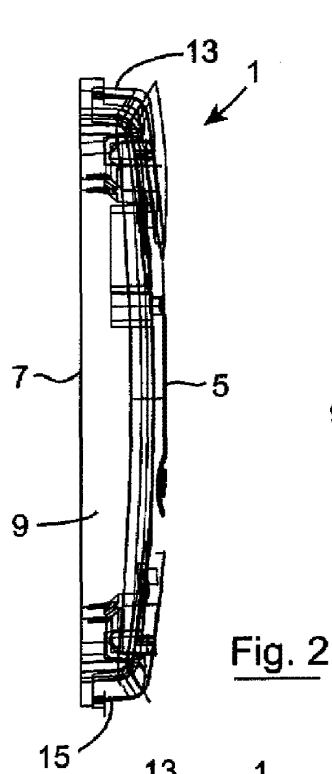


Fig. 2

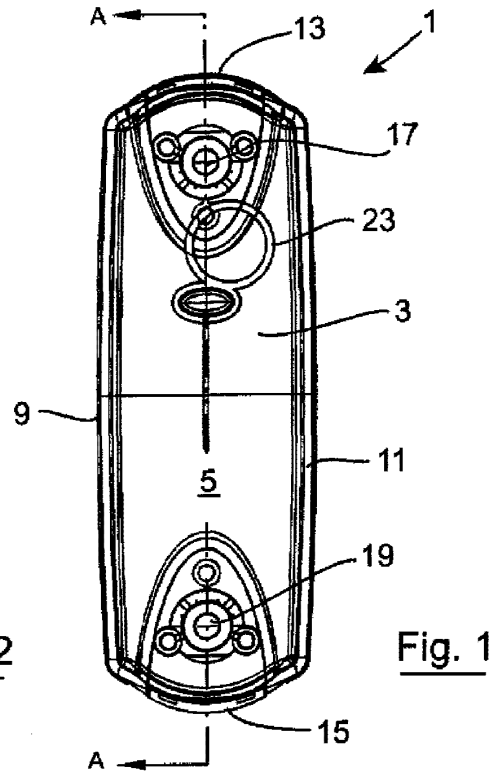


Fig. 1

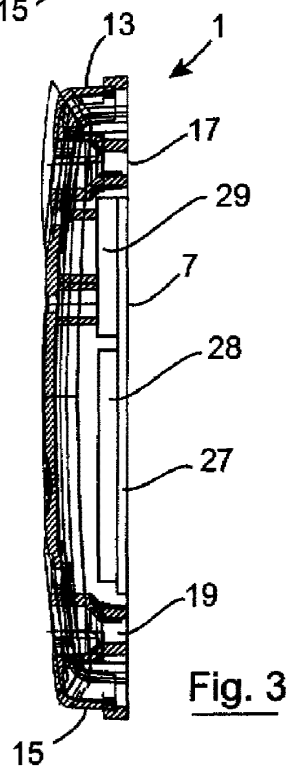


Fig. 3

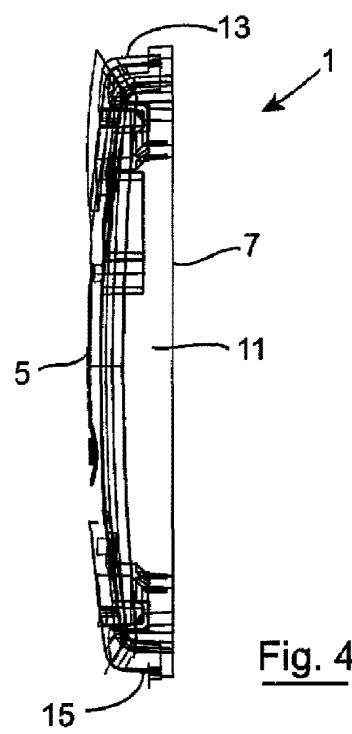


Fig. 4

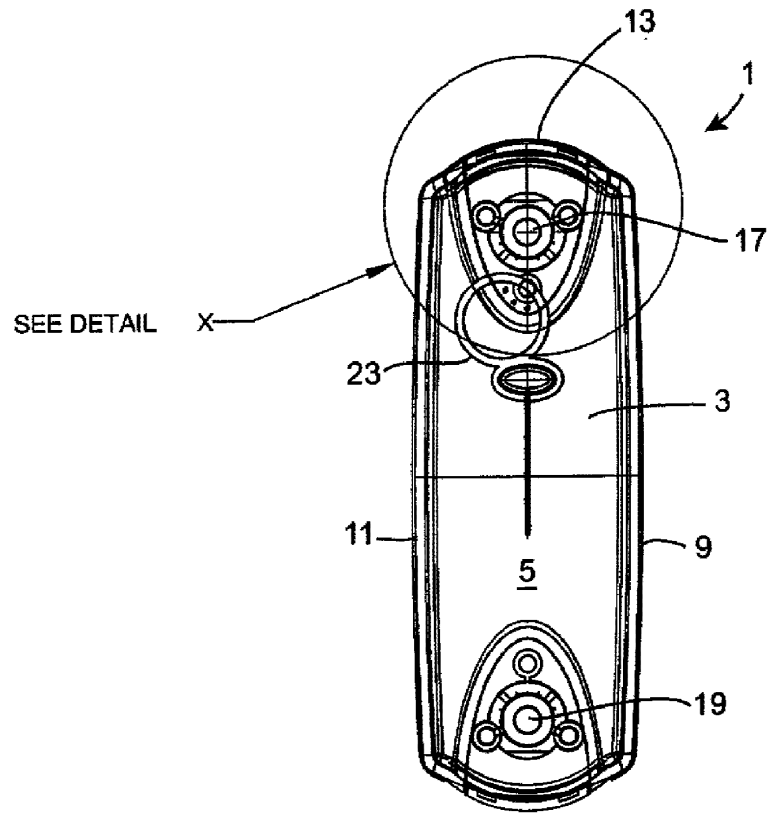


Fig. 5

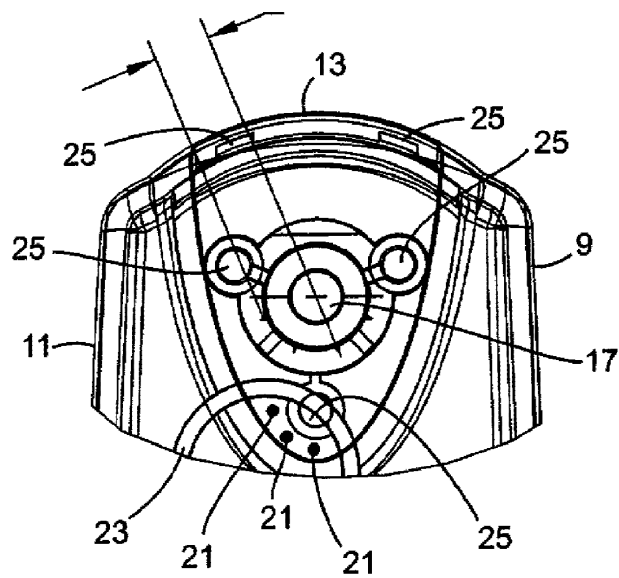


Fig. 6

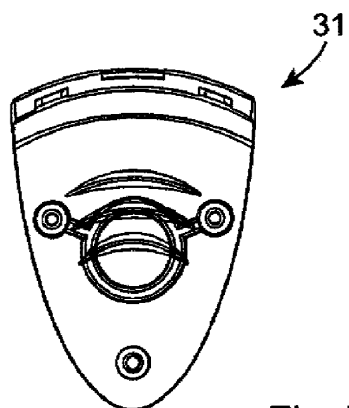


Fig. 7

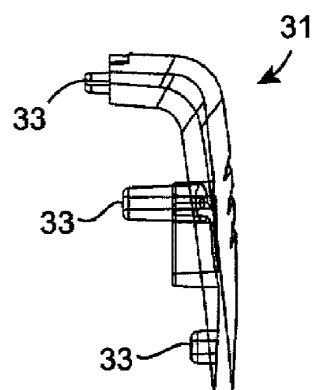


Fig. 8

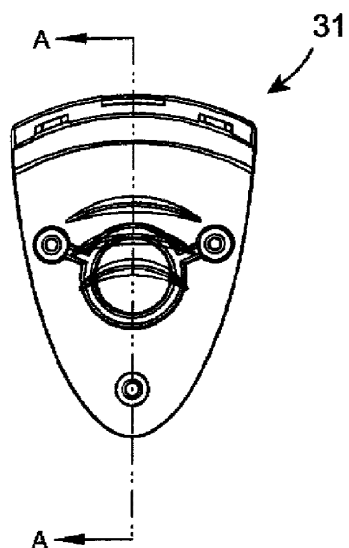


Fig. 9

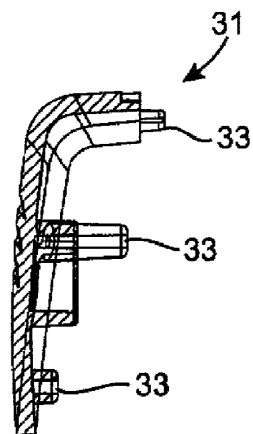


Fig. 10

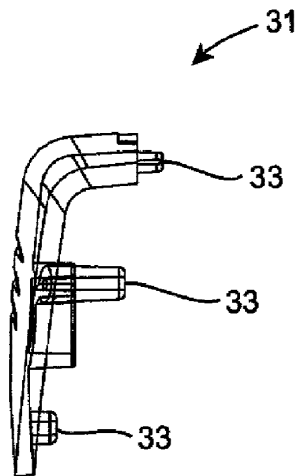


Fig. 11

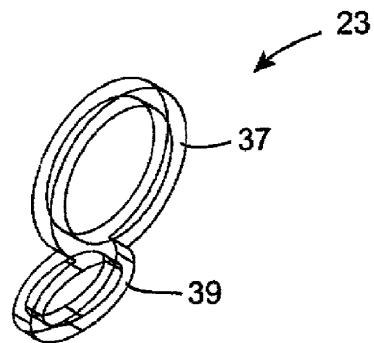


Fig. 12

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(51) INT CL⁶

H04N 7/18 , G08B 13/196 , H04N 5/77

(52) UK CL (Edition P)

H4F FAAE FD12M FD12X FD24 FD30T3 FD83B FKX

(56) Documents Cited

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US 4897732 A

(58) Field of Search

UK CL (Edition P) H4F FAAE FAAX FCK FKA FKX
INT CL⁶ G08B 13/196 , H04N 5/77 5/907 7/18

(54) **Video camera recorder which records via a buffer store so that video data generated before the recorder is switched on is recorded**

(57) A video camera recorder is provided with "hind-sight" by locating a buffer store between the camera pick-up (eg a CCD) and the recording device. The buffer comprises a RAM configured to operate as a FIFO buffer and is interposed between the input and the recording sections of a camcorder. The action of the buffer is to delay (eg for 10 seconds) the recording of the audio and video data to the recording medium for a period of time at least equal to the period between the operator triggering the recording control and the data being registered on to the recording medium. Prior to recording the buffer merely overflows. The arrangement may be used for time lase and slow motion video effects by using the buffer as a time shifter. The recorder may be used for surveillance enabling images before an event to be recorded, for car security and as an electronic still camera. Single frames or multiple frames may be stored for later retrieval on to the main recording medium. The data may be monitored as it flows through the buffer.

GB 2 320 389 A

Video recording device

This invention relates to a video recording device.

Description

In the following description we will refer to the video recording device as **Hindsight**. This also has an optional ability within the software to record and save images at either slowed down or speeded up time intervals. This will be referred to as **Time Shifter option**.

A brief description of Hindsight

The device - **Hindsight** - is a system that records and stores video and sound information before the camera is switched into its normal recording mode in either a normal, compressed or stretched time scale to real time.

Overview of Hindsight

In normal operating conditions that prevail (whether in the professional or amateur domain) a camera is powered up and switched on to view a scene prior to recording it. However in many cases the action suddenly starts before the camera operator anticipates or has time to switch the camera to record mode. If the camera is in 'save condition' it can take a further 2-3 seconds to lace up the camera prior to being able to record the information. Even in 'Standby Mode' slow reactions can lose valuable seconds of unrepeatable action. Even if the camera is a disc based recording machine the reaction time can still be half a second to press the Record Start button. More often than not action has already taken place and the camera operator and or director wishes that he could have started earlier. The device - **Hindsight** - will allow this wish to become a reality, not only for the 2-3 seconds lace up time but also the previous several seconds prior to the lace up time will be recorded as a lead into the action.

(Ten seconds is a realistic amount of time missed but in fact it could be thirty seconds or even one minute if enough memory were supplied.

Examples of practical use of the device - Hindsight

- a) Wildlife videoing. A Predator is waiting to pounce. Often this can be minutes or even hours. As the action develops the camera is switched to record and the previous ten seconds are automatically recorded along with the real time events.
- b) The expected action takes place earlier than anticipated. (The famous 'Ready when you are Mr. De Milne' syndrome when the action was missed)
- c) The camera operator simply forgets to switch on until a function has started. (All is now retrievable including loss of face !)

- d) If a director has a nervous actor, instead of shouting action he can quietly say 'Start when you are ready', knowing that when the actor eventually starts all will be captured.

The following document describes a single device which can store delayed images in real time as well as in time lapse & slow motion requirements using electronic techniques.

Hindsight can also be used for Time Lapse Photography ie **Time Shifter** option.

The concept of time lapse photography on film has long been a useful tool in the hands of creative cameramen. It has both artistic and scientific applications as it allows events which have taken place over minutes, hours and even months and years to be viewed in a matter of seconds.

The foregoing is achieved simply by exposing single frames of 'cine' film with suitable intervals between exposures. When the resulting film is replayed at a normal frame rate (25FPS) - time is effectively speeded up.

Example

A flower opening. The real elapsed time frame may be several days or weeks. Time lapse photography condenses this time frame down to several seconds

Hindsight can also be used for Slow motion photography ie **Time Shifter** option

The concept of slow motion photography on film has long been a useful tool in the hands of a creative cameraman. It has both artistic and scientific applications as it allows events which take place in a very small period of time to be viewed over an extended time period. The method of achieving this result is to pass the film through the cine camera at a high speed and then replay it at a lower frame rate.

Example:-

- 2) A car crash. The real elapsed time frame may last fractions of a second. Slow motion photography stretches this time frame back to several seconds.

With conventional cine film both of these effects (Time lapse and Slow Motion) are achieved by variations of the existing largely mechanical technology. Various factors limit the performance, particularly of slow motion cinematography where filming events which occur in fractions of a second requires significant outlay.

video Time lapse appraisal

A Video recorder is far from ideal for time lapse photography because essentially it is a 'Real Time' recording process where the video heads and tape are revolving at a constant speed, in fact recording can not take place until the required speeds have been achieved.

Time lapse can be achieved by starting and stopping the recording each time an exposure is required. The minimum gap between exposures is then determined by the time period between the start and stop time of the video recorder. This is both time consuming and expensive on wear and tear of machinery. Similarly the same effect could have been achieved by extracting single frames of continuously recorded video tape. This method, whilst allowing a simpler recording technique, is limited to what can be recorded on a single reel of tape.

Slow motion systems have been engineered to enable the tape to run much faster than normal but ultimately there is a limit to the amount of data that can be transferred to the recording medium.

Combining Hindsight & Time Shifter option

Both these techniques use the concept of a stored buffer prior to downloading onto the main recording mechanism. Whereas the advantage in 'combination' with Time lapse photography is marginal, the advantage using Slow Motion photography is much as the chances of missing the action in a compressed time frame are greatly magnified.

E.g. In a wildlife sequence you may decide to shoot a Cheetah kill in slow motion. (Remember when getting this result using high frame 16 mm film it was easy to run out of film before the main action had happened and the film was wasted). Using a combination of Time Shifter in slow motion mode and Hindsight with its constant FIFO overflowing buffer, we could guarantee the shot because the only action necessary on the controls would be to switch to stop after the slow motion event had happened !

Technical description of Hindsight

The **Hindsight** device and its implementation is a solid state electronic unit which uses RAM (Random Access Memory) devices configured as a FIFO buffer, interposed between the input and recording sections of a camcorder. Its action is to delay the registering of the audio and video signals to the recording medium for a time period. The delay period is fixed and is designed to be of sufficient length of time to ensure that the **Hindsight** device fulfils its desired function. The minimum period is that which is required to cover the period between the operator triggering the recording control and valid data being registered on to the recording medium. Dependent on the intended application the optimum data storage, the period of time stored may be considerably greater.

Technical description of Time Shifter option

The Time Shifter device and its implementation is an solid state electronic unit which uses RAM (Random Access Memory) devices configured as a FIFO buffer, interposed between the input and recording sections of a camcorder. Its action in conjunction with suitable control circuitry is to store & delay the registering of video signals to the recording medium for a time period. The delay period is fixed and is designed to be of sufficient length of time to ensure that the Time Shifter device fulfils its desired function.

The minimum period is that which is required to cover the period between the recording part of the camcorder and valid data being registered on to the recording medium. Dependent on the intended application the optimum data storage, the period of time stored may be considerably greater.

Duration of Time Shifter option

The Time Shifter device with a 10 second RAM memory can store 250 frames. These can be captured either as single individual frames as in Time Lapse (less than 25 fps) or in the case of slow motion (more than 25fps). For purposes of this description we assume that standard video in PAL is replayed at 25 FPS therefore if the camcorder is fitted with a suitable solid state storage device capable of holding say 10 seconds of real time video data (when replayed at 25FPS) then dependent on whether these 250 frames of data were stored into memory over an extended or a foreshortened period of time the resulting viewed image would either be slowed down or speeded up.

Technical Summary of Hindsight

The device relies on 'DSAV' for its operation. DSAV which (in this application stands for '**Digitally Stored Audio and Video**') is a method and a device which is capable of receiving an electronic signal (namely the data stream which emanates from the camera and microphone (input) portion of a video recorder), and storing it in a **FIFO** (First In, First Out) buffer before outputting the same data stream to the recording section of a video recorder.

Additional Advantages of Hindsight

Pre-start

Allows absolutely instant start feature to video recorder. Normally (in the 'Save' configuration) there is a few second lace up period during which time the tape stored inside the cassette is threaded around the recorder mechanism. During this time (and any additional time whilst the recording mechanism builds up to the correct speed), recording does not begin. However, if the length of stored data time exceeds the lace up time, then to all intents and purposes the recording will appear to have started even before the instant the record button is pressed.

Reducing head and tape wear

Many video recording systems have a pause facility whereby the forward motion of the tape is stopped whilst the recorder is in pause mode. The tape remains laced up and the drum carrying the record heads continues to revolve. Whilst many video recorders have the facility to be left in this pause mode indefinitely, most manufacturers advise against doing so as wear will take place on one point of the tape. In addition wear is still taking place on the recorder heads. Using the DSAV (Digitally Stored Audio and Video) device this will allow the tape to be unlaced and re-laced and the recorder mechanism left in an inactivated state.

The controls feature required for Time Shifter option

- 1) A shutter speed control ranging from 10 to 2000 or even 5000 fps
- 2) A trigger control to either start or end the data stream and hence to stop the FIFO buffer from losing any information at the output end of the buffer when the required elapsed period has finished.
- 3) A timer clock ranging from 1 week to $1/500^{\text{th}}$ sec
- 4) A strobe control whereby it is possible to make a combination of the two - elapsed time duration followed by an amount of frames that are recorded after each time period. I.e. 5 second interval after which 10 frames are put down and then repeated as long as necessary. (*See non linear effects)
- 5) Fill or Flow control. This selects whether the buffer fills up and holds its maximum memory waiting to be downloaded or whether it allows the information to flow out at the end as new information replaces it. This would be particularly useful if an action event has not yet occurred but where the built up time prior to the event is still relevant. In the case of a repetitive sequence and with constant monitoring, all that is required to happen is that the buffer be stopped at the required moment and depending upon the before and after control setting, the relevant information will be stored waiting to be downloaded.
- 6) A Before and After delay control. This allows for a before & after delay. When it is desirable to see cause and effect the ten second buffer (real time in playback) can be split into two parts depending upon what part of the action is required to record. I.e. The action of a bullet striking a light bulb all happens in a fraction of a second. The cause (the bullet) has little interest until it strikes the glass envelope of the bulb, then the effect will be analysed. In this case the 10 second real time buffer holding the slowed down images would be set for one third prior to impact and two thirds afterwards.

NB There will be an overlap range which is not possible to select i.e. a slow shutter speed with a short elapsed time frame which amounts to a longer exposure than the

frequency of time between frames. The software programme will not allow this to be selected.

Advantages of the Time Shifter option device are:-

- 1) Consecutive individual frames may be stored that can be replayed without further selective editing.
- 2) The mechanical and electronic recording parts of the video recording mechanism are not constantly in use in the case of time lapse intervals and constant back space editing and in the case of slow motion the mechanical framework is not expected to run at a very high speed. Therefore there is a significant saving in wear and tear on both counts.
- 3) For time lapse the buffer allows any number of individual frames to be collected and downloaded onto tape which typically would be 30-40 minutes of real time duration on a current professional recording device or 60 - 240 minutes for a current domestic VHS recorder. Either way the real replay time far exceeds the requirements of any practical usage for which the time lapse period covers. In other words the Time Shifter can cover periods of time ranging from seconds to many months or even years.
- 4) The exposure interval in between frames can be as long as the interval between frames minus one 24th. of a second. In other words a time lapse that recorded one frame per second could have an exposure of 24/25ths of a second which could be desirable for low light usage as the actual exposure period could be up to 24/25ths of a second. On the other hand a far higher shutter speed (such as 1/500 or 1/2000 Th. sec) could also be selected with the intention of making separate but fast moving images sharper. Similarly an elapsed duration of 10 seconds between frames could allow an exposure time of almost 10 seconds long.
- 5) Using the 'Before and After' control the cause and effect photography can be recorded. E.g. A bird of prey strikes a kill in slow motion. We can see the just before the kill and the effect immediately afterwards.
- 6) Using the fill and flow we can either fill up the buffer to a maximum amount then download it or if the required happening has not quite taken place we can shift the time frame by allowing some of the end information to flow off the end of the buffer.
- 7) Ultra high speed images can be slowed right down and again the before and after effect can be utilised to great advantage with the very short time span covered.
- 8) More than one buffer can be used each with a lens and camera but without several recording devices.

Monitoring - especially of time lapse in progress can take place.

How Time Shifter option works in practice

The device is programmed for either time lapse or slow motion. In the case of time lapse it is how many frames that are recorded at less than 25 per second. The time interval range should be from between 10 frames per second through to one week. Typically 10-5-3 fps - 1 per sec - 3-5-10-20-30-60 seconds -1-2-4-8 -12-24-48-72-168 hours

In the case of slow motion it is how many frames that are recorded at more than 25 per second. The time interval range should be from between 50 frames per second through to 1000 (or even 5000).

The buffer memory stores individual frames at pre-set intervals. Once the buffer approaches its full capacity, the recording device is programmed to make a back space edit then go into its record mode and the buffer is downloaded onto the tape or larger hard disc recording format. This leaves the buffer free to store more individual frames. Although in the case of slow motion video recording the buffer will take longer to download than the elapsed time frame which it recorded. In other words in the slow motion mode the timing for the start of the action is critical and can only be used as a one off until the information is downloaded. However two or more of these devices can be linked in series to extent the elapsed real time period which is to be covered.

Duration of Hindsight

It can be any duration (dependent upon memory capacity) and acts as a 'buffer' between the camera/lens objective and the recording device whether it be tape, disk or other method by which video and sound signals can be stored. Typically it could be of ten seconds duration as this would cover most purposes although it would not be limited to this time duration. If, after ten seconds duration, the main recording medium is not switched on, then the 'buffer' will overflow and earliest information will be lost and it will be continuously replaced by newer data.

Downloading Hindsight

At the end of the 'recording period' the system must keep running for a further 'ten seconds' to download the 'buffer' contents onto the recording medium.

Downloading Time Shifter option

The minimum duration that could utilise the Time Shifter would be defined by the maximum duration of the buffer memory and its ability to be downloaded before it stores newer images. E.g. If the intervals between pictures was one second and it took the camera 3 seconds to reach record speed, then a minimum memory of five seconds would be desirable.

With a one hour duration interval between frames the recording mechanism could be switched off and would only be required every three days to download ! This would be quite advantageous as it would mean that the main recorder would not need to be permanently on site.

Time Shifter option as Stand alone &/or Integral part of main recording device

The Time Shifter device can either be built into the main recording device as an optional extra or can be a separate stand alone device. The device can be operated without the main recording device being linked up. In this case a lens and CCD camera with video output into the device and battery are all that are required. One or more of these devices can be used to obtain different angles or different framing rates. Once the buffer is full it will need to be downloaded before being able to be used again to collect more data.

(Researching throughout the BBC we find that the normal time lapse duration of final shot is 30 seconds, even though the average duration of final shot used is 6-8 seconds. With the ability to monitor stored frames and thus progress and with the added ability to shift the 'before and after' effect, it will be easier to operate within a 10 second window. However the great advantage with this Time Shifter device is that this extended window is instantly attainable by downloading existing images and re-storing new ones. Even a multi camera shoot, utilising two or more Time Shifter devices used with a few second offset, to allow downloading time from individual buffers, would enable a built up of a longer than 10 seconds final shot to be attained.

However a 10 second window would suit 90% of applications.)

Monitoring Time Shifter option

All stored images are able to be accessed and viewed onto a monitor at any time during the acquisition period. This would require a separate set of monitoring controls.

Other possibilities using the Time Shifter device

Multi exposure images could be built up in the same way as photographic images on film. This would in effect be a series of still images with a series of different component parts that formed the final image.

Non Linear effects

The software with which to operate this buffer could be programmed to allow each frame to be outputted several times (*see controls). This would give the impression of time lapse but allowing each individual picture to be seen for a selected elapsed time period. In other words a time lapse sequence of one second duration (which is speeding up real time images by 25 times) could be replayed and downloaded as say five consecutive picture images. This would give the impression of strobed time lapse without any additional editing. Any permutation of repetitive frames could be programmed from this buffer. E.g. A plant growing over a two week period could be speeded up via time lapse but made more understandable by seeing bursts of real time action.

Variable shutter speeds

The software with which to operate this buffer could be programmed to allow each frame to be exposed for a longer period or shorter than normal.

Time Shifter option shutter speeds

A modern CCD camera has the option of a range of shutter speeds. These are normally from $1/50^{\text{th}}$ second up to a $1/2000^{\text{th}}$. The Time Shifter option device could store these images at any of these shutter speeds depending upon the results desired.

Shutter Speed	Pictures stored per sec	Slow Motion Factor		Elapsed time span
$1/50^{\text{th}}$	25	1 x	10	sec
$1/100^{\text{th}}$	50	2 x	5	sec
$1/200^{\text{th}}$	100	4 x	2.5	sec
$1/250^{\text{th}}$	125	5 x	2	sec
$1/500^{\text{th}}$	250	10 x	1	sec
$1/1000^{\text{th}}$	500	20 x	0.5	sec
$1/2000^{\text{th}}$	1000	40 x	0.25	sec
$1/10000^{\text{th}}$	5000	200x	0.05	sec

The camera device

The 'camera and microphone' portion referred to above can be any devices capable of converting visual images and audible sounds to an electronic signal. Typical camera devices are CCD (Charged Coupled Device) cameras and capacitor microphones (although cathode ray tube cameras would benefit equally). Both these, together with their relevant interface circuitry, produce a signal which can be of analogue or digital nature which is then normally fed into the recording section of a camcorder.

The recording device

The recording section usually consists of a cassette tape transport mechanism at the heart of which is a helical scan drum system capable of registering magnetically on the recording medium (tape) the analogue or digital data generated by the input portion of the camcorder system.

When the camera is switched out of record mode but a further shot is required before the 10 second 'buffer' has been downloaded, then exactly the same conditions would apply - namely that the recorder would continue to receive information as it fell off the end of the 'buffer' and continue for 10 seconds after all recordings had stopped. (It would not be necessary to aim the camera at the subject after the decision had been taken to stop recording even though the recording was still downloading).

Hindsight Functionality.

The **Hindsight** device would ideally be build into and incorporated within a video recording system, however it could also be an external device that allowed information to be fed into it (where it was stored and delayed) and then onto the recording medium. If it was an optional extra then it would be desirable for the camera to be manufactured so as to enable this 'additional unit' to be plugged in between the camera/lens viewing device and the actual recording device. It may be that existing camcorders could be modified to incorporate the **Hindsight** device. The camcorder would have to have an outlet interface from the camera viewing side and have an inlet interface to the recording device. At all times the device is in use it operates in-between the camera/lens function and the recorder/recording mechanism. There would be no reason why the **Hindsight** device could not be either in use at all times or it could be switched out of the system.

Hindsight as a stand alone device

The Hindsight device does not need a separate recording outlet when the action can predictably take place within the time scan of its memory capacity. With a ten second 'buffer' that is constantly storing fresh information then all that is required to keep this information is that the device is switched off before the wanted information has been lost. The **Hindsight** device buffer can then be downloaded onto a tape or disc storage medium in the normal way at a later time. The advantages of this are practical and economic. In a predictable video recording location it is often desirable to have two or more cameras running at the time of the action. EG a car crash scene. Two such cameras with **Hindsight** buffers could be recording permanently along with the main video camera. A few seconds after the action has stopped the two extra cameras are switched off. Their image and sound information is then downloaded onto the main camera and they are ready to be used again. This saves having three of the more expensive recording machines and keeps the quality of recording consistently the same for all three.

Hindsight Quality

The process of storing and retrieving the data in the **Hindsight** device should be such that no loss of quality of the video or audio data is perceivable and ideally data transfer rates and data bandwidth should equal or better the specification of the original system. A professional camera such as a Sony DVW700P, which stores information at the rate of 125.58 M/bits/Sec, would require higher quality and more memory and processing than an amateur domestic VHS type camera.

Hindsight as a Surveillance camera

Typically Surveillance cameras take single frames or bursts of frames at intervals and these are stored onto a low quality recording medium. If the **Hindsight** device were utilised then the lead up to the moment of required surveillance could be stored and downloaded in the same way as described previously. Real time images rather than time lapsed would be more useful in identifying a crime. The only difference being that

some form of triggering mechanism such as a broken beam, an emergency switch, a trembler device or sound activated switch must be operated to save the previously stored images.

Hindsight as a car security camera

With a **Hindsight** device incorporated within a car, each new driver would be recorded and stored for a few seconds after which time the 'buffer' would run continuously. If the driver was unauthorised then his image would be retrievable once the car was recovered. Perhaps the most important use would be in the event of a crash. The **Hindsight** device, running continuously, would be de-activated in the event of one of the cars sensors detecting a crash and stop immediately. The device would be built into an inaccessible part of the vehicle that was fireproof and tamperproof. The recording would legally belong to the owner of the car and could be presented in evidence on his behalf in any analysis of the accident.

Hindsight as a stills Cameras

The same principal would apply to stills cameras as moving image cameras. Once the camera is switched on and the **Hindsight** device activated then images at a pre determined rate are being constantly stored into the memory. Until the camera shutter control is activated the information is lost after say 10 seconds. However as a still photo requires higher quality than a video frame, then more memory would be required. However if a frame rate of say 3 pictures per second were selected, then this would make the memory more desirable in size and economics. Once images were stored they should be reviewed and only ones capturing the required action need to be kept, thus releasing the rest of the memory for future use. For still photographs this 3 second frame rate would be very desirable as most motor drives operate at about this speed. If a higher rate was required (say 5 frames per second) then this could be selected but less elapsed time would be available as stored pictures in memory. I.e. the window of information would be less, the more images were stored for a given memory capacity.

Framing rates and memory

For a given memory capacity there would be a number of photographs stored at a given file size. Let us say this is 15 images to be held in temporary memory.

Frames per second	Elapsed time covered (in seconds)
1	15
3	5
5	3
10	1.5
15	1

Claims

- 1) **The Hindsight Device** comprises a solid state electronic memory unit which uses RAM (Random Access Memory) devices configured as a FIFO buffer, interposed between the input and recording sections of a camcorder. Its action is to delay the registering of the audio and video signals to the recording medium for a time period. The delay period is fixed and is designed to be of sufficient length of time to ensure that the device fulfils its desired function. The minimum period is that which is required to cover the period between the operator triggering the recording control and valid data being registered on to the recording medium. Dependent on the intended application the optimum data storage, the period of time stored may be considerably greater.
- 2) **The Hindsight Device** as claimed in 1 relies on 'DSAV' for its operation. **DSAV** which (in this application stands for '**Digitally Stored Audio and Video**') is a method and a device which is capable of receiving an electronic signal (namely the data stream which emanates from the camera and microphone (input) portion of a video recorder), and storing it in a **FIFO** (First In, First Out) buffer before outputting the same data stream to the recording section of a video recorder.
- 3) **The Hindsight Device** as claimed in 1 & 2 can be any duration (dependent upon memory capacity) and acts as a 'buffer' between the camera/lens objective and the recording device whether it be tape, disk or other method by which video and sound signals can be stored. Typically it could be of ten seconds duration as this would cover most purposes although it would not be limited to this time duration. If, after ten seconds duration, the main recording medium is not switched on, then the 'buffer' will overflow and earliest information will be lost and it will be continuously replaced by newer data.
- 4) **The Hindsight Device** as claimed in 1,2 & 3 can be downloaded at the end of the 'recording period' so long as the system is keep running for a further 'ten seconds' in order to download the 'buffer' contents onto the recording medium.
- 5) **The Hindsight Device** as claimed in 1,2,3,4 can be used with any 'camera and microphone' portion referred to in the description which act as any devices capable of converting visual images and audible sounds to an electronic signal. Typical camera devices are CCD (Charged Coupled Device) cameras and capacitor microphones (although cathode ray tube cameras would benefit equally). Both these, together with their relevant interface circuitry, produce a signal which can be of analogue or digital nature which is then normally fed into the recording section of a camcorder.
- 6) **The Hindsight Device** as claimed in 1 & 5 can be used to download onto any recording section which usually consists of a cassette tape transport mechanism at the heart of which is a helical scan drum system capable of registering magnetically on the recording medium (tape) the analogue or digital data generated by the input portion of the camcorder system.

- 7) **The Hindsight Device** as claimed in any preceding claim will allow absolutely instant start feature to the video recorder. Normally (in the 'Save' configuration) there is a few second lace up period during which time the tape stored inside the cassette is threaded around the recorder mechanism. During this time (and any additional time whilst the recording mechanism builds up to the correct speed), recording does not begin. However, if the length of stored data time exceeds the lace up time, then to all intents and purposes the recording will appear to have started even before the instant the record button is pressed.
- 8) **The Hindsight Device** as claimed in any preceding claim can reduce head and tape wear. Many video recording systems have a pause facility whereby the forward motion of the tape is stopped whilst the recorder is in pause mode. The tape remains laced up and the drum carrying the record heads continues to revolve. Whilst many video recorders have the facility to be left in this pause mode indefinitely, most manufacturers advise against doing so as wear will take place on one point of the tape. In addition wear is still taking place on the recorder heads. Using the **DSAV** (Digitally Stored Audio and Video) device this will allow the tape to be unlaced and re-laced and the recorder mechanism left in an inactivated state.
- 9) **The Hindsight Device** as claimed in any preceding claim can will enable pictures and sound to be recoverable from earlier time prior to the recorder being activated. In normal operating conditions that prevail (whether in the professional or amateur domain) a camera is powered up and switched on to view a scene prior to recording it. However in many cases the action suddenly starts before the camera operator anticipates or has time to switch the camera to record mode. If the camera is in 'save condition' it can take a further 2-3 seconds to lace up the camera prior to being able to record the information. Even in 'Standby Mode' slow reactions can loose valuable seconds of unrepeatable action. Even if the camera is a disc based recording machine the reaction time can still be half a second to press the Record Start button. More often than not action has already taken place and the camera operator and or director wishes that he could have started earlier. The **Hindsight** device will allow this wish to become a reality, not only for the 2-3 seconds lace up time but also the previous several seconds prior to the lace up time will be recorded as a lead into the action. (Ten seconds is a realistic amount of time missed but in fact it could be thirty seconds or even one minute if enough memory were supplied.
- 10) **The Hindsight Device** as claimed in any preceding claim, when the camera is switched out of record mode but when a further shot is required before the 10 second 'buffer' has been downloaded, then exactly the same conditions would apply - namely that the recorder would continue to receive information as it fell off the end of the 'buffer' and continue for 10 seconds after all recordings had stopped. (It would not be necessary to aim the camera at the subject after the decision had been taken to stop recording even though the recording was still downloading).
- 11) **The Hindsight Device** as claimed in any preceding claim would ideally be build into and incorporated within a video recording system, however it could also be an external device that allowed information to be fed into it (where it was stored and

delayed) and then onto the recording medium. If it was an optional extra then it would be desirable for the camera to be manufactured so as to enable this 'additional unit' to be plugged in between the camera/lens viewing device and the actual recording device. It may be that existing camcorders could be modified to incorporate the **Hindsight** device. The camcorder would have to have an outlet interface from the camera viewing side and have an inlet interface to the recording device. At all times the device is in use it operates in-between the camera/lens function and the recorder/recording mechanism. There would be no reason why the **Hindsight** device could not be either in use at all times or it could be switched out of the system.

- 12) **The Hindsight Device** as claimed in 1-11 can be a stand alone device. The Hindsight device does not need a separate recording outlet when the action can predictably take place within the time scan of its memory capacity. With a ten second 'buffer' that is constantly storing fresh information then all that is required to keep this information is that the device is switched off before the wanted information has been lost. The **Hindsight** device buffer can then be downloaded onto a tape or disc storage medium in the normal way at a later time. The advantages of this are practical and economic. In a predictable video recording location it is often desirable to have two or more cameras running at the time of the action. EG a car crash scene. Two such cameras with **Hindsight** buffers could be recording permanently along with the main video camera. A few seconds after the action has stopped the two extra cameras are switched off. Their image and sound information is then downloaded onto the main camera and they are ready to be used again. This saves having three of the more expensive recording machines and keeps the quality of recording consistently the same for all three.
- 13) **The Hindsight Device** as claimed in 1-12 would have sufficient memory to maintain the quality of the stored and retrieved data in the **Hindsight** device should be such that no loss of quality of the video or audio data is perceivable and ideally data transfer rates and data bandwidth should equal or better the specification of the original system. A professional camera such as a Sony DVW700P, which stores information at the rate of 125.58 M/bits/Sec, would require higher quality and more memory and processing than an amateur domestic VHS type camera.
- 14) **The Hindsight Device (with Time Shifter option)** as claimed in 1-13 would have a strobe control whereby it is possible to make a combination of the two :- elapsed time duration followed by an amount of frames that are recorded after each time period. I.e. 5 second interval after which 10 frames are put down and then repeated as long as necessary. (*See non linear effects)
- 15) **The Hindsight Device (with Time Shifter option)** as claimed in 1-14 would have Fill or Flow control. This selects whether the buffer fills up and holds its maximum memory waiting to be downloaded or whether it allows the information to flow out at the end as new information replaces it. In the case of a repetitive sequence and with constant monitoring, all that is required to happen is that the buffer be stopped at the required moment and depending upon the before and after control setting, the relevant information will be stored waiting to be down loaded.

- 16) The Hindsight Device (with Time Shifter option)** as claimed in 1-15 would have A Before and After delay control. This allows for a before & after delay. When it is desirable to see cause and effect the ten second buffer (real time in playback) can be split into two parts depending upon what part of the action is required to record. NB There will be an overlap range which is not possible to select i.e. a slow shutter speed with a short elapsed time frame which amounts to a longer exposure than the frequency of time between frames. The software programme will not allow this to be selected.
- 17) The Hindsight Device (with Time Shifter option)** as claimed in 1-16 has a buffer memory which stores individual frames at pre-set intervals. Once the buffer approaches its full capacity, the recording device is programmed to make a back space edit then go into its record mode and the buffer is downloaded onto the tape or larger hard disc recording format. This leaves the buffer free to store more individual frames.
- 18) The Hindsight Device (with Time Shifter option)** as claimed in 1-17 can store any number of individual frames which are collected and downloaded onto tape which typically would be 30-40 minutes of real time duration on a current professional recording device or 60 - 240 minutes for a current domestic VHS recorder. Either way the real replay time far exceeds the requirements of any practical usage for which the time lapse period covers. In other words the Time Shifter option can cover periods of time ranging from seconds to many months or even years.
- 19) The Hindsight Device (with Time Shifter option)** as claimed in 1-18 can have an exposure interval between frames which can be as long as the interval between frames minus one 24th. of a second. In other words a time lapse that recorded one frame per second could have an exposure of 24/25 Th. of a second which could be desirable for low light usage as the actual exposure period could be up to 24/25ths of a second. On the other hand a far higher shutter speed (such as 1/500 or 1/2000 Th. sec) could also be selected with the intention of making separate but fast moving images sharper. Similarly an elapsed duration of 10 seconds between frames could allow an exposure time of almost 10 seconds long.
- 20) The Hindsight Device (with Time Shifter option)** as claimed in 1-19 can have software with which to operate this buffer that can be programmed to allow each frame to be outputted several times (*see controls). This would give the impression of time lapse but allowing each individual picture to be seen for a selected elapsed time period. In other words a time lapse sequence of one second duration (which is speeding up real time images by 25 times) could be replayed and downloaded as say five consecutive picture images. This would give the impression of strobed time lapse without any additional editing. Any permutation of repetitive frames could be programmed from this buffer.
- 21) The Hindsight Device** as claimed in 1-17 can be used as a Surveillance camera. Typically Surveillance cameras take single frames or bursts of frames at intervals

and these are stored onto a low quality recording medium. If the **Hindsight** device were utilised then the lead up to the moment of required surveillance could be stored and downloaded in the same way as described previously. Real time images rather than time lapsed would be more useful in identifying a crime. The only difference being that some form of triggering mechanism such as a broken beam, an emergency switch, a trembler device or sound activated switch must be operated to save the previously stored images.

22) **The Hindsight Device** as claimed in 1 can be used as a car security camera. With a **Hindsight** device incorporated within a car, each new driver would be recorded and stored for a few seconds after which time the 'buffer' would run continuously. If the driver was unauthorised then his image would be retrievable once the car was recovered. Perhaps the most important use would be in the event of a crash. The **Hindsight** device, running continuously, would be de-activated in the event of one of the cars sensors detecting a crash and stop immediately. The device would be built into an inaccessible part of the vehicle that was fireproof and tamperproof. The recording would legally belong to the owner of the car and could be presented in evidence on his behalf in any analysis of the accident.

23) **The Hindsight Device** as claimed in 1 can be used with electronic stills Cameras. The same principal would apply to stills cameras as moving image cameras. Once the camera is switched on and the **Hindsight** device activated then images at a pre determined rate are being constantly stored into the memory. Until the camera shutter control is activated the information is lost after say 10 seconds. However as a still photo requires higher quality than a video frame, then more memory would be required. However if a frame rate of say 3 pictures per second were selected, then this would make the memory more desirable in size and economics. Once images were stored they should be reviewed and only ones capturing the required action need to be kept, thus releasing the rest of the memory for future use. For still photographs this 3 second frame rate would be very desirable as most motor drives operate at about this speed. If a higher rate was required (say 5 frames per second) then this could be selected but less elapsed time would be available as stored pictures in memory. I.e. the window of information would be less, the more images were stored for a given memory capacity.

24) **The Hindsight Device** as claimed in 16 would have variable still frame rates. For a given memory capacity there would be a number of photographs stored at a given file size. Let us say this is 15 images to be held in temporary memory.

Frames per second	Elapsed time covered (in seconds)
1	15
3	5
5	3
10	1.5
15	1



Application No: GB 9725832.1
Claims searched: 1-24

Examiner: John Coules
Date of search: 7 April 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): H4F FAAE,FAAX,FCK,FKX,FKA

Int Cl (Ed.6): H04N 5/77,5/907,7/18; G08B 13/196

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2295065 A (Mitsubishi) see particularly abstract and description starting on page 14 line 6	1 at least
X	GB 2231753 A (Golden River) see particularly page 6 line 3 to page 7 line 8, and claim 7	1 at least
X	US 5402167 (Cornell Research) see time delay memory network 19	1 at least
X	US 4897732 (Canon) see frame memory 7 in figures 4,6 and 8, column 2 line 54, column 5 line 55.	1 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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(51) INT CL⁷

G07C 5/08

(52) UK CL (Edition R)

G1N N3S3 N4C N4E N7L3

(56) Documents Cited

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(58) Field of Search

UK CL (Edition R) G1N NACNR N3S3 N4E N7L3
INT CL⁰ G07C 5/08
ONLINE: WPI EPODOC PAJ

(54) Abstract Title

Vehicle speed monitoring

(57) A system of monitoring the speed of a vehicle comprises three subsystems. The first is a speed measuring device attached to the vehicle which stores speed data, especially traffic law violations, and can also alert the driver to instances of speed violation. The second is a transportable hand held device (26) for receiving and storing information recorded by the first subsystem, for use by law enforcement personnel, and includes several security features to prevent unauthorised use and tampering. Data is transferred to the second device via an infra-red communications module. At the end of the data transferral to the hand held device, the data can be transmitted to a third subsystem receives and stores information provided by the transportable device.

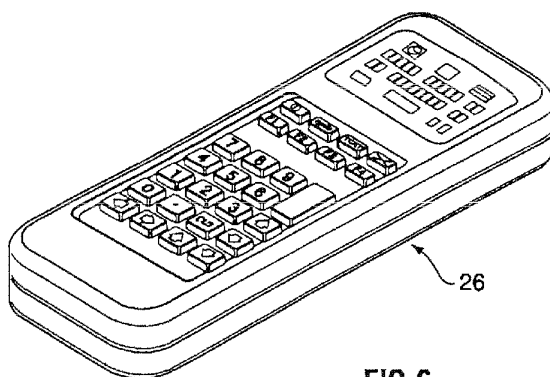


FIG.6

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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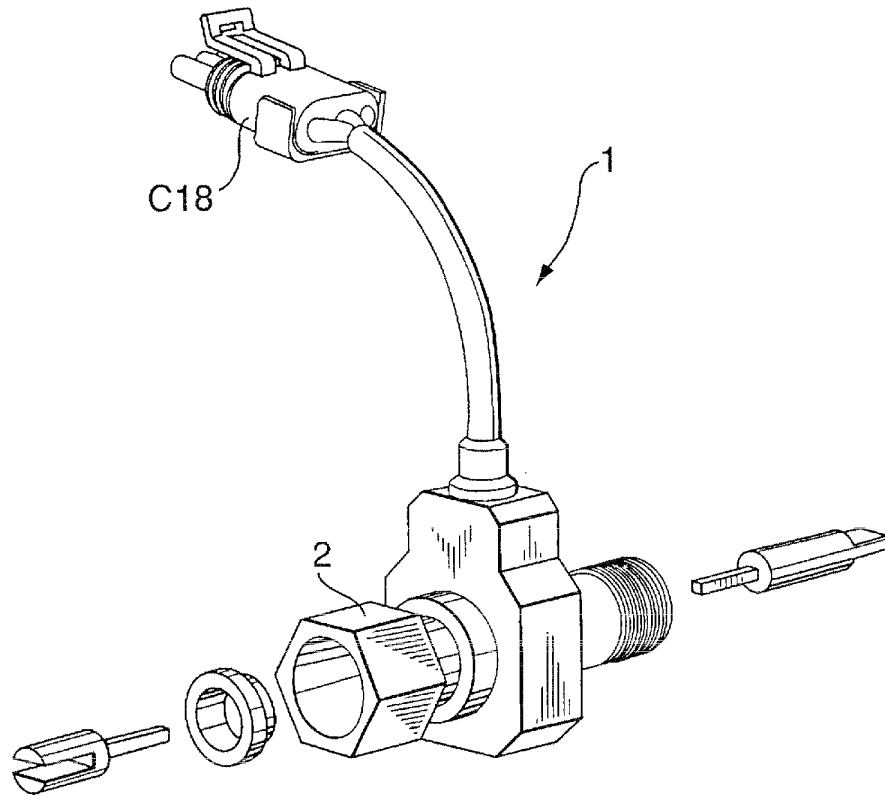


FIG. 1

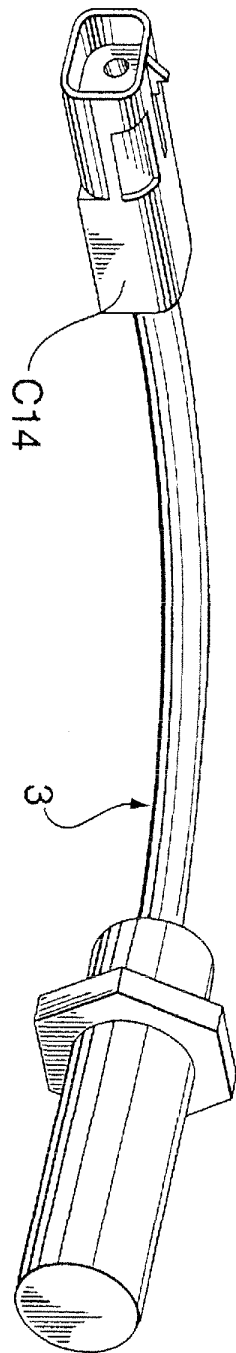


FIG. 2

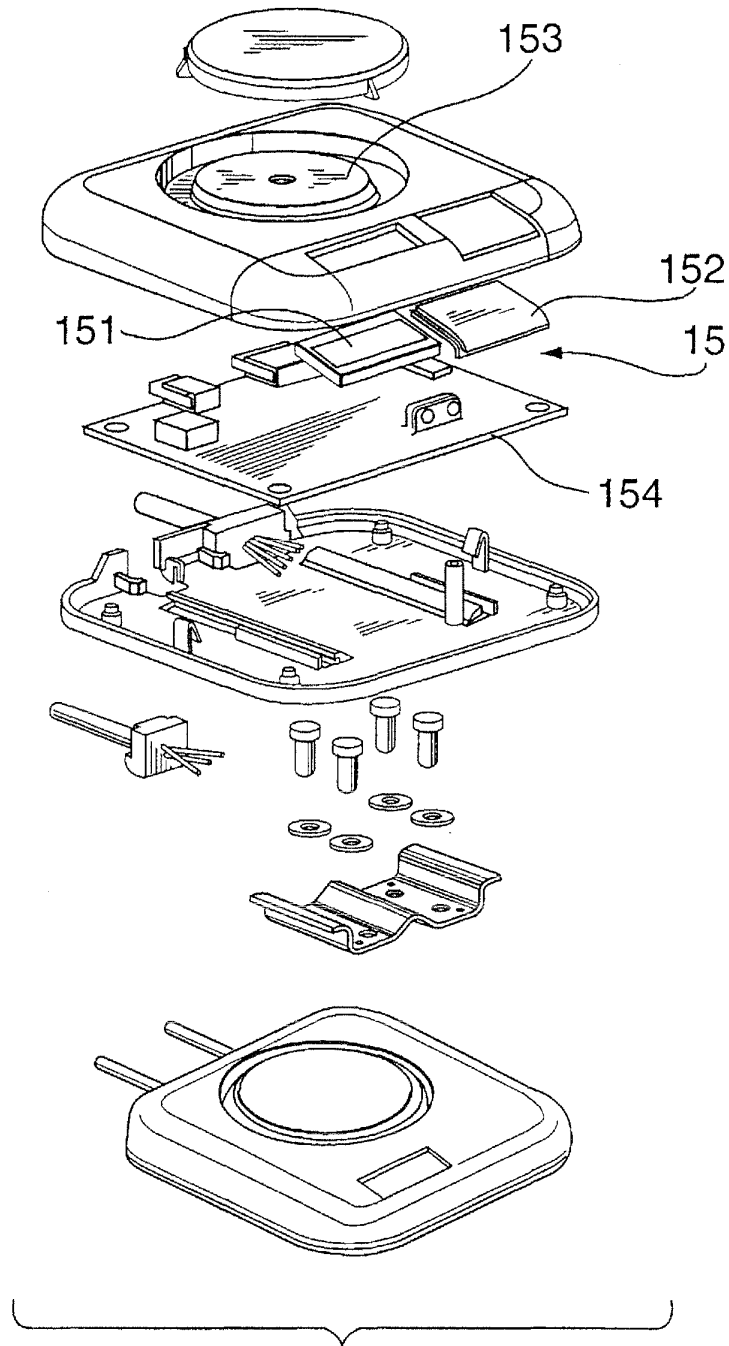


FIG. 3

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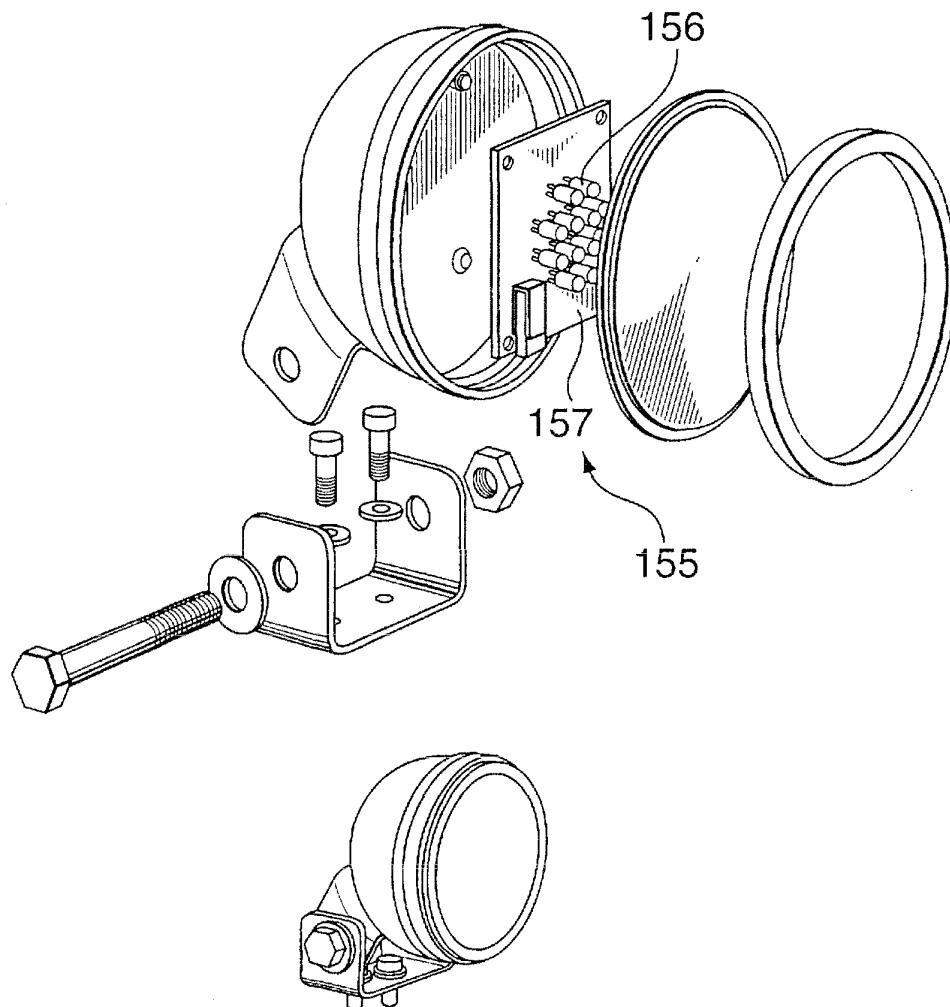


FIG. 3A

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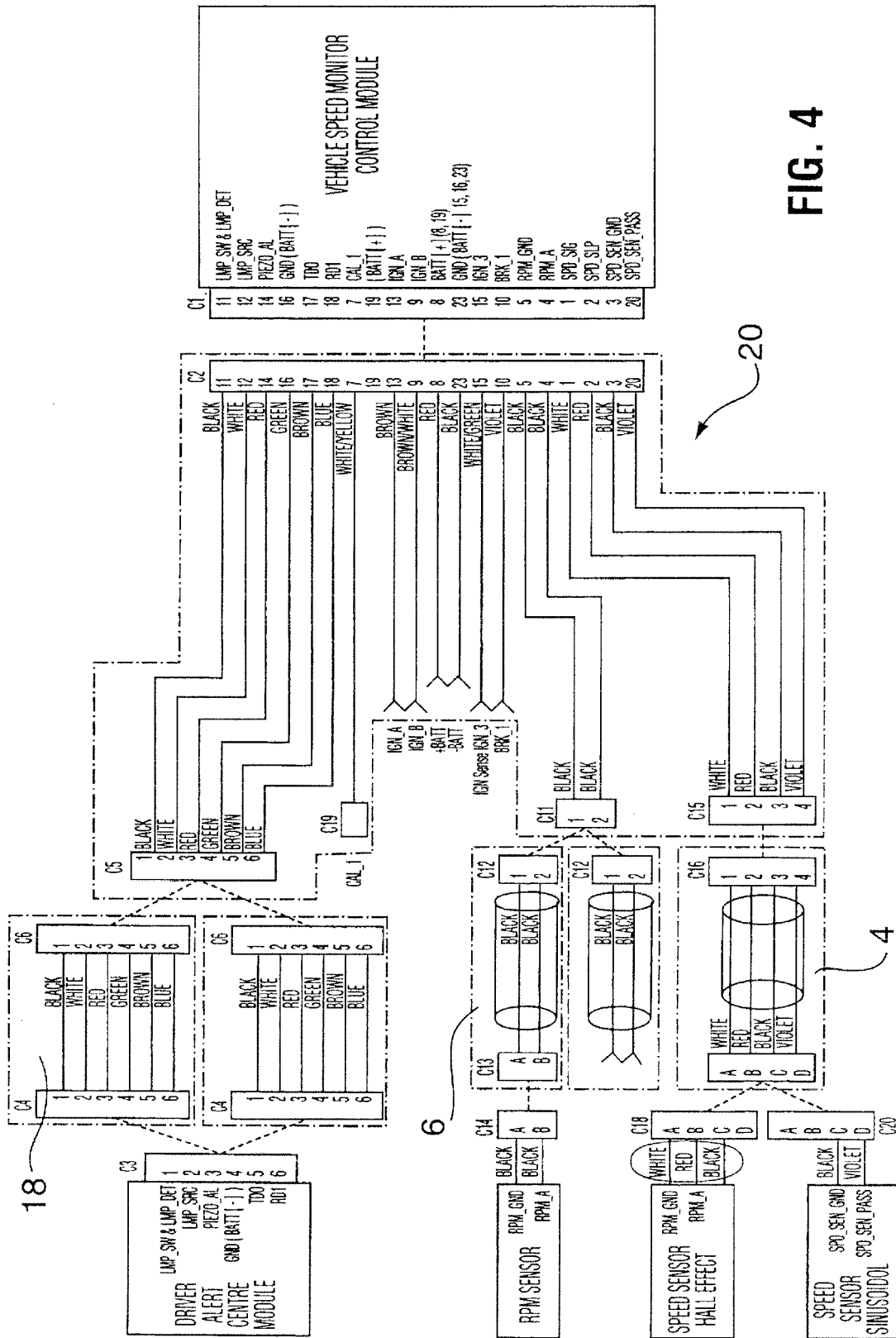


FIG. 4

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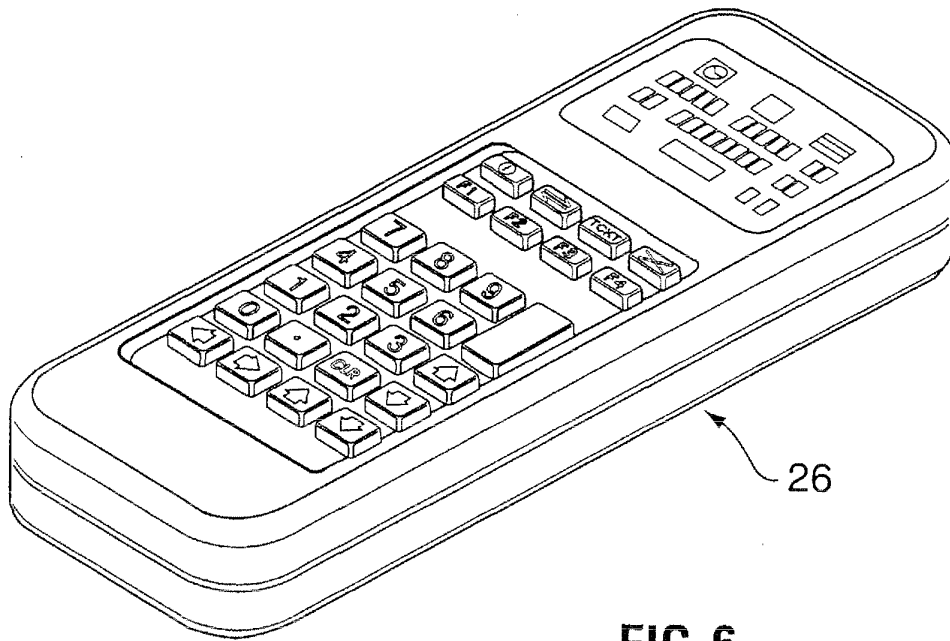


FIG. 6

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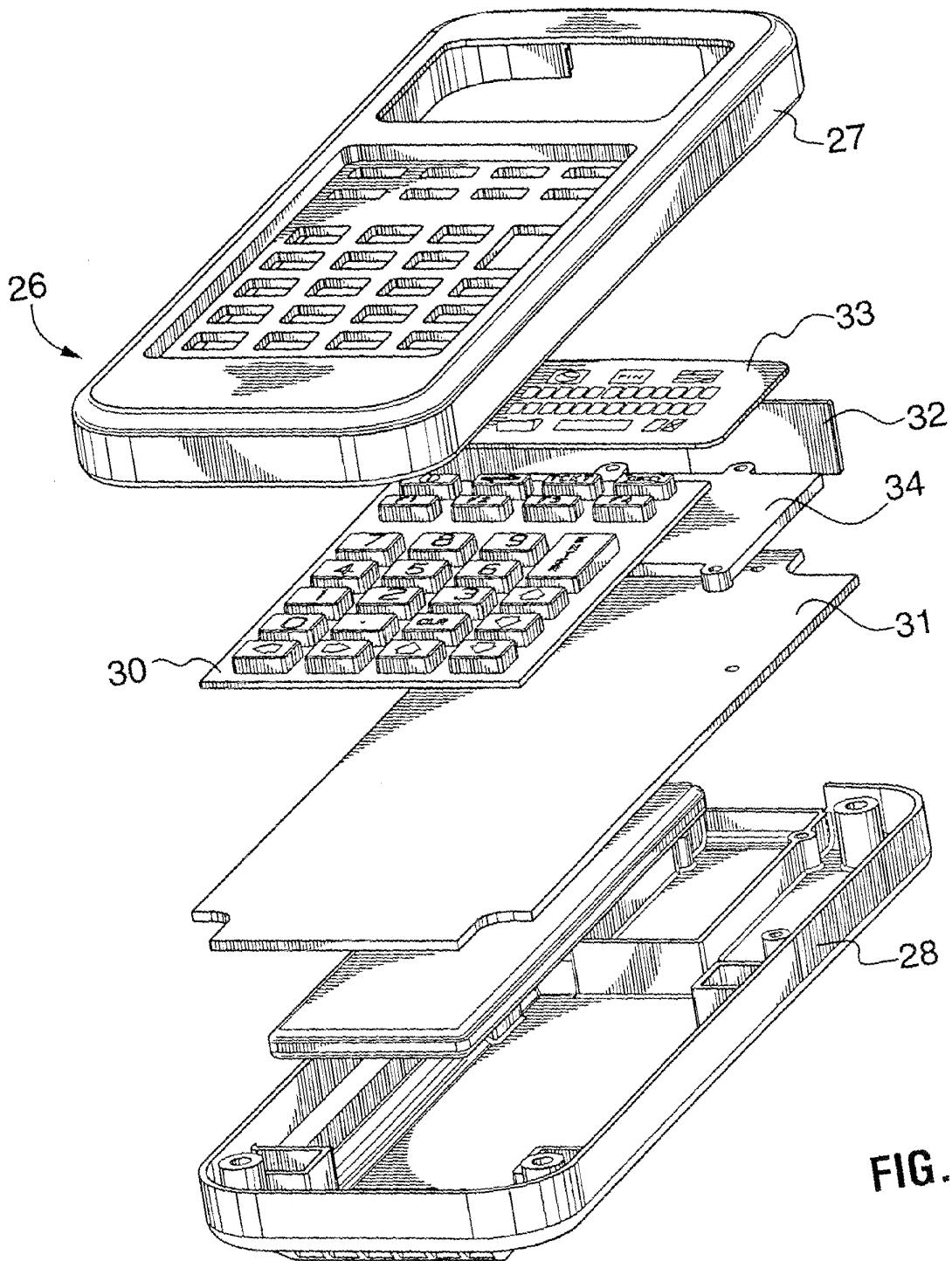


FIG. 7

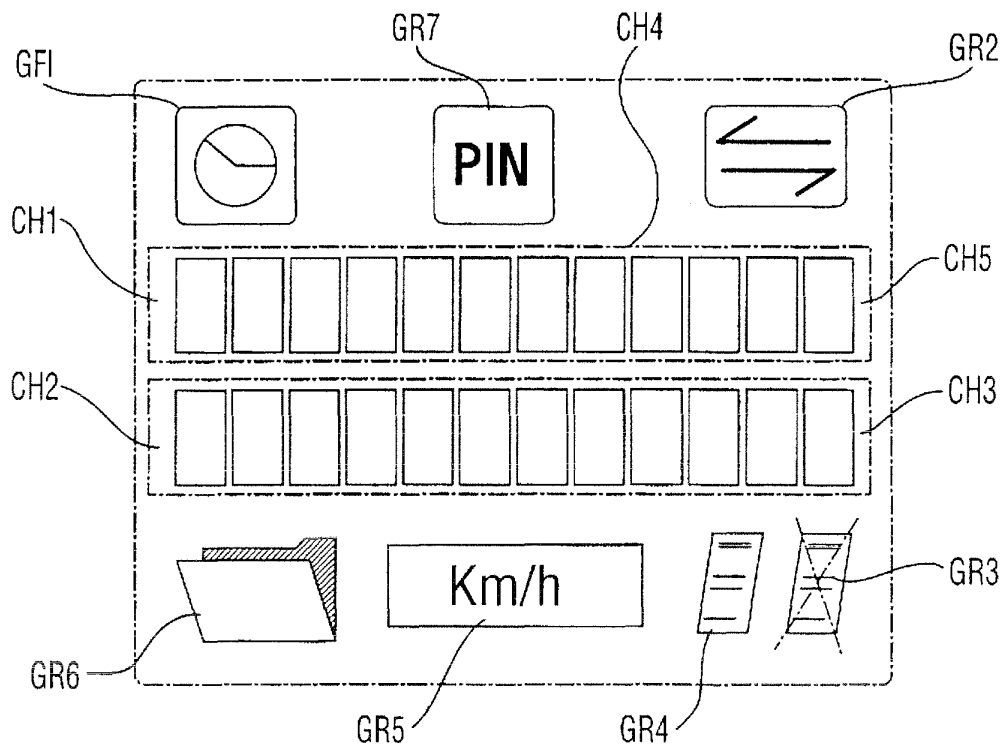


FIG.8

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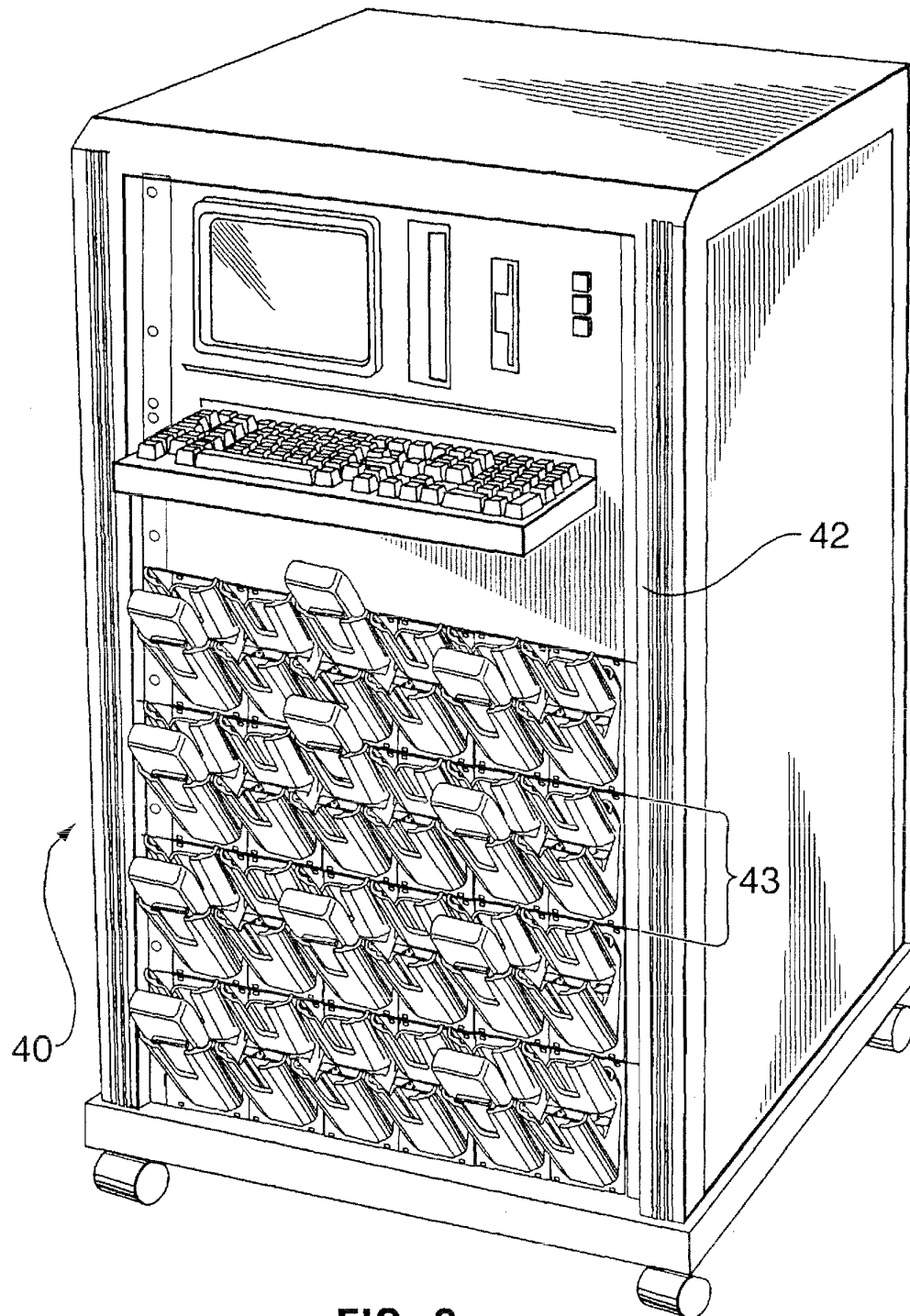


FIG. 9

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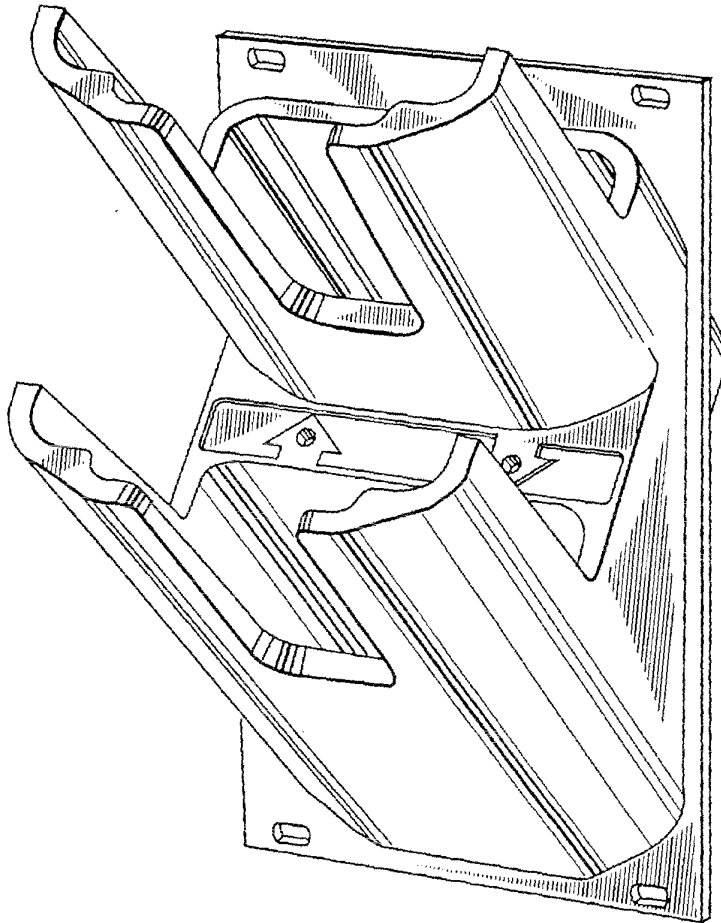


FIG. 9A

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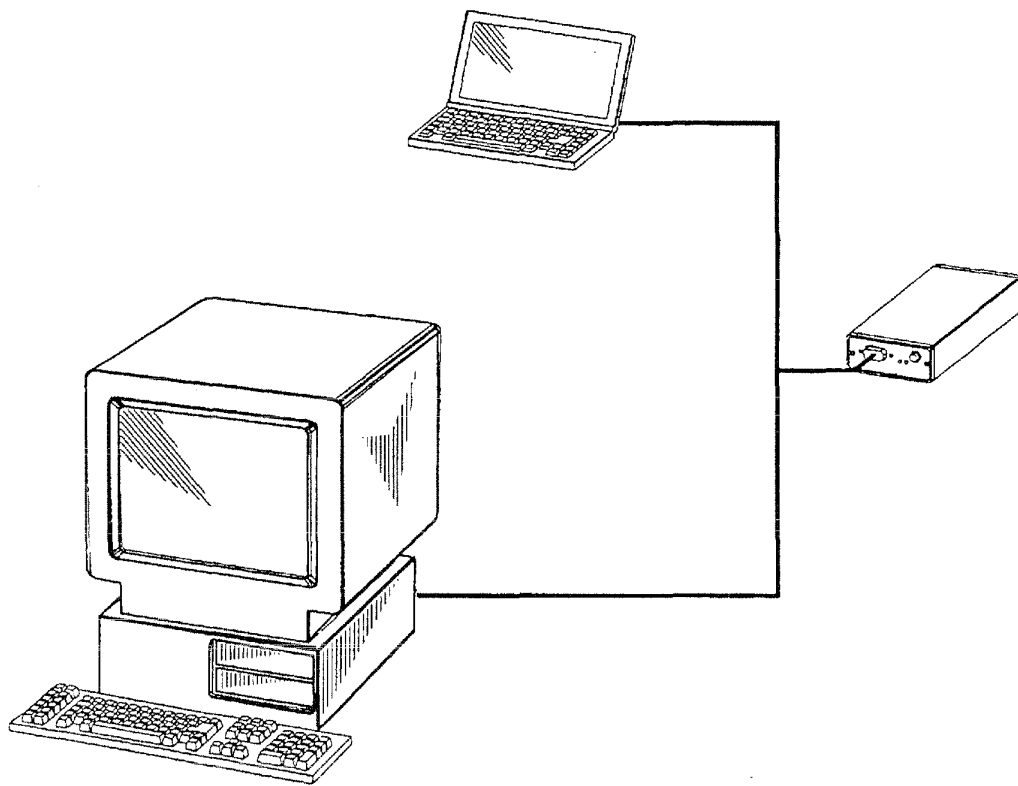
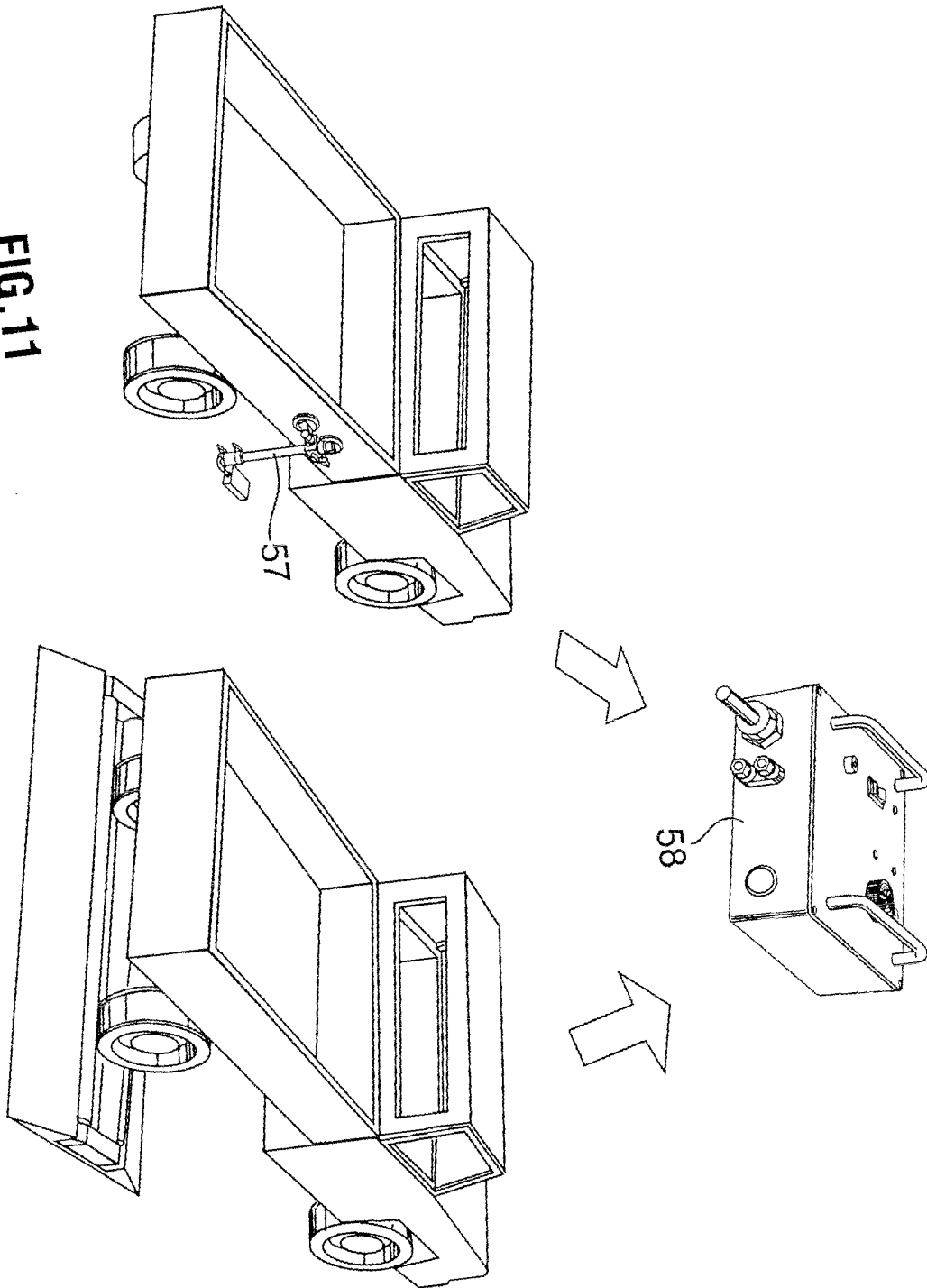


FIG. 10

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FIG. 11



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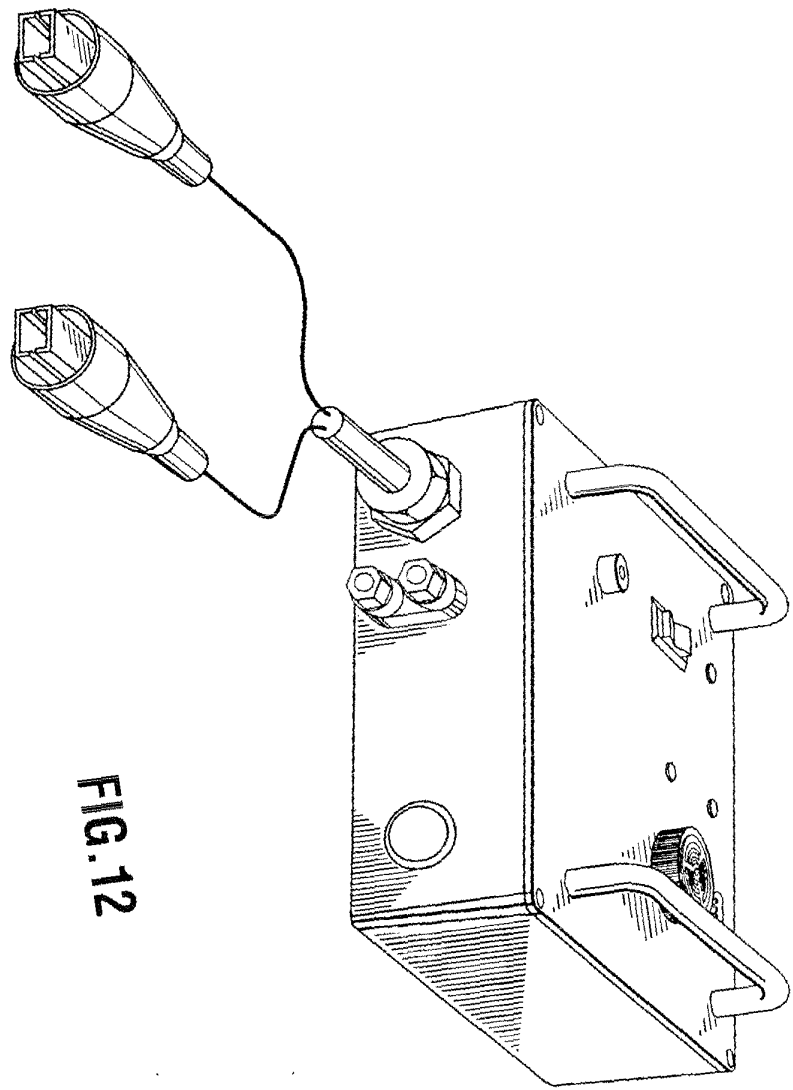


FIG. 12

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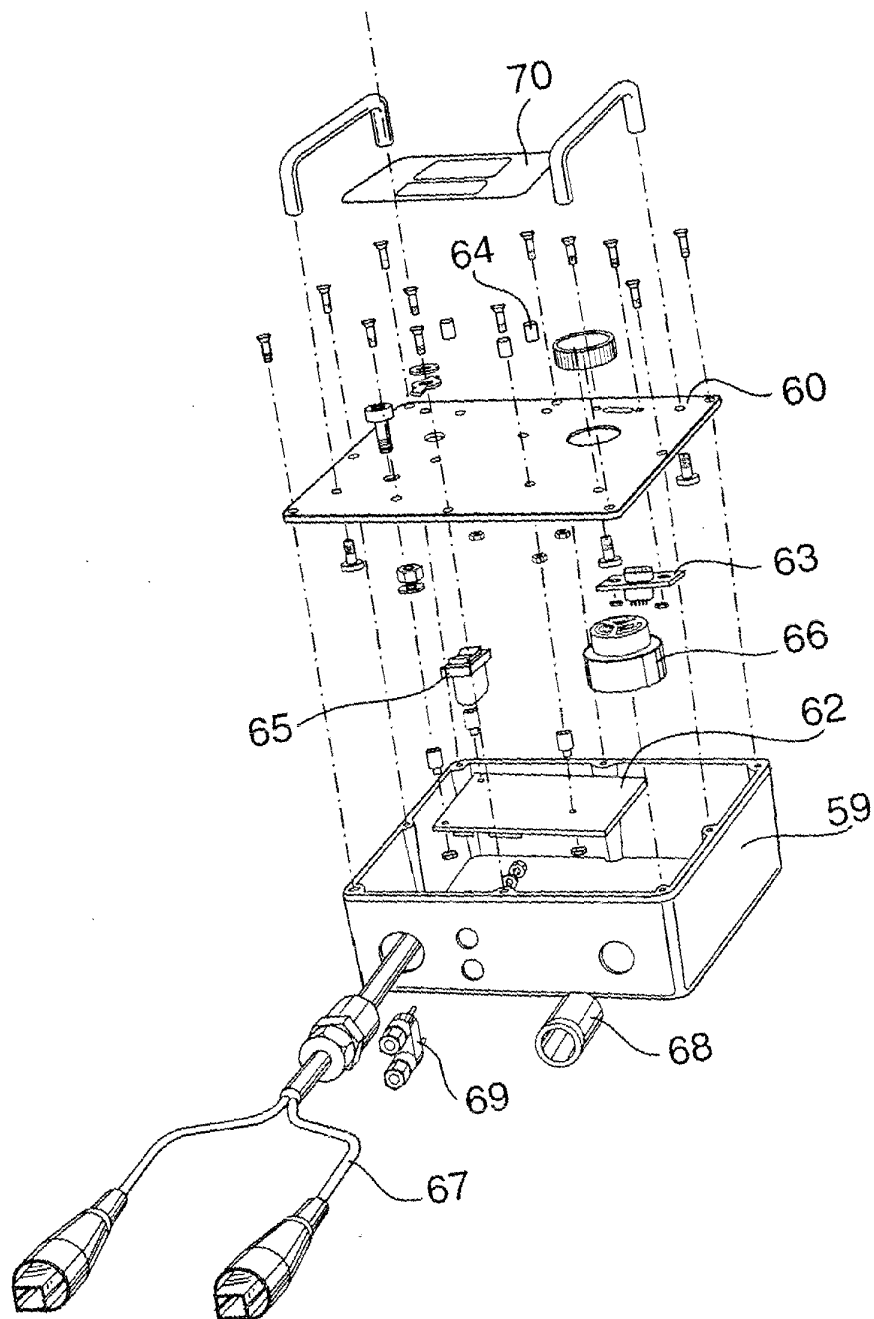


FIG.12A

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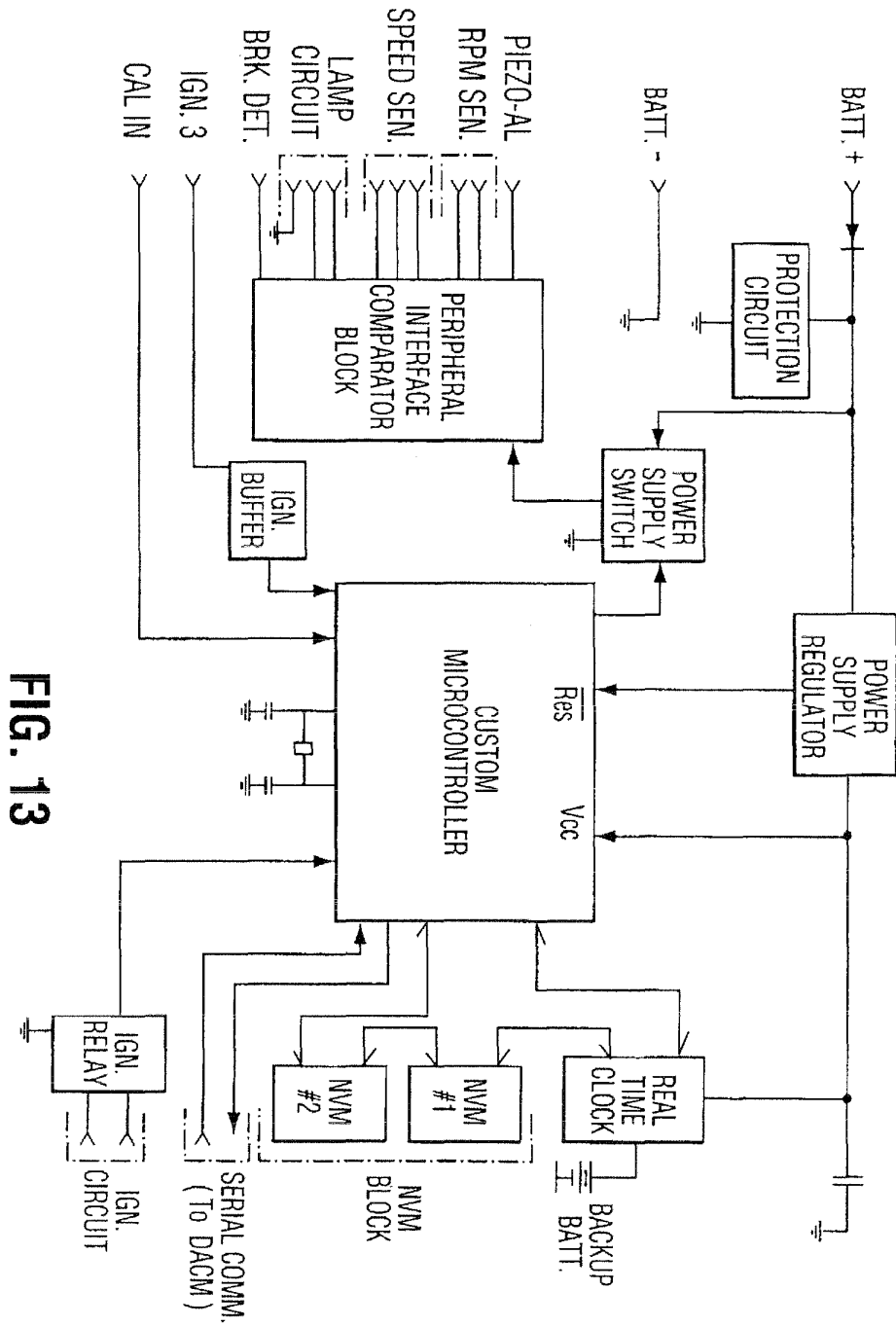


FIG. 13

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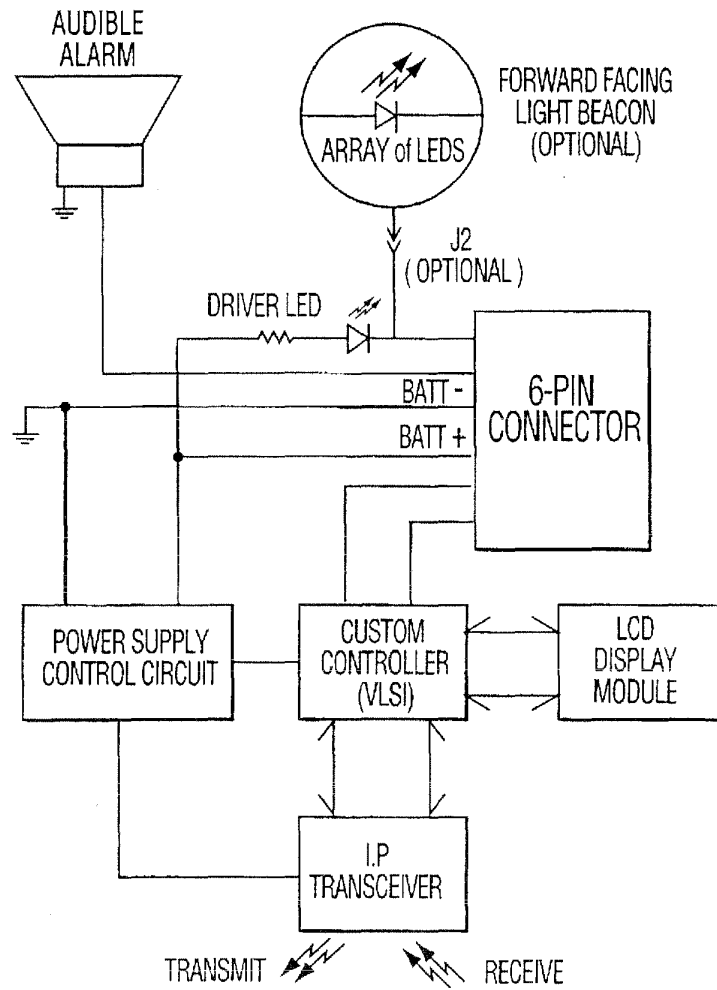


FIG. 14

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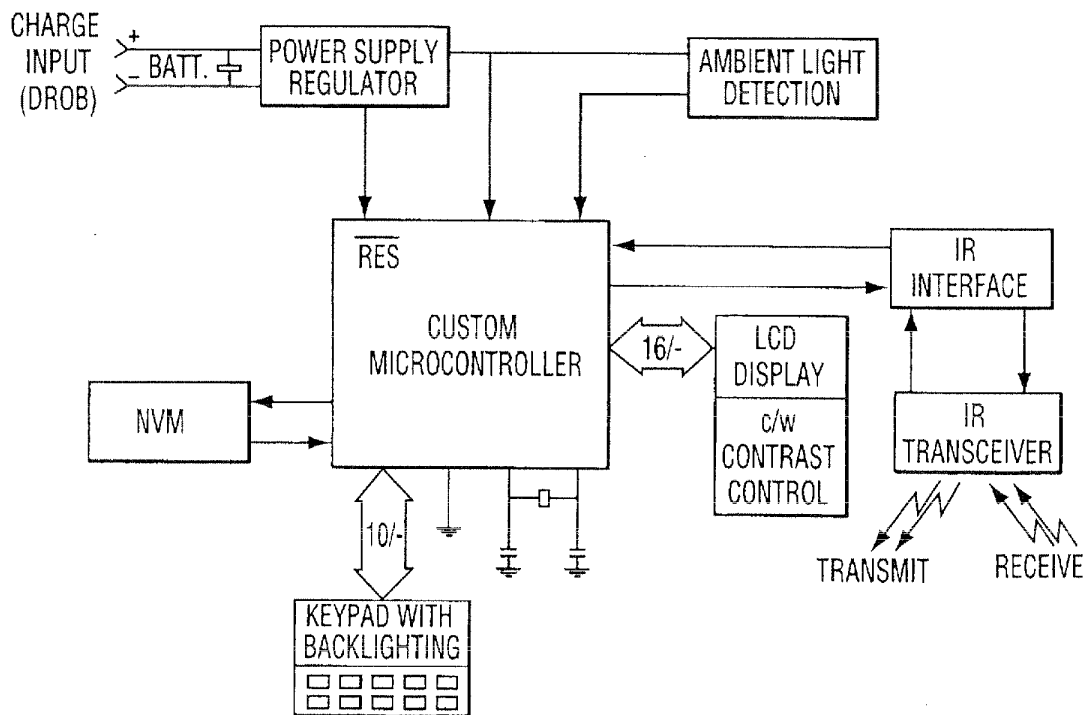


FIG. 15

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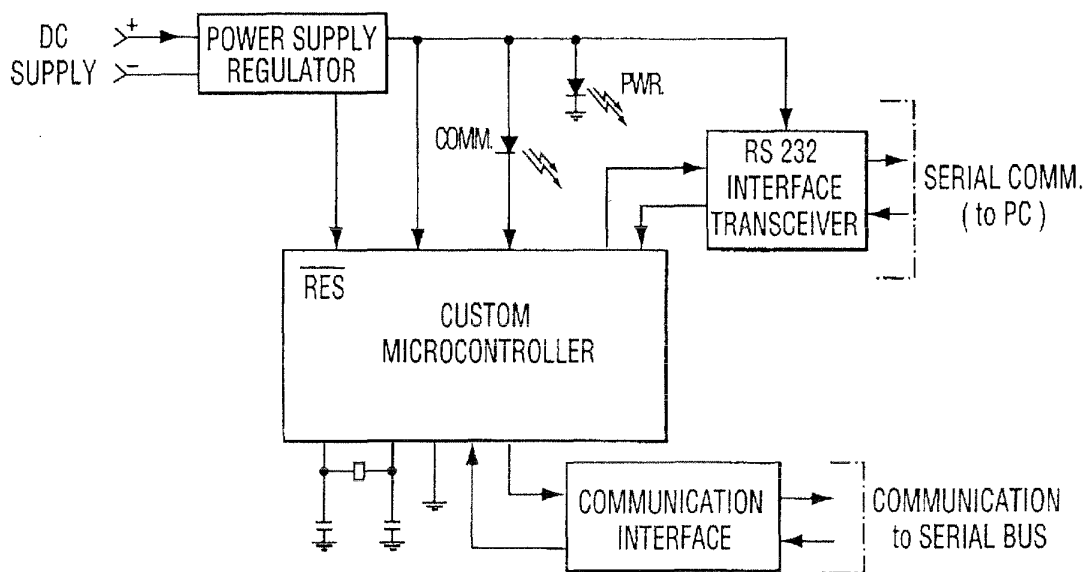


FIG. 16

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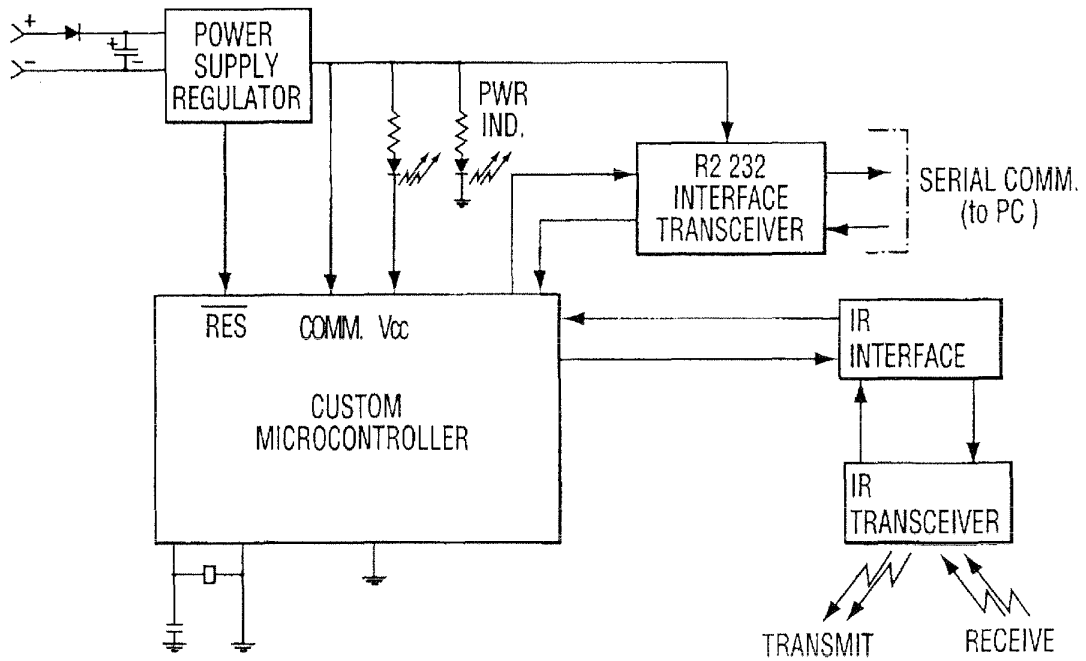


FIG. 17

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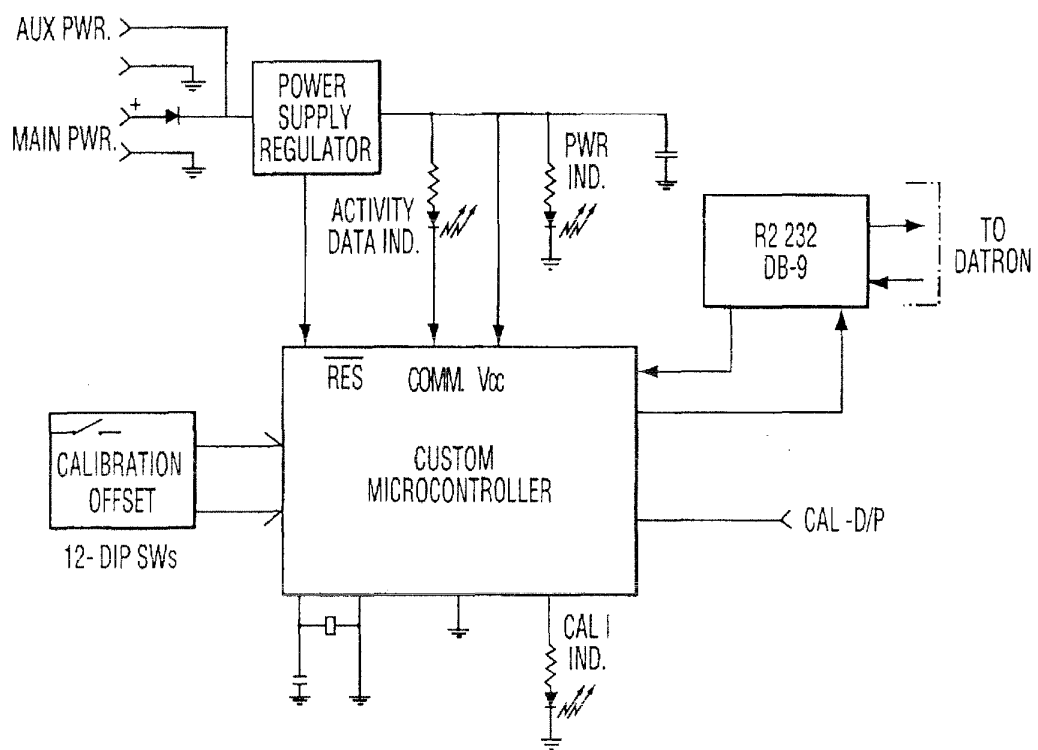


FIG. 18

VEHICLE SPEED MONITORING SYSTEMField of the Invention

The present invention relates to the field of vehicle speed monitoring. In particular, the present invention provides a system for continuously monitoring vehicle speed, and detecting violations of legal speed limits. The present invention also provides means for law enforcement personnel to access data from vehicles.

Currently, traffic law enforcement in most jurisdictions is a daunting task. There are simply too many vehicles on the road for a reasonably sized police force to monitor by direct observation. In the absence of strict monitoring of vehicular speed, there is a tendency for drivers to exceed legal speed limits. This is especially true for drivers of commercial vehicles, since the financial return in respect of a commercial vehicle such as a truck or bus will be directly dependent on the speed with which a driver can use it to perform tasks.

Vehicle speed monitoring by police forces has heretofore been accomplished by direct observation of vehicles. This can be accomplished by radar scanning of the vehicle in motion, by timing the vehicle from point to point, or by tracking the vehicle in a second vehicle of known speed. There are also systems in some jurisdictions to alert police to fast moving vehicles. For instance, it is known to mount warning lamps on trucks, to light up when the vehicle is speeding. However, this only assists in the direct observation method of enforcement of speeding laws, since a law enforcement officer must actually observe the warning lamp, and then measure the speed of the vehicle.

The object of the present invention is to provide a complete closed loop system. This includes the in-vehicle speed monitoring system accompanied by two distinctive peripheral support subsystems. The sub-systems are for use by law enforcement personnel and appointed government depots. The law enforcement system allows only for the review of data stored to the in-vehicle system and that the issuing of tickets to the owner of the vehicle is at the discretion of the officer. In the case of a depot, the altering, adjusting and erasure of stored data and events from the non-volatile memory system of the in-vehicle speed-monitoring system is possible.

The system of the present invention also includes appropriate electronic and mechanical sensing and support devices, as will be discussed in detail below.

In a broad aspect, then, the present invention relates to an apparatus for monitoring vehicle speed, and detecting episodes of vehicle speed in excess of a predetermined maximum speed, including: a first subsystem for mounting on a vehicle to monitor and record vehicle speed related information; a transportable device for receiving and storing information recorded by said first subsystem; and a second subsystem for receiving information stored by said transportable device.

Brief Description of the Drawings

In drawings which illustrate the present invention by way of example:

Figure 1 is a perspective view of typical speed sensors for use in the in-vehicle subsystem of the present invention;

Figure 2 is a perspective view of a typical RPM sensor, for use in the in-vehicle subsystem of the present invention;

Figures 3 and 3A are exploded and perspective views of a warning driver alert centre for use in the in-vehicle subsystem of the present invention;

5 Figure 4 is an electrical wire harness block diagram for an in-vehicle subsystem of the present invention;

Figure 5 is a perspective view of a main control module for use in an in-vehicle subsystem of the present invention;

Figure 6 is a perspective view of a portable data reader for use in the present invention;

10 Figure 7 is an exploded view of the said portable data reader;

Figure 8 is a schematic of a data reader liquid crystal display graphics and text in a preferred embodiment of the present invention;

15 Figures 9 and 9A are perspective views of a data reader peripheral docking bay for use in the present invention;

Figure 10 is a perspective view of a data reader/eraser calibration module and a host computer, for use in the present invention;

20 Figure 11 is an illustration of the means of calibration of the in-vehicle subsystem of the present invention;

Figure 12 is a perspective view of a calibrator interface for use in the present invention, Figure 12A being an exploded view thereof;

25 Figure 13 is a block diagram of the vehicle speed monitoring control module;

Figure 14 is a block diagram of the DACM with optional forward facing optional beacon lamp and liquid crystal display;

Figure 15 is a block diagram of the Data Reader;

Figure 16 is a block diagram of the DRBD Unit, controller;

5 Figure 17 is a block diagram of the DREC unit;

Figure 18 is a block diagram of the CI unit.

Detailed Description

The vehicle speed monitoring system (VSM) of the present invention consists of three subsystems, the in-vehicle
10 subsystem and the two peripheral support sub-systems.

The in-vehicle subsystem consists of a main control module and multiple sensors and interface/ output devices, all interconnected by a prefabricated wire harness. The in-vehicle system is preferably installed and individually calibrated
15 into every commercial duty and/or official heavy vehicle.

The peripheral sub-systems, divided into the support subsystem and the enforcement subsystem, allows the proper calibration and certification and re-certification of the in-vehicle systems, as well as data downloading, and audits of the same.
20 This also includes devices that support the collation of the distributed data to a central database within a particular jurisdiction or state.

In-vehicle Subsystem

The in-vehicle system of the present invention may be broken
25 down into several parts, the central control module, the sensors, the output devices, wire harnesses, and various hardware components.

The Speed Sensor (Figure 1)

The speed sensor detects the rotation of the drive shaft and converts these signals into electrical pulses. There is a wire and connector from either of the variations that is connected to the main harness.

The RPM Sensor (Figure 2)

The RPM sensor detects the revolutions of the engine and converts the RPM signal to electrical pulses. There is a wire and connector from this unit that is connected to the main harness.

The Driver Alert Centre Module, (DACM), (Figures 3 and 3A)

The driver alert centre (Figure 3) is the visual and audio output device of the in-vehicle system. Mounted on the vertical surface of the instrument panel, it allows for easy indication and viewing by the driver. The outward forward facing optional beacon lamp (Figure 3a) is mounted onto the upper portion of the windscreen or can be mounted onto the exterior roof of the cab portion of the vehicle. The DACM, will by means of the visual and audio circuits, indicate to the driver /operator his current speed violation status by a variety of flashing patterns and audible tones, in the event that he is speeding. The DACM has the option of having a Liquid Crystal Display (LCD) for the purpose of written text messages from the in-vehicle system, i.e. display the current total of accumulated violations.

The Main Harness (Figure 4)

The main harness and its various extensions connect electrically the main Control Module (CM) to both sensors and output devices; the CM provides the needed power to all of the VSM in-vehicle peripherals.

The Control Module, (CM), (Figure 5)

The CM receives pulses from the various sensors and signals through connectivity of the wire harness. Embedded proprietary software analyses these pulses and signals and compares all of these continuously updated signals to set internally memorised values. From these comparisons, over-speeding or tampering is determined, depending on what the particular vehicle is engaged in at that time. If the state is over-speed, then the conditions, i.e., date, time, speed, details etc. are written to integral memory and an alarm triggered through the means of the connected DACM. If the vehicle is stationary and tampering is detected then the conditions, i.e., date, time, tamper code type, etc. is written to the integral memory.

The Ignition Relay

The ignition relay is in place to open the starter circuit of the vehicle. The relay as mentioned is an integrated into the CM printed circuit board assembly. When, a pre-set number of violations are attained, the relay is opened, rendering the starter circuit inoperative, in a preferred embodiment.

Various Hardware Components

The in-vehicle systems are installed with various hardware components, screws, bolts, etc. Key components, such as the speed sensor, CM unit, and specific connector junctions of the wire harness, preferably have additional numbered security tags wired around the installed units to discourage unauthorised removal or tampering. Each tag is branded with a unique serial number and the application crimping tool imprints the installer's assigned identification number. Thus the security devices can be tracked and traced to the location and day of installation, along with the installer.

Peripheral Support Systems (Figures 6 and 9)

The peripheral support systems of the present invention may be broken down into several parts, being the Data Reader Eraser/Calibrator module and related devices for the support subsystem and the Data Readers and related devices for the enforcement subsystem. Integral into each of these systems is custom copyright software embedded into each of the microprocessors of each assembly, or running in a separate computer, either laptop or desktop personal computer configuration.

THE SUPPORT SUBSYSTEM

The Data Reader Eraser/Calibrator Units (Figure 10)

The in-vehicle system once installed must be initialised, calibrated and certified. The instrument used for this purpose is called the Data Reader Eraser/Calibration module, (DREC). When connected to a laptop computer, the DREC provides an infrared communications link to the in-vehicle system through the DACM and. It allows a technician access to the data stored within the CM unit as well as the ability to alter and set the operating parameters of the system. The technician can also set the system to its pre-calibration state and thus prepare the vehicle for calibration.

Calibration Systems

The in-vehicle system is calibrated to the true road speed of the vehicle with the use of a calibration system. These systems can be either a stationary dynamometer system or a portable calibration system, both means require the inter-connection of the calibrator interface unit.

Calibration Sensor (Figure 11)

The calibration systems (Figure 11) depict two types of calibration systems. The stationary system is based on a running wheel dynamometer and the second system is based on a

type of non-contact microwave sensor that senses the distance travelled by the vehicle over the ground. Both systems output a set number of pulses per unit distance travelled. Thus, the faster the vehicle travels the greater number of pulses are outputted per sampled period. The pulse data output signal is connected to the calibration interface unit and is processed accordingly. Other types of dynamic and static calibration will be obvious to those skilled in the art.

The Calibration Interface Unit-Calibrator (Figures 12 and 12A)

The calibrator interfaces the in-vehicle system to the calibration system. It is connected to the Calibration Sensor through a computer cable and to the VSM CM via a signal wire through the wire harness assembly. The unit is powered from the vehicle's own power system, (vehicle battery), then provides power to other systems requiring vehicle power. The pulse signal received from the Calibration Sensor system, either being stationary or portable is compared to pre-set programmed values. The calibration interface unit by means of embedded copyright software and dip -switch settings determines when the vehicle has achieved the calibration set velocity. When the vehicle has achieved the set calibration velocity, the calibration interface unit outputs a signal to the control module. The control module then stores the data from the various signals, being received from its own various sensors and signals, into the internal non-volatile memory. Visual and audio alarms in the calibrator indicate to the calibration technician the status of the calibrator and VSM. The calibrator is equipped with a talk-through adapter that allows monitoring of the calibration activity through a laptop computer.

THE ENFORCEMENT SUBSYSTEM

The Data Readers (Figures 6, 7 and 8)

The hand-held Data Reader (DR) units give users the ability to review and retrieve data stored in the in-vehicle control modules' memory via the wireless infrared communications link. These DR units are assigned to law enforcement officers under normal circumstances. With the data in readable form, the officer can access the data and issue tickets if warranted. The DR unit has limited capabilities beyond reviewing and retrieving data and the issuance of tickets. The tertiary function of the DR is the ability to reset the violation counter if the officer issues tickets against stored violations and/or infractions and thus enable a VSM shutdown vehicle to be restarted should the vehicle have reached this state of operation. The DR cannot erase the memory, nor can it alter the set performance parameters of the VSM.

The Data Reader Docking Bay (Figures 9 and 9A)

The Data Reader Docking Bay (DRDB) system allows the retrieving of stored data from handheld Data Readers. Multiple DR units may be plugged into the DRDB simultaneously. Installed enforcement station locations, a DRDB is connected to a personal desktop computer running proprietary copyrighted application software. Officers coming off their duty shifts plug their DR units into the DRDB. All functions after the placement of the DR to the DRDB is transparent and automatic. The data from each DR unit is saved as readable file to a database file within the desktop computer. Initiating the battery charge cycle for each DR follows this. In a practical embodiment, the DRDB can accommodate up to 128-DR units simultaneously.

THE IN-VEHICLE SYSTEM

The Speed Sensor, (Active Sensor), (See Figure 1)

The speed sensor (1) is a transducer that is installed between the transmission drive pinion gear and the speedometer cable of the vehicle. The connected transducer has a built in rotary encoder that outputs a set number of pulses per revolution and allows for direct passthrough mechanical connection of the speedometer cable. Since the revolution of the drive pinion shaft is directly coupled to the drive shaft of the vehicle, the output of the sensor is directly proportional to the ground speed of the vehicle. The sensor does not have any ratio adapters built in, it is straight through, and thus the speedometer performance remains unchanged. The sensor has wires that are terminated to connector. Connector (C18) of the sensor couples to connector (C17) of the speed sensor extension harness (see Figure 4). The connector (C18) is a four pin shrouded sealed connector.

The connector locks into its corresponding mating connector on the speed sensor extension harness and forms a water, grease and dust proof connection.

The speed sensor (1) is installed at the pinion drive gear of the transmission of the vehicle. Various adapter drive tips such as the one shown allow the sensor to be driven by a variety of different transmission drive configurations. These drive tip adapters are purchased separately from the various manufacturers.

A select number of vehicle configurations do not allow the installation of the speed sensor directly to the transmission speedometer drive output. This may be because the drive configuration is too specialised and generic adapters are not available, or the speedometer method of attachment is not the same as standard heavy vehicle convention. There may also not

be enough physical room to install the sensor its supplied configuration. These cases require special procedures and adapter hardware in order to install a speed sensor to the vehicle.

- 5 The sensor (1) is mounted and a security tag is placed around points of the sensor, which makes removal the sensor apparent. A speed sensor suitable for use in the present invention is available from Arthur Allen Manufacturing U.S.A.

Speed Sensor Extension Harness

- 10 The speed sensor extension harness (4), (see Figure 4) electrically connects the speed sensor to the central harness. It is a fabricated four-conductor harness, 18AWG stranded tinned copper wire, cut to a specified length. The wire is rated for harsh environment and has a temperature rating of
15 -20C to +105C.

Usually the speed sensor is located near the back of the transmission; the harness extension must reach from the under dash location of the CM unit back down the undercarriage of the vehicle to the rear transmission area.

- 20 Both ends are terminated with a four position sealed mating connector (C16) and (C17), and the entire length of wire is jacketed in a split plastic sleeve for protection. Connector (C16) is coupled to connector (C15) of the central harness, as illustrated in Figure 4.

The RPM Sensor (see Figure 2)

- 25 The sensor (3) is a magnetic proximity detector installed into the transmission bell housing of a vehicle. The sensor is a type of device that when a ferrous mass passes in front of the sensing face, generates a small electrical potential. In this
30 application, the individual gear tooth of the starter gear

acts as the ferrous mass. The output is a sinusoidal signal, the frequency equal to the rate the individual gear teeth that pass in front of the sensor face.

5 The output signal is connected to the CM unit through a RPM Sensor Extension harness. The connector (C14) is a sealed, shrouded, locking male connector that locks into the corresponding female connector on the RPM extension harness. Connector (C14) couples to connector (C13) on the RPM extension harness (see Figure 4). An appropriate RPM sensor
10 for use in the system of the present invention is obtainable from Wabash Electronics U.S.A.

RPM Sensor Extension Harness

The RPM sensor extension harness (6) electrically connects the, RPM sensor to the central harness. It is a fabricated
15 two-conductor wire harness, 18AWG stranded tinned copper wire, cut to a specified length. The wire is rated for harsh environment and with a temperature rating of -20°C to +105°C.

Usually the RPM sensor is located midway between the transmission and engine adjacent to the starter ring gear in
20 the bell housing. The harness extension must reach from the under-dash location of the CM unit, back down the undercarriage of the vehicle to the location as specified.

Both ends are terminated with a two position sealed mating connector (C12) and (C13), and the entire length of wire is
25 jacketed in a split plastic sleeve for protection. Connector (C12) is coupled to connector (C11) of the central harness, as illustrated in Figure 4.

The Driver Alert Centre, (DACM), (see Figures 3 and 3A)

The driver alert centre 15 of Figure 3 contains the audio alert 153, a visual indicator 151 (LED) and the infrared communications module 152. The assembly consists of an integrated plastic housing into which is installed an electronic printed circuit board and the two lenses. The assembly has been designed to allow for placement into tight and restricting areas. However, the front surface or face of the unit is to be placed in clear view of the driver allowing visual notification of the system status in addition to visual indication of speeding or the approach of the speed limit. The secondary requirement to have the face of the unit in clear view is to allow for infrared communication with the support systems.

The audible alarm transducer 153 is an integrated part of the upper housing assembly, which allows for unhindered sound dispersion when active.

The main circuit PCB 154 contains the infrared communications components, control circuitry, power regulator and protection circuit. A six conductor locking header connector (C3), (Figure 4) is soldered to the board and when coupled with (C4a) of the driver alert centre extension harness (18), allows electrical connection to the rest of the VSM in-vehicle system. The DACM includes on the PCB a 2-pin connector that allows for the connection of an optional visual warning lamp as described.

The optional visible warning beacon lamp (Figure 3a) 155, is made of twelve high power pre-focused amber Light Emitting Diodes 156 (LED's) positioned on the PCB 157 in a circular pattern array. The twelve LED's are soldered directly to the PCB. The combined luminance power of the array is such that when projected through the lens, it is highly visible when

viewed on-axis in noon sunlight. The intensity however is not high enough to make the driver alert centre light blinding or highly distracting when viewed at night or in a dark environment.

- 5 The optional visible warning lamp has a 2-pin connector port located to the base of the unit and allows for connection of a custom wire harness assembly. The mounting of the unit can be either to the interior of the cab or be placed to the exterior cab roof. Appropriate mounting hardware is provided. The
10 extension leads from the DACM pass under the instrument panel and up the "A" pillar, and across to the two-pin connection port of the visual warning lamp. Both ends of the wire harness assembly are fitted with moulded over strain relief bushings.

- Optional to the DACM is the liquid crystal display, (Figure
15 3). The LCD, when installed, allows for written text messages from the control module to be displayed. The display can be set to allow for the continuous display of the current number of violations stored to the control module, or any other pertinent information of the system that is required to be
20 displayed on a continuous basis. The LCD will interrupt to display speeding messages and or problems being currently experienced by the system when the vehicle is running. The LCD is backlit by means of an integral electroluminescent panel to allow for nighttime viewing.

25 **The Driver Alert Centre (DACM) Extension Harness**

The driver alert centre extension harness (18) is provided in lengths of 2, 3 and 13,7 metres, the longest designed typically for buses with rear mounted engines.

- The DACM extension harness electrically connects the driver
30 alert centre module to the central harness. As seen in Figure

4, one end is terminated with a six position sealed connector (C6); the other end is terminated in a six-conductor locking plug (C4). The sealed connector mates to a mating connector of the central harness, the other plugs into header (C3) on the driver alert centre PCB board and is strain-relieved into the driver alert centre module. The extension leads from the central harness, under the instrument panel and across to the driver alert centre location.

The cable is a six-conductor cable composed of 20AWG tinned copper stranded wires. The connector (C6) is a 6 conductor shrouded and sealed locking automotive grade connector. The other end is terminated with a locking 6-conductor plug that mates with the header (C3) on the driver alert centre PCB.

The Ignition Relay

The purpose of the ignition relay is to open the vehicle's ignition starter circuit. If the VSM CM has determined that the number of stored violations equals or exceeds a set number of violations stored in its non-volatile memory, the relay is energised and the IGN circuit is therefore open circuit. The relay is integral to the control module assembly PCB. The wires intercepted usually are connected to the start push button or the key switch, and are chosen such that if opened, prevent the vehicle from starting.

Power Connection and Ignition Sense Extensions

The power extension provides the means by which power is supplied to the VSM in-vehicle system. The two power lead connect to the vehicle battery plus (+) and negative (-) points.

The ignition sense is connected to the ignition "ON" point, that is, the point in the vehicle's ignition circuitry that is powered only when the ignition is "ON".

The wire used in a preferred embodiment is 18AWG tinned copper, PVC insulated, 105°C hook-up wire, 2m in length.

The Main Harness (See Figure 4)

5 The main harness (20) is an assembly of special automotive grade connectors interconnected with wires of specific specification and length. The central harness plugs into the CM unit, and is terminated with various connectors for the extension harnesses. Various extension harnesses allow connection of the central harness to the remote sensors, power and ignition etc., the driver alert centre.

15 The connector designated as C2 is a high performance sealed female connector. It mates with a corresponding male bulkhead mounted header on the CM unit. Various leads terminated at one end in C2 lead out and are terminated into several smaller connectors or terminals.

All other wires of the harness assembly are connected to their specific location and function noted herein or indicated in Figure 4.

Main Control Unit (See Figure 5)

20 The main control unit (22) contains the electronic circuitry that controls the VSM in-vehicle systems. It consists of a black plastic case (24), an electronic printed circuit board including right angle shrouded header (23); black encapsulation compound hermetically seals the entire assembly.

25 The main function of the VSM system is to monitor the vehicle speed through its sensors, and to determine if the vehicle has exceeded the pre-set speed limit. The VSM control module will, for such an event, record the date, time, and the peak speed at which the vehicle was travelling when the speeding event occurs. The VSM control module will also detect system

30

tampering and will record it as a tamper violation. The tamper violation record contains the date and time at which the tamper violation occurred, along with a code to identify the tampered item. These speeding and tampering violation records
5 will be stored in the VSM control module non-volatile memory.

The VSM monitors the vehicle speed and determines if the vehicle is exceeding the pre-set speed limit. It achieves this by counting the pulses from the speed sensor. At every speed sample event, the VSM acquires a new speed sample and compares
10 it to the speed limit set points which were programmed into its non-volatile memory during calibration. The VSM has two programmed set points:

1. The "Warning Speed" set-point which is the velocity approaching the set speed limit that will warn the driver
15 that the limit is being approached and activate a warning alarm,
2. The "Speed Limit" which is the set point at which the VSM will log violations and activate the violation warning alarm.

20 In a preferred embodiment, if the vehicle's velocity is below the warning set point, the warning alert alarms are inactive, and the driver alert centre lights are normally "OFF". The driver alert centre may be active with a quick double flash if tampering has been detected.

25 If the vehicle speed is between the warning and violation speed set points the system will generate intermittent light flashes and short beeps at approximately half-second intervals. This audibly warns the driver that the vehicle is approaching the speed limit set point. When the VSM detects a
30 speed sample which is greater than the violation speed set

point, the warning alert alarm and lamp are activated continuously. At this point, the driver can still avoid triggering a violation by immediately slowing, because the VSM determines violations by analysing the speed data over several
5 samples.

If the vehicle exceeds the speed limit for more than a set number of samples the VSM will register a violation. If the speed of the vehicle is reduced below the speed limit before the end of the set number of samples the speed violation will
10 not be captured. It will be understood, however, that depending on law enforcement needs, more, or less, warning may be given to a driver, without departing from the basic mode of operation of the system.

The black plastic case (24) is a custom moulded thermoplastic
15 case. The resin was chosen for its good balance of strength, toughness, electrical properties, surface appearance and chemical resistance.

The case design incorporates three mounting feet (25), with through holes moulded in for screw mounting. The mounting feet
20 are reinforced with flanges. The three mounting feet are set at opposing corners of the case except in the corner where the connector prevents placement. The tripod method is considered appropriate as it is unlikely the surface to which the case would be mounted would be flat.

25 The electronic circuit board is mounted into the cavity of the case and held in place securely by two screws and is sealed into place with black encapsulating compound.

The printed circuit board material is a high-grade glass epoxy copper clad substrate. The PCB is stuffed with a combination
30 of through hole and surface mount components. The shrouded

sealed locking header (C1) is soldered onto the circuit board. The microprocessor which controls the function of the CM is located on this board.

5 The connector has a flat mounting flange that sits flat against the inside surface of the CM case at the connector cut out. Sealant is applied between the mounting flange and the inside face of the case around the connector cutout. This seals the area around the connector.

Electrical connections

10 The (C1) electrical connections of the VSM system are as follows:

<u>Pin</u>	<u>Designation</u>	<u>Connection</u>
1	SPD_SIG	Pulse signal from the speed sensor
2	SPD_SUP	Speed sensor supply from VSM
15 3	SPD_SEN_GND	Speed supply ground from VSM
4	RPM_A	RPM sensor signal input to VSM
5	RPM_GND	RPM sensor ground connection to VSM
6	BATT (-)	System, vehicle battery negative connection
7	CAL_IN	Calibration signal input to VSM
20 8	BATT (+)	System, vehicle battery positive connection to VSM
9	IGN_B	Ignition interrupt circuit to VSM
10	BRK_DET	Brake detector input to VSM
11	LMP_SW & DET	DACM lamp driver circuit connection to VSM
12	LMP_SRC	DACM power supply connection from VSM
25 13	IGN_A	Ignition interrupt circuit to VSM
14	P_ALRM	DACM piezo alarm driver circuit connection to VSM
15	IGN_3	Ignition signal to VSM
16	BATT (-)	System, alternate vehicle battery negative connection to VSM
17	TDO_OUT	Serial communication to DACM from VSM
30 18	RDI_IN	Serial communication to VSM from DACM
19	BATT (+)	System, alternate vehicle battery positive connection to VSM
20	SPD_SEN_PASS	Pulse signal from passive speed sensor, (alternate)
21	N/C	Reserved
22	N/C	Reserved
35 23	BATT (-)	System, alternate vehicle battery negative connection to VSM

CIRCUIT DESCRIPTION

Block Description

5 The VSM CM is a micro-controller-based design used for monitoring the vehicle speed through an array of sensors and vehicle connections. The CM Unit is a microprocessor based design that is programmed with custom embedded software copyright Ardtech Inc., 1996, 1997, 1998.

10 The sensors and certain vehicle connections are connected to the micro-controller through an interface array or active comparison block. The balance of connections is directly connected through to the micro-controller. The flash memory configuration allows the internal software to be upgraded when necessary by means of special equipment and protocols.

15 The Power Supply Regulator is always active, supplying power to the micro-controller and its dependent peripherals. The Power Supply Regulator is connected to the vehicle battery.

20 The Real Time Clock (RTC) module is the system clock that is used to accurately keep track of the date and time and is constantly monitored by the micro-controller. The micro-controller uses the RTC to identify the date and time at which violation incidents occur. The RTC date and time are set during the unit calibration. The RTC module is battery backup powered by a separate battery that will keep it working even if the VSM module has been disconnected from the vehicle battery.

30 The Non Volatile Memory (NVM) is used to store the violation records and the calibration parameters. The microcontroller reads the NVM contents every time a power reset occurs and/ or when the VSM control module is first powered up and as needed. Writing to the NVM takes place whenever there is a violation to store and when the vehicle is being calibrated or re-

certified. All critical information/ data is striped across both memory cells for purposes of redundancy.

The Ignition relay is used to disable the vehicle, by disrupting the ignition key switch circuit continuity. This happens whenever the number of stored violations exceeds a set allowable number. This set number of violations to shut the vehicle off is programmed into the NVM during calibration.

The audio alarm (P_ALRM) part is used to generate an audible warning at the DACM when the vehicle is approaching the speed limit or when speeding. It is also used during the prove-out cycle to signal that the VSM module is powered up and is operating.

The Auto Calibration (CAL_IN) is an input and is used only when the VSM has been primed to receive a calibration or recalibration of the system. This input is used in conjunction with the "Calibration Interface Unit". When the calibration velocity has been reached by the subject vehicle, the calibration interface unit outputs a signal to the CAL_IN lead which triggers the VSM control module to capture the current count of the speed pulses and particulars and store that data to the NVM's.

The Speed and the RPM sensors are connected to the microcontroller via the sensor and peripheral interface circuit. These sensors output a continuous train of pulses to the microcontroller which in turn samples these pulses and determines the speed of the vehicle and the engine speed and particulars.

Also connected to the sensor and peripheral interface is the visual warning lamp (LMP_SW and DET signals). It is used to generate a visual warning at the DACM when the vehicle is

approaching the speed limit or when speeding. It is also activated during the prove-out cycle to signal that the VSM module is tampered with.

5 The Ignition sense (IGN_3) signal is used to determine whether the vehicle ignition switch is turned ON or OFF.

The version of the DACM that contains the optional LCD module communicates with the control module (CM) by means of serial communication only and does not require independent connection of the P_ALRM and LMP_SW circuits. This DACM contains its own
10 micro-controller running proprietary embedded software.

The Serial Comm is used to input communication to and from the infrared (IR) serial communication module contained to the DACM and is also used to communicate with VSM Data Reader (DR) and the VSM Data Reader/Eraser Calibration unit (DREC).

15 DETAILED OPERATION

VSM Action on Power-up

When power is first applied to the VSM control module, per the installation instructions, either because it is being installed or because the vehicle is being serviced (main
20 battery replaced etc.), the VSM audible alarm (P_ALRM) will beep with 4 short bursts to indicate that it has powered up and started operation. If the alarm does not activate as described, the VSM, alarm, or wiring may be defective.

25 Certain data, which is needed for the operation of the unit, is retrieved from the NVM's during a power-up. This includes maximum speed and warning set points, data file pointers, counters, current tamper flags, etc.

After power up, the internal Tel-Tale Truth Table algorithm will execute and determine the current operating state of the VSM system.

The Prove-out Cycle

5 This function is executed when the IGN 3 switch is put into the ON (RUN) position. At this time, the DACM audible alarm (beeper) and visual lamp are activated for a short period. The alarm will activate 4 times if no tampers are present and a single continuous four-second alarm will be emitted if tampers
10 are present.

Monitoring the Vehicle Speed

The primary function of the VSM is to monitor the vehicle speed; this is achieved by counting the pulses from the speed sensor. Every sample period, the VSM acquires a new speed
15 sample and compares it to the speed limits (set points) which were programmed into its NVM during calibration. The new VSM speed sample is stored in a buffer that has stored the last several samples. This means that the VSM has the history of the vehicle speed available for analysis by its firmware. The
20 VSM has two programmed set speed detection points:

1. The warning speed set point is the velocity above which the VSM will warn the driver that he is approaching the:
2. Speed limit, which is denoted by the violation speeding set point.

25 If the vehicle velocity is below the warning set point, the beeper is inactive, and the driver alert centre is normally OFF, (The driver alert centre may be active with quick double flashes if tampers have been detected). If the vehicle speed is between the warning and violation speed set points, the
30 beeper and lamp are both activated with a 50% duty cycle

factor based on a frequency of 2 Hz (flash once every 2 seconds). This is to indicate to the driver that the vehicle is approaching the speed limit set point. When the VSM detects a speed sample which is greater than the violation speed set point, the beeper and lamp are activated continuously. At this point, the driver can still avoid triggering a violation by rapidly slowing below the violation speed set point.

Determining that a violation has occurred

The VSM uses two methods to issue a violation, Continuous Speeding (CS) and Discontinuous Speeding (DS).

Continuous Speeding (CS) violation

This is the primary method of determining whether a violation is occurring. If the vehicle speed exceeds the maximum speed set point for a given number of consecutive samples defined by Maximum CS (programmed during calibration), a violation is issued. If the maximum CS is set to 3, which is the suggested default value, then exceeding the maximum speeding set point for 3 samples or more will trigger a CS violation. The value programmed for "Max CS" should be between 1 and 16 samples. A CS violation will not be registered until Max CS consecutive samples are greater than the "Max CS" set point.

Discontinuous Speeding (DS) violation

This is a method of determining that a violation should be issued which will discourage drivers from "hovering" close to the maximum speeding set point. By studying how a CS violation is determined, it may be observed that it is possible to avoid causing the VSM to register a violation if the vehicle does not exceed the maximum speed set point for 3 samples. If the driver only exceeds the limit for 2.5 samples and then drops below for 2 more samples, and then repeats this cycle, he can actually travel at an average speed above the maximum speed set point and not trigger a violation.

The DS detection studies the speed history of the vehicle over the last 16 samples, which is stored in the 16-sample speed buffer. With every sample, when a new speed sample is available, the firmware first determines if a CS violation has occurred. If not, and the new sample is above the maximum speed set point, it counts the number of samples of the last 16 which exceeds the maximum speed set point. If this number is equal to the value programmed as Max DS, the firmware indicates that a DS type violation has occurred.

10 Tracking the "Peak Speed" after a "Violation" occurs

Once the speed-monitoring module has determined that either a CS or DS violation is occurring, it tracks the peak speed of the vehicle for the time programmed during calibration as "Tracking Time" (time between tickets). For example, if tracking time (time between tickets) is set to 120 seconds, the firmware will track the vehicle peak speed for 120 seconds after first determining that a violation is occurring. At the end of the time interval, the peak speed recorded during the interval will be stored as the violation speed, along with the date and time. The VSM will now start the process of determining if the vehicle is speeding again. It can be seen that the value programmed as tracking time (time between tickets) controls how often it is possible to create a new violation in the VSM violation memory.

25 Tamper Detection Routine

The tamper detection routine executes once every minute on average when the "Run-mode = 0", (the vehicle ignition is off). It determines whether the peripheral devices are connected properly and/or are disconnected. The devices checked and reported back are:

1. IGN_3, Ignition signal "Open Circuit"
2. SPD_SEN, speed sensor "Open Circuit"
3. DACM, driver alert centre "Open circuit"

4. BATT (+), Vehicle battery connection to module is "Open circuit"
5. IGN_RELAY, Ignition circuits disrupter relay "Open circuit". (Applies to revision "A" only).

5 N.B. All items can be adjusted to be reported as service flags and not tampers.

When a new tamper detection has been detected it will be stored in the violation memory along with the date and time of its occurrence. These tamper records will increment the violation counter just as a speeding violation does.

The occurrence of a tamper will sets a "Tamper" flag which causes the driver alert centre to continuously flash in a specific pattern (fast double flash), when run-mode = 1, and the vehicle speed is below the warning speed set-point. In addition, the beeper will sound continuously for -5 seconds during the diagnostic prove-out cycle to indicate to the driver that one or more sensors/peripherals are not responding as expected. The tamper flag will be cleared when any violation records are read from the VSM module while using a DR or DREC.

The Vehicle Auto Calibration

The Auto Calibration process is initialised by the DREC system to put the VSM control module in the "Auto_Cal' mode. After the calibration parameters are entered in the DREC host computer and written to the in-vehicle CM NVM, (as described in the DREC User' s Manual), the vehicle is to be prepared for the road calibration.

The VSM system is calibrated by running the vehicle at the calibration speed. Various techniques both mobile and stationary exist for determining the exact apparent speed of

the vehicle. Such techniques include stationary speed
dynamometers, motion and speed sensors of which are mounted on
the vehicle and operate independent of the vehicles own
instrumentation, and also various other fifth wheels, radar
5 units etc.

The calibration interface unit is configured to interface with
the sensing equipment. It outputs a signal at the precise
instant the vehicle achieves the calibration reference
velocity. The Calibration Interface will signal the VSM
10 through the "Auto-Cal" signal wire of the same. At this
instance the current speed and RPM sensor pulse data is
recorded to non-volatile memory NVM as an absolute value. It
will then calculate the pulse count for other speeds and store
them in a table in the non-volatile memory for later
15 reference.

PERIPHERAL SUPPORT SYSTEMS

The Data Reader (See Figures 6 and 7)

The Data Reader (DR) (26), unit is a portable hand-held unit
that allows law enforcement personnel to access the speeding
20 violations stored in the in-vehicle VSM control module. The DR
user can issue tickets against any of those stored non-
ticketed violations. At the end of the access session, the DR
sends the ticket information back to the CM which stores this
data in its NVM.

25 The DR is an integrated assembly that consists of a compact
upper and lower plastic housing, a rechargeable battery pack
and printed circuit board assemblies (PCB). The printed
circuit board assemblies include the integrated Keyboard/
Micro-controller/ and IR assembly, and the LCD assembly. The
30 front face of the DR (not shown) includes the infrared window
for the IR module that is used to communicate with the in-
vehicle system.

The keypad (30) is arranged as a 4 X 7 contact matrix assembly. The ENTER key comprises two locations thereby reducing the push-button key count to twenty seven. The keypad is directly interconnected to the micro-controller assembly.

5 The keypad (30) is fitted with a night viewing backlit system. The backlighting will be turned on automatically by the microcontroller whenever the light detection circuit detects insufficient ambient light.

The micro-controller and IR PCB assembly contains the

10 microcontroller (31) and Infrared communication module (32). The micro-controller is a microprocessor based design that is programmed with custom embedded software copyright Ardtech Inc., 1996, 1997, 1998.

The data reader includes an LCD assembly with an LCD display

15 (33), LCD driver and an LCD backlighting system (34). The LCD is an application specific custom design.

The housing design incorporates appropriate bracing, mounting bosses, alignment ribs, and additional locating features to hold the circuit boards and the silicone membrane keypad in

20 place.

The DR case is made of high performance engineering thermoplastics. The case is assembled from a top (27) and bottom (28) section. A tongue and groove runs along the mating edges. This aligns the two sections during assembly, serves as

25 a barrier to moisture and dust and hides the parting lines of the two halves. The top half is characterised by the individual key cutouts, the large cutout for the LCD display and ambient light detector. The inside of the top section features ribs and mounting bosses for the purposes of affixing

30 the various PCB assemblies. Around each keyhole is a surrounding thin-wall rib. When the keyboard assembly is

fastened into place, the rib is pressed into the silicone surrounding each pad. This forms a gasket around each key that provides protection against dust and moisture. The case of the DR unit is designed to house and protect the internal electronics from moisture and dust.

User Keypad.

The keypad (30) is moulded from silicone. Under each key is a small carbon low resistance formed pill that is used to provide a switch closure contact when depressed to the keypad PCB copper etched pattern.

The graphics and text is applied to the tops of the keys using a screened ink process, after which, are coated with a hard layer of plastic encapsulation. This gives the keypad a "hardtop" feel. Alignment depressions moulded into the top surface of the keypad align with corresponding pins moulded onto the bottom surface of the upper case. Mechanical depressions are moulded into the underside of the keypad to clear surface mounted Leeds' for backlighting of the keys.

In a preferred embodiment, the keypad array is divided into 7 rows and 4 columns, referring to Figure 6.

The battery pack or power source for the DR is a rechargeable flat pack type assembly. The battery pack is removable, and snaps and locks into place at the bottom surface of the lower case. Thus, an extra battery can be plugged in for extended use.

The Liquid Crystal Display

Referring to Figure 7, in a preferred embodiment, the Liquid Crystal Display, (LCD) consists of two lines, each of which is twelve characters long and eight graphic icons as shown in Figure 10, and as set out below in Table II.

TABLE II

	<u>Symbol</u>	<u>Function</u>	<u>Description</u>
	GR1	Clock	Clock graphic symbol
	GR2	Comm	communication graphic symbol
5	GR3	NO TCKT	No ticket graphic symbol
	GR4	TCKT	Ticket graphic symbol
	GR5	SPEED	Speed graphic symbol
	GR6	Violation File	Violation file graphic symbol
	GR7	PIN	PIN graphic symbol
10	CH1	TIME HH:MM	Time of day, character display area
	CH2	VIOLATION	Violation number 01-99 display area
	CH3	SPEED/PIN	Speed/PIN display area
	CH4	DATE DD:	MMDate characters display area
	CH5	Comm	Communication direction display area
15	The LCD (33) is bonded to the backlighting assembly (34) with thin water clear double-sided tape. This assembly is in turn bonded to the LCD circuit board with 3mm double-sided foam tape. This arrangement isolates the LCD glass (39) from any violent shock and vibration.		
20	The DR hand unit incorporates backlighting for the keypad and LCD. This is controlled via the micro-controller as earlier mentioned. The light from the LED's are transmitted into the translucent silicone of the keypad, which acts as a light pipe. This distributes the light around the keypad buttons.		
25	The LCD is backlit by conventional methods, i.e., electroluminescence, etc.		
	The infrared assembly is responsible for the communications with the VSM in-vehicle system. The infrared module is compatible with the infrared module in both the DACM and DREC.		
30	The light is projected outwards through the infrared lens (32).		

The contacts located to the bottom of the lower DR housing is the means by which data transfers out of the DR to DRDB and charging of the DR battery is achieved, when plugged to the DRDB unit. The DR unit is charged whenever it is inserted into the DRDB slot. The charge circuit is a "smart" charger, i.e.; it discharges the batteries and then charges them at a fast rate thereby actually prolonging the life of the battery.

The DR has provision to automatically monitor the status of its internal battery. When the DR detects that the battery voltage drops to a pre-determined level, it will display "Battery Low" on the LCD and displays the message for 30 seconds after which will turn off. The unit should be returned to the DRDB control station to recharge the battery and to transfer the data stored in its non-volatile memory. A spare battery may be plugged into the unit.

The DR incorporates a battery saver function, which saves the batteries from being depleted if the unit is inadvertently left on or is accidentally turned on. If the user does not press any key within a three-minute period, the unit will abort the current operation and shutdown. The user must turn the unit ON and go through the PIN verification cycle to commence using the unit.

Security Features of the Data Reader

There are several security features that were designed into the software of the system of the present invention to ensure proper use and prevent unauthorised usage.

In a preferred embodiment, the main security feature that protects the DR against unauthorised use is the Personal Identification Number (PIN) which is assigned to the user at the time the DR is taken from the Data Reader Docking Bay (DRDB).

For proper operation after a DR has been successfully issued from the DRDB, the user must enter, via the keypad, their PIN number. The DR gives the officer three chances to enter the PIN. After three attempts the unit will shut off for about
5 three minutes, after which another three chances will be given to the user. If the user fails to enter the correct PIN after the second round of three attempts, the DR will be rendered inoperable. In such a case, the unit must be returned to the DRDB to be reinitialised by an authorised superior.
10 Preferably, any DR unit, even those that are to be used for the first time must be plugged in the DRDB control station to be initialised with a user PIN and the user badge number before it can be re-used.

When the DR unit release process is started, the unit will be
15 checked to see if its battery is fully charged or not. The DRDB controller will not release any DR that has not had its batteries fully re-charged. The batteries require approximately two hours to complete the charge cycle.

The Data Reader Docking Bay

20 The Data Reader Docking Bay (DRDB) System (Figure 9) is designed, as part of the Vehicle Speed Monitoring system (VSM). The DRDB serves as a station for recharging the Data Reader (DR) units' battery and for downloading or transferring stored data of the DR through to the host desktop computer via
25 the DRDB integral controller. The DRDB system consists of a compact control station (40), with a number of pockets or slots, for purpose of plugging DR units into. Each slot provides a power source to recharge the DR battery and communication contact points that connect with the DR units
30 microcontroller communication port. The DRDB control station is connected to a host desktop computer through a standard RS232C serial port. The host custom application software allows the user to interact with the DRDB control station. The

custom DRDB embedded software is copyright Ardtech Inc., 1996, 1997, 1998.

5 In a preferred embodiment of the present invention, the DRDB consists of a "custom enclosure" rack mountable assembly (42), able to hold several cage assemblies (43). The DR pocket modules are fastened into a cage assembly by four front captive screws. The cage assembly is then fastened into the rack assembly.

10 Daisy-chained power and data harnesses are connected to polarised locking mating connectors on the PCBs mounted onto each docking bay module. If one of the docking bay modules is in need of service, the power and data harnesses can be disconnected from the back of the module, four screws are loosened at the front panel of the assembly and the module is
15 slid out. The rest of the DRDB will remain functional with a unit or several units removed, or, a replacement module can be slid into its place and reconnected accordingly.

Each DRDB complete assembly rack contains its own Controller Module. The PC interface cable is plugged into an RS-232 port
20 at the back of this unit. The daisy-chained data and power harnesses are also connected to this module. The assembly additionally has the provision to accommodate the system power supply to one of the free panel openings not occupied by a DR module. The entire DRDB rack assembly is enclosed in a
25 standard metal housing.

The Docking Bay

The docking bay pockets (See Figure 9A) are fabricated from high performance engineering thermoplastic; moulded in custom tooling.

The PCB for the docking bay pocket contains six spring loaded contacts that mate up with the six contacts of the DR, two contacts for the purpose of recharging the batteries, two are for data communication and the balance are for battery temperature monitoring through the recharge cycle. Two LED's are located to a visible forward facing surface indicating status of the particular DR, "BATTERY CHARGING" or "DATA TRANSFER".

The controller card (not illustrated) of the DRDB contains the circuitry that directs the data transfer among the up to 128+ addressable DR's while plugged to the DRDB. The DRDB assembly additionally has the provision to accommodate the system controller assembly to one of the free panel openings not occupied by a DR pocket or power supply. The front face or front panel of the controller card contains two LED's to indicate power and status of communication. The controller card assembly is fastened into the rack by the front panel with four screws.

The docking bay pockets are loaded into the rack and secured in place with screws, free panel openings not occupied by a DR pocket or other items are covered with blank front covers that are held in place with four screws as well. The power supply harness and data transfer harness is daisy-chained to the appropriate connectors at the back of each module. The harnesses are designed to have enough distance between the connectors so that a module can be slid out of the rack with the connectors attached for ease of service. This may be required if the rack is mounted into a larger rack with an enclosed back.

The DRDB Software

All information pertaining to the description and operation of the custom application software is detailed to the respective document.

5 The Data Reader/Eraser Calibration Unit, (DREC) System.

The Data Reader/Eraser Unit is a microprocessor based design that is programmed with custom embedded software copyright Ardtech Inc., 1996, 1997, 1998.

10 The DREC (See Figure 10) is designed, as part of the VSM System, to serve as a tool allowing an authorised individual the ability to initialise, calibrate and verify an in vehicle VSM System. The DREC system can also read, download, write and/or clear, any of the stored information in the in-vehicle VSM system.

15 The DREC unit contains (not illustrated) a PCB assembly with controlling circuitry, and the IR module. The PCB is housed in an extruded aluminium case, the ends are capped by plastic end bezels and aluminium face plates. The rear face accommodates the serial connector for the computer, LED indicator lamps for
20 power and data transfer, and power connector. The front face accommodates the IR lens.

Power for the unit is derived from either the vehicle battery and/or the Calibration Interface Unit.

25 The DREC unit is connected through to a host laptop computer by means of standard RS232C serial communication port.

The DREC Software

All information pertaining to the description and operation of the custom application software is detailed to the respective document.

Calibration Systems

The calibration system used for the VSM system calibration process consists of a "Reference Speed Sensor" unit (57), (see Figure 11) and an interface (Calibration Interface) unit (58) (see Figure 12). The reference speed sensor outputs a compatible pulse train signal, which varies proportionally with the true ground speed of the vehicle. This signal is detected and processed by the calibration interface unit. The interface unit, known as the Calibration Interface Unit, compares this signal against an internal reference setting and outputs a calibration command pulse to the in-vehicle VSM system. This reference point is the calculated value that the reference speed sensor will output when the vehicle's velocity is, for instance, exactly 80.0 Km/h.

The Reference Speed Sensor

The reference sensor (57) used to calibrate each in-vehicle system is a small microwave based unit. The sensor functions on the basis of the "Doppler" effect by using the frequency shift of a wave reflected by a moving surface. The advantages of this non-contact system over other ground contact methods is that it is slip free, i.e., it is unaffected by gravel, dirt or wet roads, and it compensates for vehicle pitch movements. The sensor is attached to the outside of the vehicle using suction clamps or magnetic holders. A variety of mounting bars and articulated knuckle clamps aid in the placement of the sensor. Cables connect the sensor to the calibrator and the power source-10.5 Vdc to 30 V dc. The power is taken from the vehicles own power system.

The sensor is supplied with software, which allows an operator to view the output signal of the sensor in Km/h or M/h, and monitor acceleration and distance travelled. The software also allows for calibration of the system.

Since the unit outputs a fixed number of pulses per unit distance travelled, the calibration takes place over a reference length of road. A vehicle with the sensor mounted to the body is driven a fixed reference distance and the number of pulses counted. The number of pulses per metre is calculated and this becomes the reference set point.

The speed sensor is a known device, which is obtained, along with the software and mounting fixtures from DATRON MESSTECHNIK.

The DATRON system for the purpose of calibration is by no means the only method for the purpose of investigating an in-vehicle VSM system to receive calibration etc., but is one of many methods to achieve the same required conclusion.

The Calibration Interface Unit, (CIU) Figures 12 and 12A)

The Calibration Interface Unit is a microprocessor based design that is programmed with custom embedded software copyright Ardtech Inc., 1996, 1997, 1998.

The calibration interface unit derives its signal from a reference calibration speed sensor system. These signals are compared to the internal reference point settings. At correlation, it outputs a signal to the in-vehicle system to store within the non-volatile memory, the particulars and data collected at that instant, to be used as reference and operational parameters.

The calibrator is powered from the vehicle's power system. A power output socket 68 and binding posts 69 supply power from the calibrator to the other equipment, such as the DREC system.

The calibrator is made from a die cast aluminium box (59). The top lid (60) is reference labelled (70), drilled and punched to accommodate connectors, switches and handles. The box is punched to accommodate power sockets, power cables and binding posts. The PCB (62) is attached through stand-offs to the top lid (60), as is the DB9 computer connector (63), the LED indicator (64) and the main power switch (65). The audio alarm (66) also projects through the top lid.

The power cable (67) is a 4-metre line cord with a red and black battery alligator clip terminating the two conductors. The cable is a rubber jacketed grease resistant grade cab tire configuration. A fluid tight box connector clamps the cable to the box.

The front panel indicators indicate power and data transfer from the Reference Speed Sensor System, and display the current calibration status. The power indicator lights when power is applied to the calibrator and the power switch is on. The data transfer indicator flickers when a signal is being received from the reference speed sensor system.

This indicator is useful as a gross indication of whether the system is connected properly. The calibration signal lights when the vehicle has obtained the calibration reference speed and the VSM system has been calibrated. The audio alarm is also activated at this point.

25 Block Diagrams

- Figure 13, Block diagram, VSM Control Module
- Figure 14, Block diagram, DACM w/ LCD
- Figure 15, Block diagram, VSM DR unit
- Figure 16, Block diagram, DREC unit
- 30 Figure 17 Block diagram, VSM CI unit
- Figure 18, Block diagram, VSM Calibration unit

DESCRIPTION OF FIGURES (BLOCK DIAGRAMS)

Block diagrams, VSM Control Module

Block diagram, VSM Control Module, Figure 13 as illustrated is a microprocessor based unit that contains application specific
5 embedded software. The heart of the system is based on a micro-controller surrounded with peripheral support circuitry. These peripherals consist of a "Power Supply Regulator" that provides the system with a regulated system voltage independent of the changing vehicle voltage, all of which is
10 protected by a common "Protection Circuit".

The "Peripheral Interface Comparator Block" is used to interface the analogue sensors and convert the signals being received to a compatible format for the micro-controller. The PICB is controlled by the micro-controller by means of a
15 "Power Supply Switch". This switch, when turned "OFF", does not provide any power to the PICB thereby reducing the system quiescent current to minimal levels and conserving energy.

The "IGN Buffer" consists primarily of a differentiating circuit with hysteresis to provide the micro-controller only
20 valid transitions of the vehicle ignition signal.

The "IGN Relay", is used to electrically "Open Circuit" the start switch continuity of the vehicle ignition starter circuit. The relay is only energised when the vehicle has accumulated the set number of possible stored violations - as
25 explained earlier.

The "Real Time Clock", is the means of how the VSM keeps track of time. The RTC is accurate to within 6 seconds per month running time. The RTC is powered by both the internal system power regulator and when needed, the "Backup Battery". The
30 RTC/backup battery combination can be left unpowered on the shelf for up to 5 years and still maintain accuracy.

The "NVMS", Non Volatile Memory array is used by the VSM micro-controller to store operational, calibration, tamper flags and violations. The array is non-volatile-meaning that no backup battery is required for the memory array to retain stored data. Both memories are connected to the same serial bus as the RTC. Each device is individually addressed and can be bypassed if found to be defective. The data that is stored to the NVM's is split to two categories, critical and noncritical. The critical data is saved or mirrored to both memory cells called data striping. Noncritical data resides to whichever memory has been selected for the particular item.

Block diagram, VSM Driver Alert Centre Module w/ Optional Lamp

Block diagram, DACM w/ Optional Lamp, is the visual and audible portion of the VSM in-vehicle system. Control of both audible and visual alarm is controlled via the VSM CM.

The remaining circuitry is dedicated to infrared communication supported by the IR System Interface and IR Transceiver. The on-board IR communication is the means that is used by all of the support subsystems to communicate with each other.

The "Power Supply Control Circuit" provides the DACM with a regulated system voltage independent of the changing vehicle voltage, all of which is protected by a common "Protection Circuit". The power for the VSM CM is derived through the wire harness.

The "Optional Array of LED's" is used as the forward facing lamp to visually indicate outside of the vehicle, the status of the VSM system. For the user, there is internal indicator located at the front face of the DACM.

Block diagram, VSM DR Unit, (Data Reader)

Block diagram, VSM DR Unit, (Data Reader), Figure 15 as illustrated is a micro-processor based unit that contains application specific embedded software. The heart of the system is based on a micro-controller surrounded with peripheral support circuitry. These peripherals consist of a "Power Supply Regulator" that provides the system with a regulated system voltage independent of the changing battery voltage, all of which is protected by a common "Protection Circuit".

The peripheral circuitry consists of an "IR-Interface Transceiver", "Ambient Light Detection" circuit, Non Volatile Memory, LCD (Liquid Crystal Display) and the user "Keypad".

The IR Interface Transceiver is the same as that of the DACM and is the means for communication between the various sub-systems.

The NVM memory array is similar to that of the VSM CM per function and operation.

The "LCD" assembly is based on a VLSI (Very Large Scale Integrated Circuit). The communication between the resident micro-controller and the LCD is via parallel data communication. Contrast is controlled locally by means of user adjustable setting and augmented by an internal circuit thermally tracking each adjusted range. Backlighting is provided for nighttime use.

The "Keypad" is the means how a user interfaces with the DR. Details pertaining to the description and use of the keypad, is explained herein.

The DR is a battery-powered unit. Additionally, the DR has built in circuitry that allows for continuous measurement of the removable battery pack when in place. Through application specific embedded software the DR determines whether the unit has enough battery power available prior to commencing a communication session or any high power demanding function.

The total of the circuitry is contained to 2 printed circuit assemblies interconnected via flexible multi-conductor connector strips. The keypad is located to one side of the PCB while the second side contains all of the balance of components excluding the LCD assembly, which is a self-contained assembly.

Block diagram, VSM DRDB Controller Unit

Block diagram, VSM DRDB Controller Unit, Figure 16 as illustrated is a micro-processor based unit that contains application specific embedded software. The heart of the system is based on a micro-controller surrounded with peripheral support circuitry. These peripherals consist of a "Power Supply Regulator" that provides the system with a regulated system voltage independent of the changing battery voltage, all of which is protected by a common "Protection Circuit".

The "Communication Interface" section is directly connected to the DR through wired connection. There is no infrared communication support required for communicating with the DR units. Transistor buffering circuits are provided to each pocket communication point to a DR as not to overload the common serial communication bus.

The "RS232C Interface Transceiver" is the means for the connection of the DRDB System to the personal desktop computer running the DRDB application specific software.

There are two LED's located to the front panel of each module which serve as "POWER" and "Communication" status indicators. The "Communication" LED flashes when data is either being received or transmitted to and from the DRDB.

5 Block diagram, VSM DREC Controller Unit

Block diagram, VSM DREC Controller Unit, Figure 17 as illustrated is a micro-processor based unit that contains application specific embedded software. The heart of the system is based on a micro-controller surrounded with
10 peripheral support circuitry. These peripherals consist of a "Power Supply Regulator" that provides the system with a regulated system voltage independent of the changing battery voltage, all of which is protected by a common "Protection Circuit".

15 The "IR Interface Transceiver" is the same as that of the DACM and DR units and is the means for communication between the various sub-systems.

The "RS232C Interface Transceiver" allows for the connection of the DREC System to a personal desktop computer running the
20 DREC application specific software.

There are two LED's located to the front panel, which serve as "POWER" and "Communication" status indicators. The "Communication" LED flashes when data is either being received or transmitted to and from the DREC.

25 Block diagram, VSM Calibration Interface Unit

Block diagram, VSM Calibration Interface Unit (CIU), Figure 18 as illustrated is a microprocessor based unit that contains application specific embedded software. The heart of the system is based on a micro-controller surrounded with
30 peripheral support circuitry. These peripherals consist of a

"Power Supply Regulator" that provides the system with a regulated system voltage independent of the changing vehicle battery voltage, all of which is protected by a common "Protection Circuit".

- 5 The "RS232C Connector" is the means that allows for the connection of the Reference Speed Sensor System (calibration system) to be connected. This provides pulse/distance data to the CIU.

10 There are three LED's located to the front panel, which serve as "POWER" and "DATA Activity" and "Calibration" indicators. The "DATA Activity" LED flashes when data is being received from the Calibration System. The "Calibration" indicator lights when the calibration of the subject VSM system occurs, and the "POWER" indicator is to indicate when power is present
15 to the CIU and is switched ON.

The "CAL_O/P" is the connection port to the VSM CM, to which the CIU calibration lead wire is connected. A signal is generated by the CIU when the calibration velocity is achieved.

- 20 The "Calibration Offset DIP Switches", is set when the CIU is itself being calibrated with the reference speed sensor system assuring compatibility with all types of reference systems. These switches are set providing an offset to the internal microprocessor and are left in the calibrated offset position
25 and should not be changed unless during the process of calibrator system re-calibration.

Summary

It is to be understood that the examples described above and throughout this document are not meant to limit the scope of
30 the present invention. It is expected that numerous variants

will be obvious to the person skilled in the field to which
the present invention pertains without any departure from the
spirit of the invention. The appended claims, properly
construed, form the only limitation upon the scope of the
5 invention.

All the previously mentioned custom embedded software is
copyright Ardtech Inc., 1996, 1997, 1998, as is the custom
application software. MS Windows is a product of the Microsoft
Corporation.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. Apparatus for monitoring vehicle speed, and detecting
episodes of vehicle speed in excess of a predetermined maximum
5 speed, including:
 - a) a first subsystem for mounting on a vehicle to
monitor and record vehicle speed related
information;
 - 10 b) a transportable device for receiving and storing
information recorded by said first subsystem; and
 - c) a second subsystem for receiving information stored
by said transportable device.
2. Apparatus as claimed in claim 1, wherein said first
15 subsystem comprises sensing means for sensing the speed of a
vehicle, and outputting a signal representing said speed; and
processor means for recording vehicle speed related
information, having an input for receiving the signal from
said speed sensing means.
3. Apparatus as claimed in claim 2, wherein said first
20 subsystem further comprises output means associated with said
processor means, for permitting vehicle speed related
information stored in said processor means to be output to a
said transportable device.
4. Apparatus as claimed in claim 2 or 3, wherein said first
25 subsystem further includes a warning device having an input
connected to an output from said processor means, and being
actuatable by said processor means to produce a visually or
audibly sensible signal.

5. Apparatus as claimed in claim 4, wherein said warning device is a beacon mountable on or in a vehicle for viewing from outside said vehicle.
6. Apparatus as claimed in claim 5, wherein said beacon includes audible warning means for warning a driver that vehicle speed is in excess of a predetermined allowable maximum.
7. Apparatus as claimed in any one of claims 2 - 6 wherein said first subsystem includes an ignition relay having an input for receiving a signal from said processor means, said processor means being programmable to actuate said ignition relay to prevent operation of said vehicle, in predetermined circumstances relating to detected episodes of vehicle speed in excess of a predetermined maximum speed.
8. Apparatus as claimed in any one of claims 2 - 7, wherein said speed sensor is connected to the speedometer cable of a said vehicle.
9. Apparatus as claimed in any one of claims 1 - 8, wherein said first subsystem includes an RPM sensor for sensing the engine speed of a said vehicle, and outputting engine speed information to said processor means, said processor means including comparator means for comparing engine speed and vehicle speed, to monitor the accuracy of said vehicle speed sensor.
10. Apparatus wherein said processor means comprises a control module having inputs at least from said vehicle speed sensor, and said RPM sensor, and outputs at least to said warning beacon and said ignition relay.

11. Apparatus as claimed in claim 10, wherein said control module includes communication means for outputting a signal to a transportable device, and receiving a signal from a transportable device.
- 5 12. Apparatus as claimed in claim 11, wherein said means for outputting a signal to a transportable device and receiving a signal therefrom is an infrared serial communication module.
- 10 13. An apparatus as claimed in any one of claims 10, 11 or 12, wherein said control module includes power input means for receiving power from the electrical system of a said vehicle, and power output means for providing electrical power to all parts of said first subsystem.
- 15 14. An apparatus as claimed in any one of claims 2 - 11, wherein said transportable device comprises a hand held device that is provided with means for communicating with said first subsystem.
- 20 15. An apparatus as claimed in claim 12 or 13, wherein said transportable device comprises a hand held device that is provided with a infrared communications module for communicating with said controller module.
- 25 16. An apparatus as claimed in claim 14 or 15, wherein said transportable device includes a keyboard, a screen and a microcontroller, to permit a user thereof to visually inspect vehicle speed related information received from the control module of a vehicle, store said information, and select from predetermined options the manner of proceeding to deal with an episode of excessive speed.
17. An apparatus as claimed in claim 16, wherein said transportable device is provided with a rechargeable battery.

18. An apparatus as claimed in claim 17, wherein said screen is an LCD for visually presenting graphical and/or alphanumeric symbols relating to vehicle speed related information, and said predetermined options.

5 19. An apparatus as claimed in claim 18, wherein said keyboard includes keys for selecting information and/or options displayed on said screen.

20. An apparatus as claimed in claim 19, wherein a light detection circuit is provided in said transportable device,
10 connected to a backlighting LCD system for illuminating said keyboard in connection of low ambient light.

21. An apparatus as claimed in any one of claims 1 - 16, wherein said second subsystem comprises means for interfacing with said transportable devices, and means for storing vehicle
15 speed related information downloaded from said transportable devices.

22. An apparatus as claimed in any one of claims 17 - 20, wherein said second subsystem comprises means for interfacing with said transportable devices, and means for storing vehicle
20 speed related information downloaded from said transportable devices.

23. An apparatus as claimed in claim 22, wherein said second subsystem includes an assembly for receiving one or more of said transportable devices in individual docking stations,
25 each of which is provided with means for recharging the battery of a said transportable device, and communication means for receiving a signal from a said transportable device, and sending a signal to a transportable device.

24. An apparatus as claimed in claim 23, wherein a plurality of said docking stations are arranged as a docking assembly and are connected to a computer for storing information downloaded from transportable devices.

5 25. An apparatus as claimed in any of claims 1 - 24, further including:

(d) a calibration subsystem.

10 26. An apparatus as claimed in claim 25, wherein said calibration subsystem includes a mountable/demountable reference speed sensor for sensing ground speed of a vehicle, a processor having a signal input from said reference speed sensor and an output to said first subsystem.



Application No: GB 9823846.2
 Claims searched: 1 - 26

Examiner: Iwan Thomas
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Patents Act 1977 **Search Report under Section 17**

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): G1N NACNR

Int Cl (Ed.7): G01P 1/06, G07C 5/08

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2275336A (WEST) See abstract, and pages 2-3	1-3
X	EP 0592166A2 (MATRA MARCONI) See abstract, col. 1 line 36- col. 2 line 45, and col. 4 line 20-33	1-3
X	WO 96/32699A1 (LAIS) See abstract.	1-3
X	WO 93/21583A1 (PARRA) See abstract, and pages 2-3	1-3
X	US 4866616A (TOKYO KEIKI) See abstract, and especially cols. 2&3.	1-3
X	US 4853856A (UEC) See abstract, and cols. 1&2	1-3
X	US4258421A (ROCKWELL) See abstract, and cols. 1-3	1-3
X	US 3792445A (MARK & SON) See abstract, and cols. 1&2	1-3
A	CA 2231853A (ARDTECH) See abstract.	1-26
X	FR 2676298A (PICHOT) See abstract.	1-4

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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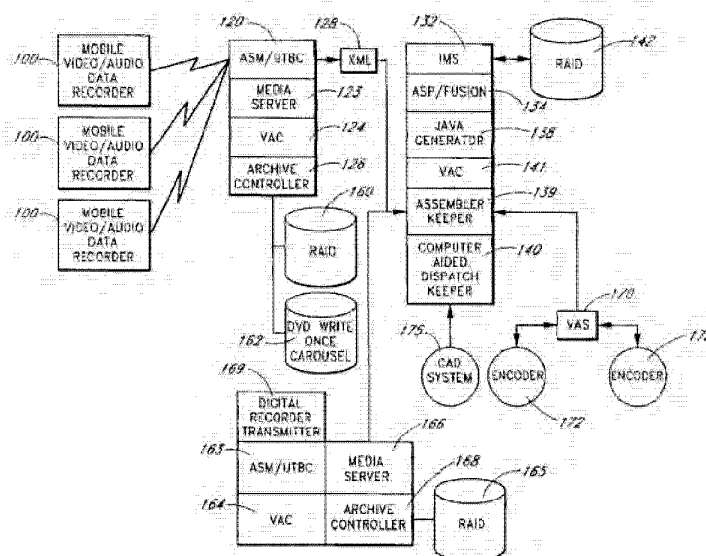
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(54) Title: VIDEO AND TELEMETRY APPARATUS AND METHODS



(57) Abstract: The present invention is related to methods and systems for acquiring, storing, and distributing video and telemetry. Methods and systems are provided for the comprehensive management of audio, video and data recorded by one or more sensors, such as surveillance sensors. Users can select and play back video records based on meta-data embedded within the video record. The frame rate and resolution of the video can be customized to be appropriate for the user terminal.

VIDEO AND TELEMETRY APPARATUS AND METHODS

Background of the Invention

Field of the Invention

5 The present invention is related to video and telemetry, and in particular to methods and systems for acquiring, storing, and distributing video and telemetry information.

Description of the Related Art

Conventional video surveillance systems often suffer from many deficiencies. For example, many conventional video surveillance systems fail to deliver television-quality
10 streaming video with synchronized audio. Instead, many systems use a technique called motion JPEG or Wavelet "push" technology. Disadvantageously, motion JPEG and Wavelet systems are primarily designed to provide a series of individual "photographs" from a video camera source. This process of transporting individual pictures is sometimes called "Serial Still Frame" transport, or "SSF." SSF does not adequately synchronize audio
15 and other data. Further, the bandwidth needed for SSF transmission can be relatively high, as with conventional systems each individual picture is separately encoded, recorded and transmitted.

Further, once the image data is captured, it can be very difficult to find a particular frame or sequence of frames without having to manually search by viewing large number of
20 the frames to locate the desired frame or sequence of frames.

In addition, many conventional systems do not provide tamper-proof archiving technologies to ensure that archived data is not later improperly modified or edited. For example, some conventional video archiving systems rely on watermarks embedded within the video frames during the recording process to detect tampering. This method however,
25 can often be circumvented, and so these systems often do not have adequate evidentiary credibility.

Summary of the Invention

The present invention is related to methods and systems for acquiring, storing, and distributing video and telemetry. Example embodiments further provide methods and
30 systems for the comprehensive management of audio, video and data recorded by one or more sensors. Thus, embodiments of the present invention enables users to select and play back video records based on meta-data embedded within the video record.

One embodiment is a recording and transmission system comprising: a recorder mountable in a police vehicle configured to record video and meta-data synchronized with the video, wherein the recorded video includes a plurality of segments having fixed lengths, the recorder including a wireless transmitter configured to wirelessly transmit the recorded video segments and meta-data, wherein the meta-data includes: data related to vehicle status; subjective time information; objective time information; serial data. An assembler is configured to wirelessly receive the transmitted video segments and assemble the video segments into a file including the meta-data, the assembler further including a mass storage device used to store the assembled video and transmit the assembled video. An information management system is coupled to the assembler to receive the assembled video and to store the meta-data in a relational database, wherein the information management system is configured to receive a user search query from a first terminal having a first resolution, conduct a search of the meta-data based at least in part on the search query, transmit the results of the search to the first terminal, receive a user selection of at least a first of the results, configure the video corresponding to the selected result for the first terminal based at least in part on the first resolution, and transmit the configured video to the first terminal.

Another embodiment is a method of storing and providing video data, the method comprising: receiving a first video file including video and embedded meta-data, the meta-data including at least timing information and status information; storing copies of at least a portion of the first video file in a second video file on a first data storage system and in a third file on a second storage system; generating at least a first string searchable file based at least in part on the meta-data; receiving a user search query; conducting a search of information in the first string searchable file based at least in part on the user search query; presenting results of the search to the user via a user terminal; receiving a user search results selection corresponding to the second video file; retrieving the second video file and the third video file based at least in part on the user selection; comparing at least a first portion of the meta-data in the second video file with a corresponding portion in the third video file in order to determine if file tampering has occurred; and transmitting at least a portion of the second video file to the user terminal.

One embodiment is a method of storing and providing video data, the method comprising: receiving and storing data including a video sequence and synchronized meta-data; generating at least a first string searchable data structure based at least in part on the

meta-data; receiving a user search query; and conducting a search of information in the first string searchable data structure based at least in part on the user search query.

One embodiment is an apparatus for storing and providing video data, the apparatus comprising: a storage device configured to store data including a video sequence and synchronized meta-data; a first instruction configured to generate at least a first string searchable data structure based at least in part on the meta-data; a second instruction receive a user search query; and a third instruction configured to conduct a search of information in the first string searchable data structure based at least in part on the user search query.

10

Brief Description of the Drawings

Figure 1 illustrates an example video acquisition, storage and distribution system.

Figure 2 illustrates an example authentication process and system.

Figure 3 illustrates an example Web page used to display a retrieved video.

15 Figures 4A, 4B and 4C illustrate example video files with embedded timing information.

Figure 5 illustrates example video segments.

Figure 6 illustrates an example assembler file conversion process.

20 Figure 7 illustrates an example of merging data from multiple sources for rendering on a user terminal.

Figure 8 illustrates an example search page.

Figure 9 illustrates an example file access, download and rendering process.

Figure 10 illustrates an example encoding process.

Detailed Description of the Preferred Embodiment

25 The present invention is related to methods and systems for acquiring, storing, and distributing video and telemetry. Example embodiments further provide video archive management that enables users to select and play back video records based on meta-data embedded within the video record.

For example, when used in a law enforcement patrol vehicle scenario, the meta-data 30 may include, by way of example, date, time, vehicle identification, personnel names, global positioning coordinates, and a comprehensive variety of additional data, including mobile data terminal traffic, event logs or intrusion alarms. As discussed in greater detail below,

automated upload of video files onto archive storage media and automatic entry into a corresponding database is also provided, optionally with little to no user intervention.

For example, in the law enforcement patrol vehicle scenario, in one embodiment, files, including video, audio, and meta-data, are temporarily stored onboard vehicle-based recording units which are transmitted to an archive database when the vehicle returns to its home station. The meta-data is optionally stored both in the home station archive database, as well as on a remote centralized database that stores meta-data from a plurality of station archive databases.

A variety of electronic sensors and associated electronics and software, that encode, transmit, and record video, audio, and many channels of streaming real-time meta-data, such as telemetry and event information, can be included in an embodiment of a surveillance system to detect a variety of events or occurrences. The meta-data is embedded and synchronized with the recorded video. The sensors may be positioned on mobile platforms, such as cars, trains, or planes, or on stationary platforms, such as buildings, posts, fences, and the like. The sensors can include, by way of example, one or more of pan/tilt/zoom, passive and active infrared and visible light cameras, covert wireless cameras and microphones, glass breakage detectors, door open/close detectors, gun discharge detectors, crash detectors, light bar on/off inputs, siren on/off inputs, gun rack detectors that sense when a gun is removed from and/or placed in the rack, vehicle speed sensors, tachometer, radar gun, fuel level, heartbeat monitors, pulse monitors, chemical weapons detectors, GPS systems, radio receive and transmit switches, public address ports, and the like.

Advantageously, the sensors and supporting circuitry are optionally capable of simultaneously transmitting live (low latency) video, audio, and data telemetry wirelessly over wireless networks while recording, and further provide data terminal functionality. In one embodiment, a variety of server components are used to cost effectively and securely deliver video, audio, and data telemetry, such as that recorded via the sensors and supporting circuitry, to long-term storage archives, optionally in accordance with Federal Evidentiary Rules.

Upon receiving the recorded files that include video, audio, and data telemetry, an example apparatus automatically extracts and parses pre-determined data-points from the recorded telemetry to construct a scalable video meta-data "comparator" file that is used by

a central database to enter the data to fields for sorting; seek extract, and include selected data and information from other databases related to the recording for central access; and provide for string-searches of meta-data embedded in videos. For example, in response to user string searches and using the meta-data entered into the meta-data database, specific videos and even specific segments or frames within a video sequence are located and retrieved from the video archives. The located videos can be substantially instantly delivered to the requesting user starting from the moment of a selected meta-data "incident" or data-points, or beginning at a selected time period relative to the incident or data point. Thus, use of an embodiment of the present invention can result in the reduction or elimination in the need to spend time manually locating and retrieving video records, or manually viewing such records in order to locate specific events.

Further, the system advantageously optionally provides secure user access locally and/or remotely, optionally without needing customized client display software on the user computer or terminal. For example, access to and display of videos and meta-data can be provided using a standard browser, such as Microsoft Internet Explorer or the like, and a standard media player, such as Windows Media Player or Apple QuickTime, executing on a personal or server computer, personal digital assistant, cell phone, and the like, thereby lowering the client cost and easing maintenance. However, custom media players and browsers can be used as well.

In addition, video teleconferencing interfaces, such as the standard H.323 teleconferencing, is provided for remote observers. By optionally using an existing teleconferencing standard the system is compatible with legacy video teleconferencing systems. Optionally, the system and applicable sensors can utilize one or more of ISO MPEG-4, MPEG-1, MPEG-2, and H.323 encoding/decoding. Optionally, for certain application, the system employs extremely compressed video to reduce bandwidth and storage requirements. For example, in one embodiment, an I (intracoded) frame is only transmitted when at least a certain number or percentage, such as 25% of pixels change luminance and/or chrominance relative to the previous intracoded frame, otherwise P (predicted) frames or B (bi-directionally interpolated) frames are used. As is well known in the field, I frames generally utilize many more bits than P or B frames. Optionally, this process allows six frames/second to be transmitted using as little as about 5.9 kbs, and at a

nominal transmission rate of 7.2kbps, which is well within the capacity of existing cellular data transmission services.

One embodiment advantageously utilizes asymmetrical encoding which provides a multi-session digital video compression process that enables multiple simultaneous transmissions of various video resolutions and frames rates while a high quality recording is created or played. This process permits various users utilizing dissimilar devices to view live and/or prerecorded video transmissions appropriate for the type of viewing device in use.

The foregoing methods and systems will be described in greater detail below with reference to the figures. Throughout the following description, the term "Web site" is used to refer to a user-accessible server site that implements the basic World Wide Web standards for the coding and transmission of hypertextual documents. These standards currently include HTML (the Hypertext Markup Language) and HTTP (the Hypertext Transfer Protocol). In addition, reference is made to Java script (also referred to as JavaScript), though other types of script, programming languages, and code can be used as well. For example, VBScript or Active X objects can be used with appropriate platforms. It should be understood that the term "site" is not intended to imply a single geographic location, as a Web or other network site can, for example, include multiple geographically distributed computer systems that are appropriately linked together. Furthermore, while the following description relates to an embodiment utilizing the Internet and related protocols, other networks, such as networked interactive televisions, and other protocols may be used as well.

In addition, unless otherwise indicated, the functions described herein are preferably performed by executable code and instructions running on one or more general-purpose computers, terminals, personal digital assistants, cellular phones, or the like. However, the present invention can also be implemented using special purpose computers, state machines, and/or hardwired electronic circuits. The example processes described herein do not necessarily have to be performed in the described sequence, and not all states have to be reached or performed.

Further, while the following description may refer to "clicking on" a link or button, or pressing a key in order to provide a command or make a selection, the commands or

selections can also be made using other input techniques, such as using voice input, pen input, mousing or hovering over an input area, and/or the like.

The overall system is shown in Figure 1 to which reference is hereby made. The system includes a mobile video/audio data recorder 100 which records high quality video/audio and serial data telemetry while simultaneously transmitting specially formatted live video/audio and information to personnel using a variety of reception devices or terminals. For example, the mobile video/audio data recorder 100 optionally records at 30 frames per second, though other frame rates can be used as well. Optionally, the mobile video/audio data recorder 100 utilizes RTSP (real time streaming protocol), a client-server multimedia presentation control protocol, which provides efficient delivery of streamed multimedia over IP networks. The RTSP may utilize RTP (Realtime Transport Protocol), which is a packet format for multimedia data streams.

The mobile video/audio data recorder 100 optionally saves video files in multiple file segments, the length and/or duration of which is selectable by a user or system administrator. For example, if segment sizes of 300 seconds are selected with a recording bit-rate of 800kbits per second, mobile video/audio data recorder 100 will break long duration recordings into files of approximately 30Mbytes each. The foregoing process advantageously provides enhanced file resiliency, thereby reducing the incidence of file corruption, and facilitating the recovery of damaged or corrupted files by limiting the size of each binary recording. The recorder 100 can transmit files, including video records, audio records, and/or meta-data, using one or more of CDPD, GPRS, GSM, satellite, dial-up, or broadband Internet networks.

Optionally the frame rate, bit rate and resolution for transmission can be selected based on the wired or wireless network and the receiving terminal. For example, some devices, such as palm-held personal digital assistants (PDAs) and hybrid cell phones may have limited display resolution and processor power. In applications where such devices are used to view the video, such as by remote field personnel performing surveillance, the recorder 100 maintains compatibility with the target device by optionally formatting video specifically for the target device. By way of example, personnel equipped with a PDA that may only be capable of displaying 15 video frames (pictures) per second at a resolution of 320x240 pixels connect to a special URL (Universal Resource Location) associated with a Web site, and are provided video specifically formatted for the receiving device. At the

same time, when video and data streams to devices that can display full resolution and frame rates, such as notebooks and PCs, the devices receive full resolution frames at the recorded frame rate.

Thus, for example, live video can selectively be transmitted at one or more of the following video frame/bit rates, while at the same time optionally recording at a minimum frame rate and resolution, such as 30 FPS at a minimum resolution of 352 x 240 with 48KHz audio:

6 FPS (frames per second) with a resolution of 160 x 120 utilizing less than 8 kilobits per second via CDPD, GSM, GPRS, 802.11g, 802.11b, 802.11a, or Ethernet 10/100.

15 FPS with a resolution of 320 x 240 at 47 kilobits per second via GPRS, GSM, 802.11g, 802.11b, 802.11a, or Ethernet 10/100.

30 FPS with a resolution of 352 x 240 at 192 to 600 kilobits per second via 802.11g, 802.11b, 802.11a, or Ethernet 10/100.

The mobile video/audio data recorder 100 can be located in and transmit from a variety of stationary and mobile locations, such as aircraft, ships, patrol vehicles, buildings, lots, fields and the like.

In one example embodiment, a ring buffer in a recorder, such as recorder 100, captures video, audio and data until an instruction or trigger to start the recording process occurs. When the instruction or trigger is received, the content of the ring buffer is assigned a new serial record number. A file is created in the system's local temporary archive with a file name including the serial record number, system identifier, and the user assigned file naming convention is appended. The start instruction can be the result of any particular event, such as a patrol vehicle light bar being turned on, or as a result of a user providing a manual signal start instruction. Files, including video, audio, and meta-data, are then recorded and closed in optionally fixed duration intervals. The file intervals can be specified by the user or administrator during system set-up. As discussed above, the files can include embedded video, audio, and meta-data. Meta-data is recorded as virtual channels utilizing a packet-based addressing scheme, enabling a large number of virtual channels, such as up to 256 or more virtual channels. The meta-data can optionally correspond to inputs from one or more of the sensors and detectors discussed above. As each file is closed, a buffer, such as the ring buffer, captures the data for the next file

segment so that data is not lost. Advantageously, the data, video, and audio sources and encoders can remain active during file close intervals.

The files are stored in an archive clearing directory, and are serialized and identified by a record event string in preparation for automated file upload to an assembler server system 120.

The video/audio data signals recorded by the mobile video/audio data recorder 100 are uploaded either wirelessly or via a wired connection to the assembler server system 120. By way of further example, if the mobile video/audio data recorder 100 is located in a police or other vehicle, the recorder 100 can automatically upload the recorded video/audio and data using 802.11(b, g, or a) protocol upon reaching the police station at which the vehicle is based. The data transmitted with the video/audio can, for example, include the date and time of recorded segments, together with organization and sequencing information, as well as digital serial data and event data. This data may also include police vehicle number, shift, time, personnel designations, and other fields, as desired.

The date and time information can be embedded in the video file with high accuracy, such as, in one embodiment, to within 1/30 of a second accuracy. Advantageously, because the date and time are recorded as meta-data, the date and time information does not have to be recorded in the actual visible video frame. Thus, upon viewing or playback, the date and time do not obstruct information in the video frame, and instead are optionally displayed in a separate window.

The serial data, for example, can include records of data communications of an external remote data terminal, alarm data from an external security sensor system, or other data from other serial interfaces, such as an RS-232 or IP interface. The serial data can be embedded in the video stream and recorded in the video file to within 1/30 of a second accuracy, though greater or less accuracy can be used in other embodiments. In one embodiment, up to 256 external data sources can be simultaneously supported, though in other embodiments more than 256 data sources can be recorded. In addition to serial data, parallel data can be recorded as well. In one embodiment, parallel data is first serialized and then recorded as serial data. Advantageously, because the data from any virtual channel are recorded as meta-data, the data and/or information derived therefrom does not have to be recorded in the actual visible video frame. Thus, upon viewing or playback, the

data and/or information do not obstruct information in the video frame, and instead are optionally displayed in a separate window.

One embodiment of the recorder 100 provides event-based recording that enables users to activate a recording session by either pressing a button or activating another device used as an event trigger such as a vehicle light bar, or an alarm contact or other sensor. In cases where a recording is already in progress, a digital "flag" is created and embedded that enables a viewer to find the event during playback. Recording may optionally be started remotely by network connection, either manually, or automatically using a plurality of pre-determined external events, parameters, or triggers.

Optionally, a record of the location of a vehicle, such as a patrol vehicle or aircraft, can be embedded in the video file. For example, the GPS data can be provided by a GPS system within the vehicle and embedded in the same fashion as serial data.

In particular, when a recorder 100 comes into proximity with its designated home network, using, by way of example, an 802.11 wireless network, the assembler 120 recognizes each recorder 100, and interrogates the recorder 100 for new records or files. If the recorder 100 contains new recordings, the assembler 120 automatically commences the file upload process. Once the files have been transferred and verified, the assembler 120 notifies the recorder 100 that the file upload is complete, and instructs the recorder 100 to clear its record volume for new recordings. The assembler 120 optionally returns the recorder 100 to normal operations mode, or shuts the recorder 100 down.

The assembler 120 can, for example, be located in a facility with which the recorder 100 is likely to come within close proximity with on a regular basis, such as a station house. This allows a relatively short-range wireless network, such as 802.11g, to be used to communicate information and video between the recorder and the assembler 120.

The assembler 120 is coupled to a media server 123, such as Microsoft Media Server, which is coupled to a video access controller (VAC) 124, which is coupled to an archive controller 126. The archive controller 126 is coupled to mass storage units 160, 162.

The assembler server 120 optionally "assembles" associated files into a one cohesive and user-playable video recording. The assembler extracts and parses meta-data from the meta-data channels of the newly archived video file. A string searchable format file, such as an XML document, is then created by an XML generator 128 and associated

with the video recording, parsed by information type, to enable "string" searches of the data embedded with the video and audio. The searchable document is stored in an information management system (IMS) 132. In one example embodiment, the assembler 120 combines related files into a single Internet streamable file containing the original data while
5 preserving encoded RTP/RTSP streaming protocols embedded in the files by the recorder 100.

The video/audio stream is then transmitted, either immediately, or by predetermined schedule, by the assembler 120 to an appropriate video-on-demand database or storage media, such as the storage units 160 and 162 controlled by the archive controller 126. The
10 storage unit 160 can be implemented as a RAID (redundant array of inexpensive disks) system providing high speed storage and retrieval, while the storage unit 162 can be implemented as a plurality of high capacity optical digital data storage disks providing relatively more capacity at lower overall long-term storage cost than the storage unit 160. The storage unit 162 provides a more permanent record of video stored in the RAID system
15 160, however, the write/read time may be slower than that provided by RAID system 160. Optionally, the storage unit 162 may be in the form of an optical WORM (write once, read many) drive or carousel, including DVD disk or disks, the use of which prevents the editing of recorded files.

The system may include one or more digital recorder transmitter units 169, which
20 can include or be connected to a plurality of mobile video/audio data recorders. For example, the digital recorder transmitter unit 169 can optionally record on internal magnetic or optical media 165 large amounts of video, such as one year or more of CIF video from, each of several cameras at relatively high frame rates. For example, one embodiment records at 30 frames per second (fps) for 160 video cameras at CIF simultaneously, with
25 multiple audio channels, though other frame rates, resolutions, and quantity of video cameras can be used as well. The digital recorder transmitter unit 169 can further record one or more audio sources and multiple streaming data sources, such as data from alarm panels and machine controls. The system can also include one or more encoder systems 172, which is an MPEG multichannel encoder coupled to a plurality cameras transmitting
30 live video, coupled to assembler keeper 139 via (Video Access System) VAS 170.

The digital recorder transmitter unit 169 also includes an omniport which includes or acts as a television tuner card. The omniport acts as a capture device so that the digital

recorder transmitter unit 169 can be tuned to receive CCTV cable channels. This provides the capability for frequency division multiplexing to view desired images. This capability enables the user of the digital recorder transmitter unit 169 to capture the video/audio images that may be generated in such a closed circuit television system of the type often
5 utilized for security purposes in various facilities.

The omniport interfaces into existing frequency modulation CCTV signals. This may include a number of different cameras, for example 160 or more cameras, the images of which are substantially simultaneously transmitted within a particular facility. The user of the digital recorder transmitter unit 169 may then select the desired channel in addition to
10 being able to record images from other cameras. One such specific application where security is involved is on trains.

Trains or other vehicles traveling through various geographic regions will encounter communication and other device frequencies that could interfere with the wireless transmission of video/audio data signals. Under such circumstances, the video/audio data
15 signals in analog format are frequency modulated and then are applied to the AC or DC electrical network utilized within the trains or other like vehicles. This frequency modulated signal may then be acquired through the omniport resident on the digital recorder transmitter unit structure in much the same manner as acquisition of a frequency modulated CCTV signal as described above.

The digital recorder transmitter unit 169 also includes an assembler server system 163, a VAC 164, a media server 166, and an archive controller 168, which functions in the same manner as described above with respect to the assembler server system 120. The output from the digital recorder transmitter units 169 may then be transmitted to the assembler keeper 139 as was the XML signal from the assembler 120. The video/audio
25 signal is then transmitted directly to a storage medium, such as the RAID system 165. As previously discussed with regard to the mobile video/audio data recorder 100, the meta-data and other identifying information regarding the video/audio is transmitted to the IMS 132.

With regard to both the mobile video/audio data recorder 100 and the digital recorder transmitter units 169, the archive controllers 126 and 168 respectively control the
30 recording of the video in the RAID systems 160 and 165. Optionally, the storage unit 162 stores an exact copy of at least a portion of the meta-data and/or video on more permanent storage, such as on a optical media, of selected files recorded in the RAID system 160 for

authentication purposes, as discussed below, and for backup purposes. Further, having the recorded copy can be kept at a site geographically remote, such as more than 150 meters distant, from the RAID system 160 provides for increased security.

The IMS 132 will now be discussed. The IMS 132 includes one or more relational
5 databases, such as Oracle 9i or 10g, an ASP (Active Server Page)/Fusion module 134, a Java generator 138, an assembler keeper 139, and a computer aided dispatch (CAD) keeper 140. The CAD keeper 140 is further coupled to a CAD system 175.

The ASP/Fusion module 134 is used to generate pages, such as HTML pages, that include one or more scripts, such as JavaScript or VBScript. The module 134 processes the
10 scripts on a Web server associated with the module 134 to customize the pages for the user and to provide transaction security. The customization can be based on information received from the user or the user terminal. By way of example, the information can be provided by way of a URL or address for an appropriate Web site page. The URL can be provided by the user browser when requesting a page to access data from one or more of the
15 system databases. The ASP/Fusion module 134 can then build the requested page in substantially real time and send it, via a Web server, to the requesting user terminal for display in a browser or other application. By way of example, the ASP/Fusion module 134 can be implemented using Macromedia's ColdFusion product, including the ColdFusion Studio and the ColdFusion Server, though other applications and Web servers can be used
20 as well.

The CAD system 175 can, for example, be used to process emergency or help calls from the public and handle police dispatches to police officers or police vehicles. Of course the CAD system 175 can also be used to handle dispatches from other entities, such as fire department dispatches, hospital dispatches, and dispatches of other governmental or
25 non-governmental entities. By way of further example, a CAD system 175 can be used to guide a call-taker or dispatcher into collecting relevant information, such as the address or location, related to an incident or complaint being reported, which the call-taker then enters into a form presented by the CAD system 175 on the call-taker's computer terminal. The information is optionally then stored in a CAD database. The CAD system 175 may check
30 to make sure certain information, such as the address, is valid. The CAD system 175 or other entity may assign an incident or case number or code to the incident.

Appropriate resources, such as one or more police cars, foot patrols, motorcycle officers, and/or ambulance units are then selected and dispatched to handle the incident. The CAD database also stores information on which resources were selected and dispatched to handle the incident. One or more status events for each resource may also be recorded in the database. For example, the status can include an acknowledgement from the resource that the dispatch was received. Another status can include a report from the resource that the resource has arrived at the scene of the incident. Still another status might relate to the resource leaving the scene.

In particular, the IMS 132 provides users with the ability to view a particular video record which has been made of a particular event in the past. The IMS 132 further enables the user to search for meta-data associated with archived videos, permits users to play back recordings at subjective times based on the meta-data and data field searches, and enables playback of specific records when selected by a user. Authorized users also have the ability to navigate and play back requested files on the storage system, provided that they have clearance to do so. There can be multiple levels of clearance, such as up to 30 or more levels of authorization that are used to determine user access to file types and specific data. The authorization can be centrally specified by the system administrator. The IMS 132 tracks user access to files and user activity on the IMS 132. Thus, for example, if a user chooses a file by going directly to the storage system to commence playback directly from archive, the user's activities are automatically logged. User's are optionally prevented from erasing archived files. Access to "housekeeping" functions are optionally reserved to the system administrator.

The IMS 132 extracts files created by the assembler 120 and automatically enters files to its database that are initially designated by the system administrator or other user during system set-up. Video files are stored in a separated storage volume, such as storage unit 160, accessible to users provided that they receive access authorization from the IMS 132.

For example, upon occasion an individual may desire to view a particular video record which has been made of a particular event in the past. With reference to Figure 2, when such is desirable, a user may access the IMS 132 over a network 204 through the utilization of a terminal 212, which can be a personal computer, personal digital assistant, cell phone, interactive television, or the like. The network 204 can be a local or wide area

network, the Internet, or an intranet. When contact has been made between the user's terminal 212 and the IMS 132, the user logs on by providing a user identifier and pass code. After the log in has been completed and appropriately acknowledged by the IMS 132, the active server page/fusion module 134 generates a web page which will appear in a browser on the user terminal's screen 302, as illustrated in Figure 3.

Optionally, the web page is configured specifically for this particular user and will identify for the user, depending upon his position, the various files to which the user is entitled to have access. This web page is built in conjunction with the JAVA generator 138 which generates appropriate JavaScript. A web page, an example of which is illustrated in Figure 8, provides the ability for the user to enter a specific string of information into a database search field or value field for the purpose of generating a search for a specific event or for a specific period of time. The user can initiate a search by clicking on the "find" button, cancel a search in progress by clicking on the "cancel" button, initiate a new search by clicking on the "new search" button, add criteria by clicking on the "add criteria" button. The user can also specify as to whether subfolders are to be searched by clicking on the "recurse" field.

The query can include a Boolean combination of one or more of an incident or case identification code, the identity (for example, name or employee identification code) of a person or officer responding to a dispatch, the name of a person reporting an incident, the name of a person arrested, cited, or questioned during an incident, the police vehicle number, the video camera identification number, the date and/or time of an incident, the date and/or time of a video recording, an event, such as a weapon removal from a rack, a light bar turning on/off, a siren turning on/off, a vehicle speed, a vehicle door opening/closing, a gun discharge, an alarm signal, a crash signal, geographical location, GPS geographical position coordinates, and the like.

For example, the user can request or search for files associated with a particular vehicle that were recorded in response to the vehicle light bar being turned on in order to locate the beginning of all situations in which the officer issued a traffic ticket. In another example, in order to determine if an office was driving unnecessarily fast, the user can request files wherein a police vehicle driven by a named officer exceeded 65 miles/hour when the vehicle light bar was not turned on. Similarly, the user can request files associated with a specific incident number to locate videos and meta-data associated with

the incident, even when the video and meta-data was recorded by different recorders, such as recorders in all police vehicles assigned to respond to the incident. By way of further example, the user can request files associated a specific incident number that were originally recorded within 1 hour after an officer responded to a dispatch. By way of yet
5 another example, the user can request files associated with the swiping or entering a driver's license number taken during a traffic stop in order to locate video for a particular citation incident.

In response to the query, the user will be provided a list of files which matches the search string and which the user is authorized to access. The list can be sorted by time of
10 date, time, size, name, incident code, officer name, name of person reporting an incident, event, and/or on other fields, including customizable fields. Optionally, the user can specify one or more search properties, one or more operators, including Boolean and other operators (such as AND, OR, XOR, NOT, exact match, NEAR), values, and the like.

As similarly discussed above, in one optional embodiment, the particular file of
15 interest may not be stored in the IMS 132, and is accessed from the storage device 160 coupled to the assembler 120 or alternatively the RAID storage system 165 associated with a corresponding digital recorder transmitter unit 169.

Access to video files and data can be restricted and controlled. For example, when the user clicks on a link corresponding to a particular video file of interest, the video access
20 controller (VAC) 124 generates a certificate in the form of an ultra long alphanumeric string, such as a 64, 128, or 256 bit string, which can be arbitrary in nature. That certificate is transmitted as shown at 208 to the user terminal 212 along with a command to redirect the user's browser to the particular file which resides on the storage system 160, for example, as is shown at 210. Substantially simultaneously, the video access controller
25 (VAC) 124 will transmit the identical certificate directly to the archive manager or RAID system 160 as shown at 206. The certificates, transmitted by the video access controller 124 as shown at 206 and redirected by the computer 212 as shown at 210, are then matched to ascertain identical confirmation thereof. In the event that a match is obtained within a predetermined of time such as a very short period of time (seconds), access to the selected
30 file is then granted and the file is forwarded to the computer 212 and appears on the screen 302 as illustrated graphically at 304. Thus, the video associated with the selected file is

displayed, as well as the synchronized meta-data that was recorded and embedded in the video file.

For example, if a recorded event occurs, such as the light bar being turned on, the user will see that discrete recorded event happening at a certain time during the video. If the user desires to search for the light bar "on" event, the video will begin playing at the moment when the light bar is activated. Similarly, the user can search on other data or events, such as a drivers license number, which was either embedded in the video file at the time of the recording, or associated with the file during the data mining procedure after the comparator file was delivered to the IMS. Likewise, a user can search for the removal of a weapon from a weapon rack, activation of a siren, the vehicle reaching a specified speed, specified data communication transmitted to police car terminal, that were either recorded at the time of the creation of the record, or associated with the video during the data mining procedure.

As the video plays, the user may control what appears on the screen. For example, the user may play the whole video in full screen. Alternatively, as illustrated by display 718 in Figure 7, multiple frames or windows can be provided. For example, a GPS map may be generated and displayed, as well as terminal traffic (including data entered by the officer or other user), speedometer readings, date and time, and like in corresponding windows or frames. Other displayed information can show the status of various other events, such as the status of firearms, seat belts, and the like. The foregoing information optionally will appear scrolling up synchronized to the video/audio, map location, speedometer reading, etc. If the recorded video did not have a data terminal, then that information would not be displayed. Under those circumstances, the page gets reconfigured automatically and so what is displayed is something that is size appropriate reconstructed in substantially real time because it is generated for the specific user. So now the video is larger and the telemetry data is repositioned to whatever is most convenient. The ASP/fusion generator module automatically determines the best or preferred way to display the desired file.

If there is a failure to obtain the desired match up between the certificate directed by the VAC to the storage device 160 with the redirect from the computer 32 to the storage device 160, then the following process is optionally performed. The connection is immediately terminated. The period of time within which this match of the ultra long alphanumeric string needs to occur can be any time desired for the particular application,

such as for example, a few seconds or a few minutes. If the match does not occur within the specific period of time, then the user is optionally required to again log on to the IMS 132, establish the secure connection, enter the pass code and again request the file as described above.

5 If the system fails to obtain a match up of the alphanumeric string for a predetermined number of times, for example, three, then the user attempting to obtain access is optionally locked out of the system and will not be able to obtain access to the files desired without obtaining clearance through the system administrator. This process for video access control is referred to as a temporally extinguished certificate. It will be
10 recognized by those skilled in the art that what has occurred is that when the user has established initial user authentication and when the temporally extinguished certificate matches within the specified period of time, then the particular file which the user has selected and particularly for the specific moment from which playback is to start appears on the screen as shown in 304 in Figure 3. Once access has been granted, then the user may
15 control viewing of the selected video by going forward, backward, stop framing or the like as long as the socket remains open. Optionally, unless appropriately authorized by the appropriate supervisor or administrator, the user will have no overwrite capabilities of any type and may only view the video.

 Because the user is requesting a specific video file identified on the web page which
20 has been generated specifically for that user by the ASP/fusion module 134 and-JAVA generator 138, the URL for the media server for that particular storage media is provided by the video access control (VAC) and is contained in the redirect 210 generated by the video access controller 124 and transmitted to the user's computer 212. The video is streamed to the user's terminal or computer 212, and so television-quality video playback can start very
25 quickly, such as within seconds or faster, without having to wait for files to transfer to the local user's machine. Optionally, however, the entire file can be transferred to the local user terminal 212 before playback begins, though this may be a more time consuming process.

 The media storage may also include information which is obtained from alien
30 databases obtained and associated with the specific file during a data mining procedure as described below. Alien databases are databases controlled or existing outside of the information management system 132. In one embodiment, through the utilization of the

CAD keeper 140 a search is made of the alien or external databases to obtain information which is relevant to the information being generated from the video stored in the overall system. That information is automatically entered into the IMS relational database stored on the RAID 142 that is connected to the IMS 132, and optionally associated with
5 corresponding video files. This information is then also available and will appear for utilization by the user on the web page generated and displayed on the terminal 212 when log in occurs and is authenticated.

The database searches can be performed in substantially real time by generating queries, or in batch mode. By way of example, the alien databases can include one or more
10 of a DMV (department of motor vehicle records) database, a CAD database included in the CAD system 175, a database of police reports filed by police officers, a database of 911 emergency phone calls, a database of incident reports, and so on. By way of further example, as similarly discussed above with respect to CAD system 175, the CAD database can include information related to an incident or complaint being reported, such as the
15 incident or case number, the date and time the incident was reported, the date, time and location of the incident, the type of incident, which resources were assigned to handle the incident, the status of those resources before during and after handling the incident, and related incident reports.

In some applications, such as for evidentiary purposes law enforcement, it can be
20 important to ensure that archived video and meta-data has not been tampered with. Therefore, in one embodiment when a record is being uploaded for storage in a database, the IMS 132 creates a second duplicate meta-data record and stores it in a file, and optionally on a different storage device at a removed location, separate from the original uploaded record. When a user requests a record the IMS 132 automatically compares the
25 two stored meta-data records, including for example the objective time ticks, subjective time ticks, event data, serial data, and so on, to authenticate the record. If the original digital record has been modified, such as by deleting or replacing one or more video frames, the duplicate meta-data record will not match, and the IMS will alert the user and/or system administrator of the match failure. Further, because most of the encoded, stored video
30 frames are predicted or interpolated from other frames, the deletion of one or more frames can cause the other frames to visibly render properly, further indicating tampering.

An XML compare file is provided below. The file is generated by the assembler 120 and is used to transmit extracted data embedded by a recorder 100 into a video data channel of an archive file for automated data entry by the assembler keeper to the IMS relational database. In addition, the file is used to authenticate an archived record by comparing subjective time tick proximity to data for file validation. The file is further used to format the ASP user interface for concurrent data display of video and meta-data from multiple sources.

```

1. <?xml version="1.0" encoding="UTF-8"?>
2. <xs:schema xmlns:xs= (ASM Comparator File)
10 3. <xs:element name="Mobile video/audio data recorder File ID" type=" xs:string "/>
4. <xs:element name="Mobile video/audio data recorder ID" type=" xs:string "/>
5. <xs:element name="Event Date Objective Value" type=" xs:string "/>
6. <xs:element name="Event Start Objective Time" type="xs:string"/>
7. <xs:element name="Event Start Objective TimeZone" type="xs:string"/>
15 8. <xs:element name="User Label" type=" xs:string"/>
9. <xs:element name="Subjective Duration" type="xs:duration"/>
10. <xs:element name="EndingValue" type="xs:float"/>
11. <xs:element name="Increment" type="xs:int"/>
12. <xs:element name="System Label" type="xs:string"/>
20 13. <xs:element name="Element List" type=" xs:string .
14. <xs:element name="Video Format" type=" xs:string "/>
15. </xs:sequence>
16. <xs:element ref="subjective time tick"/>
17. <xs:element name="State Change Name" type="xs:float"/>
25 18. <xs:element name="Serial Data Channel Name" type="String"/>
19. <xs:element name="Objective DateTime" type="String"/>
20. <xs:element ref="subjective time tick"/>
21. <xs:element name="State Change Name" type="xs:float"/> (state change labels
    assigned to Mobile video/audio data recorder digital IO ports corresponding to
30 application – any number of different elements to maximum available IOs)
22. <xs:element name="Serial Data Channel Name" type="String"/> (serial data labels
    assigned to Mobile video/audio data recorder serial data or network IO ports
    corresponding to application – any number of different elements to maximum available
    IOs)
35 23. <xs:element name="Objective DateTime" type="String"/>
24. <xs:element ref="subjective time tick"/>
25. <xs:element name="State Change Name" type="xs:float"/> (state change labels
    assigned to Mobile video/audio data recorder digital IO ports corresponding to
    application – any number of different elements to maximum available IOs)
40 26. <xs:element name="Serial Data Channel Name" type="String"/> (serial data labels
    assigned to Mobile video/audio data recorder serial data or network IO ports
    corresponding to application – any number of different elements to maximum available
    IOs)
27. <xs:element name="Objective DateTime" type="String"/>
45 28. <xs:element ref="subjective time tick"/>

```

29. <xs:element name="State Change Name" type="xs:float"/> (state change labels assigned to Mobile video/audio data recorder digital IO ports corresponding to application – any number of different elements to maximum available IOs)
30. <xs:element name="Serial Data Channel Name" type="String"/> (serial data labels assigned to Mobile video/audio data recorder serial data or network IO ports corresponding to application – any number of different elements to maximum available IOs)
31. <xs:element name="Objective DateTime" type="String"/>

Lines 1-14 comprise the header information used to define constants, such as recorder identifier, date, time increments, and the like. The other lines are used to specify information specific to a segment, such as the value or change in status of events, time tick values, and the like.

Line 1 of the example file format provides the version number and the encoding type. In this example, UTF-8 is used, though other encoding types can be used as well. UCS characters U+0000 to U+007F (ASCII) are encoded as bytes 0x00 to 0x7F (ASCII compatibility). Advantageously, files and strings which contain 7-bit ASCII characters have the same encoding under both ASCII and UTF-8.

Line 2 is used to declare the namespace.

Line 3 is used to define the mobile video/audio data recorder file identifier.

Line 4 is used to define the mobile video/audio data recorder identifier.

Line 5 is used to specify the event date using an objective date, such as the Greenwich Mean Time (GMT) date.

Line 6 is used to specify an event start time using an objective time, such as GMT.

Line 7 is used to specify the time zone being used in lines 5 and 6. For example, the objective time zone can be GMT or Pacific standard time (PST).

Line 8 is used to specify the user label, which can be a easily remembered label, such as "Bank" recorder if the recorder is located in a bank, or "Intersection of Westwood and Wilshire" if the recorder is located on a post located at the intersection of Westwood and Wilshire.

Line 9 is used to specify the subjective duration.

Line 10 is used to specify the file size.

Line 11 is used to specify the time increment used for the subjective time ticks.

Line 12 is used to specify the system label, such as the System ID which can indicate that the system is associated with a certain entity, such as the Los Angeles Police Department, California Highway Patrol, FBI, and so on.

5 Line 13 is used to specify the element list that assigns channels to data sources. For example, GPS coordinates can be assigned to channel 1, and terminal traffic can be assigned to terminal 2. This information can also be stored in a unit configuration file in the IMS database.

Line 14 is used to specify the video format, such as MPEG 1, MPEG 2, MPEG 4, H.323 encoding.

10 Line 15 is used to as compositor to define the virtual data channel sequence. Because, in one embodiment, channels that contain no data are not transmitted, the sequence provides an efficient way of delineating what the ASM keeper is about to parse.

Line 16 is used to specify the current subjective time tick for the corresponding segment.

15 Line 17 is used to specify state change values for labels assigned to the mobile video/audio data recorder digital IO ports corresponding to a given application.

Line 18 is used to specify the serial data values for labels assigned to the mobile video/audio data recorder serial data or network IO ports corresponding to a given application.

20 Line 19 is used to specify the objective data and time for the corresponding segment.

Lines 20-31 are used to specify the subjective time ticks, state change values, serial data values and objective dates and times for additional segments.

25 As will be clearly understood from the foregoing description, the user may wish to simultaneously access different video files from the storage media. For example, as illustrated in Figure 4, three different video files labeled A, B, and C may be retrieved for simultaneous display on the user's screen. It will often be desired to synchronize the video streams A, B and C in order to assure that the events being viewed are being viewed with relation to the exact time which they occurred even though the video streams A, B and C
30 may have been generated by totally different cameras and, even in some instances, totally different parts of the world.

To facilitate such synchronization, each of the video streams A, B and C have an objective time recorded thereon as shown at 404, 412 and 416. The time indicators 404, 412 and 416 are each objective time. The objective time can be Greenwich Mean Time (GMT), sometimes referred to as ZULU time, though other time zones can be used as well. As a result, the video stream A and the video stream B may be synchronized so that the objective times 404 and 412 are identical or substantially identical, as well as having the video stream C also synchronized so that the events occurring on each of the video streams A, B and C are all occurring based upon commencement at the objective times 404, 412 and 416.

In addition, each of the video streams will have a subjective time marking as shown at 406, 410 and 414, respectively, on the video streams A, B and C. Each of these subjective time markings are relative to the duration of the specified video file. As an example, the ticks of the clock are recorded for each video frame or picture within the file. Once the video streams A, B and C are properly synchronized according to the objective time designations times 404, 412 and 416, the user may then be able to correspond the events being depicted on each of the video streams A, B and C with the local time at the particular venue for purposes of analysis, comparison to other events, or the like. This ability to synchronize is provided using a UTBC (Universal Time Base Controller) included in the assembler 120.

Figure 5 illustrates an example video sequence 500 which includes video 502, a first audio channel 504, a second audio channel 506, and meta-data 508. The variable vA is the bit rate variable, which is related to the number of frames/second and the image quality. The variable vB is the audio bit rate, which can relate to bit depth, how many audio channels are being recorded, the dynamic range. The variable vC is the meta-data bandwidth which is related to maximum bit-per second of aggregate channels. A recorder, such as recorder 100, can be constantly capturing data 510 in a buffer, such as a ring buffer or FIFO, until an instruction or start event starts the recording. The duration of the buffer is v1. The recorder then records multiple segments, such as multiple segments 512, 514, 516, 518, 520 of duration v2. The time v2 can be specified by the user and/or the system administrator. Figure 6 illustrates the conversion of the segments 512-520 illustrated in Figure 5 into an assembled file 602 as assembled or merged by the assembler.

Figure 7 illustrates the process of converting assembled video/audio and meta-data files into a Web page for display on a user terminal. The meta-data in file 602 is packetized for transmission over the meta-channel 710 using an address header 704 and a barer channel variable length packet 706, wherein the meta-data can include channels
5 corresponding to multiple datasources.

Figure 9 illustrates an example process of accessing and rendering video streams. At state 902 a user accesses the IMS. As similarly described above, the user may need to log on and provide a user identifier and password. At state 904 a determination is made as to what files the user is authorized to view, and the list of authorized files are sorted and
10 transmitted to the user terminal. The list can be sorted by time of day, date, size, event, or on other fields, including customizable fields. In response to the user selecting one or more of the files, at state 906 the ASP downloads the selected file or files. The frame rate, bit rate and resolution for transmission can be selected based on the wired or wireless network being used and/or on the receiving terminal resolution and frame rate rendering capability.
15 At state 908 data, including video, audio, and meta-data may be transmitted from more than one source, such as the IMS and/or ASM. For example, the IMS may transit a GPS map and the ASM can transmit GPS coordinates that was recorded by a vehicle in synchronization with video taken by a video camera mounted in the vehicle. At state 910 the data is rendered on the user terminal screen, such as in the user's browser.

Figure 10 illustrates an example encoding process for live source transmission and recording from up to four different simultaneous streams generated from a single camera source, though fewer or more cameras can be used and fewer or more streams can be transmitted and recorded. The example encoding process optionally uses a dedicated processor for MPEG 1, MPEG 2, MPEG 4, CIF, D-1, and High Definition, as well as using
25 real-time software-based encoders that substantially simultaneously encode at various bitrates/frame rates/frame sizes for playback or viewing on a plurality of different user devices such as PDAs, notebooks, and desktop computers. In this example, the "Stream controller" is a infinite pin tee that replicates video/audio data from a single sample source device to enable multiple encoders to simultaneously access different memory addresses for
30 the same data stream. Those familiar with the art will recognize that this is also a software driver "wrapper" used to "spoof" the functionality of a device driver for each of the

replicated signal sources. Each of the encoded video streams may be recorded, formatted for RTP/RTSP, while any or all of them are simultaneously available for live transmission.

It should be understood that certain variations and modifications of this invention would suggest themselves to one of ordinary skill in the art. The scope of the present invention is not to be limited by the illustrations or the foregoing descriptions thereof.

WHAT IS CLAIMED IS:

1. A recording and transmission system comprising:
 - a recorder mountable in a police vehicle configured to record video and meta-data synchronized with the video, wherein the recorded video includes a plurality of segments having fixed lengths, the recorder including a wireless transmitter configured to wirelessly transmit the recorded video segments and meta-data, wherein the meta-data includes:
 - data related to vehicle status;
 - subjective time information;
 - objective time information;
 - serial data;
 - an assembler configured to wirelessly receive the transmitted video segments and assemble the video segments into a file including the meta-data, the assembler further including a mass storage device used to store the assembled video and transmit the assembled video; and
 - an information management system coupled to the assembler to receive the assembled video and to store the meta-data in a relational database, wherein the information management system is configured to receive a user search query from a first terminal having a first resolution, conduct a search of the meta-data based at least in part on the search query, transmit the results of the search to the first terminal, receive a user selection of at least a first of the results, configure the video corresponding to the selected result for the first terminal based at least in part on the first resolution, and transmit the configured video to the first terminal.
2. The system as defined in Claim 1, wherein the assembler is configured to provide the information management system with the meta-data as a string searchable file.
3. The system as defined in Claim 1, wherein the assembler is configured to provide the information management system with the meta-data as an XML file parsed by information type to enable string searches of the meta-data.
4. The system as defined in Claim 1, further comprising a certificate configured to be passed to the user and at least one other destination.

5. The system as defined in Claim 1, wherein the mass storage device includes both a magnetic and optical memory, and the assembled video is stored on both the magnetic and optical memory.
6. The system as defined in Claim 1, wherein the recorder records in an MPEG compatible format.
7. The system as defined in Claim 1, wherein the wireless transmitter is compatible with at least one of CDPD, GSM, GPRS, and 802.11.
8. The system as defined in Claim 1, wherein the video is configured using an Active Server Page generator.
9. The system as defined in Claim 1, wherein the vehicle status is related to the status of a light bar.
10. The system as defined in Claim 1, wherein the vehicle status is related to the status of vehicle speed.
11. The system as defined in Claim 1, wherein the vehicle status is related to the status of a weapon rack.
12. A method of storing and providing video data, the method comprising:
receiving a first video file including video and embedded meta-data, the meta-data including at least:
timing information;
status information;
storing copies of at least a portion of the first video file in a second video file on a first data storage system and in a third file on a second storage system;
generating at least a first string searchable file based at least in part on the meta-data;
receiving a user search query;
conducting a search of information in the first string searchable file based at least in part on the user search query;
presenting results of the search to the user via a user terminal;
receiving a user search results selection corresponding to the second video file;
retrieving the second video file and the third video file based at least in part on the user selection;

comparing at least a first portion of the meta-data in the second video file with a corresponding portion in the third video file in order to determine if file tampering has occurred; and

transmitting at least a portion of the second video file to the user terminal.

5 13. The method as defined in Claim 12, further comprising:

determining the display capabilities of the user terminal based at least in part on a URL received from the user terminal; and

tailoring the portion of the second video file based at least in part on the user terminal display capabilities.

10 14. The method as defined in Claim 12, wherein the timing information includes subjective timing information, and comparing at least a first portion of the meta-data in the second video file with a corresponding portion in the third video file further comprises comparing subjective timing information.

15 15. The method as defined in Claim 12, wherein the meta-data includes serial digital data, and comparing at least a first portion of the meta-data in the second video file with a corresponding portion in the third video file further comprises comparing at least a portion of digital serial data.

16. The method as defined in Claim 12, wherein the first video file is received from a storage device located in a vehicle.

20 17. The method as defined in Claim 12, wherein tailoring the portion of the second video file is performed in substantially real time.

18. The method as defined in Claim 12, wherein tailoring the portion of the second video file is based at least in part of a URL provided by the user terminal.

25 19. The method as defined in Claim 12, wherein the status includes at least a vehicle status.

20. The method as defined in Claim 12, wherein the status includes at least a weapon status.

21. The method as defined in Claim 12, wherein the status includes at least an alarm status.

30 22. The method as defined in Claim 12, further comprising:
generating a certificate;

transmitting a first instance of the certificate to the user terminal and a second instance of the certificate to the first data storage system; and

comparing the first instance of the certificate with the second instance of the certificate to determine whether to transmit the portion of the second video file to the user terminal.

23. The method as defined in Claim 12, further comprising:

transmitting GPS coordinate information from a first data storage device to the user terminal; and

transmitting from a second data storage device a map corresponding to the GPS coordinate information to the user terminal.

24. A method of storing and providing video data, the method comprising:

receiving and storing data including a video sequence and synchronized meta-data;

generating at least a first string searchable data structure based at least in part on the meta-data;

receiving a user search query; and

conducting a search of information in the first string searchable data structure based at least in part on the user search query.

25. The method as defined in Claim 24, wherein the search query includes an incident code.

26. The method as defined in Claim 24, wherein the search query includes a police officer identifier.

27. The method as defined in Claim 24, wherein the search query relates to a vehicle light bar status.

28. The method as defined in Claim 24, wherein the search query relates to a vehicle speed.

29. The method as defined in Claim 24, wherein the search query relates to a vehicle identifier.

30. The method as defined in Claim 24, wherein the search query relates to a driver license identifier.

31. The method as defined in Claim 24, wherein the search query relates to a time.

32. The method as defined in Claim 24, wherein the search query relates to a weapon status.

33. The method as defined in Claim 24, wherein the search query relates to a sensor status.

5 34. The method as defined in Claim 24, wherein the search query relates to a geographic location.

35. The method as defined in Claim 24, further comprising:

transmitting at least a portion of the results of the search to the user via a user terminal;

10 receiving a user search results selection corresponding to the video sequence;

retrieving the video sequence based at least in part on the user selection; and

transmitting at least a portion of the video sequence to the user terminal.

36. The method as defined in Claim 24, further comprising:

15 transmitting at least a portion of the results of the search to the user via a user terminal.

receiving a user search results selection corresponding to the video sequence;

20 retrieving at least a first copy and a second copy of the video sequence based at least in part on the user selection;

comparing at least a first portion of the meta-data in the first copy with a corresponding portion in the second copy in order to determine if file tampering has occurred; and

transmitting at least a portion of the first copy to the user terminal.

25 37. The method as defined in Claim 24, further comprising displaying at least a portion of the video sequence on a first area of a user terminal display at the same as displaying meta-data in a second area of the user terminal display, wherein the first area and the second area do not overlap.

38. The method as defined in Claim 24, further comprising associating data 30 from a plurality of databases with the video sequence.

39. The method as defined in Claim 24, further comprising:

transmitting at least a portion of the results of the search to the user via a user terminal;

receiving a user search results selection corresponding to the video sequence;

5 retrieving the video sequence based at least in part on the user selection;

retrieving related data from a plurality of alien databases; and

transmitting at least a portion of the second video file and related data to the user terminal.

40. The method as defined in Claim 24, further comprising:

10 transmitting at least a portion of the results of the search to the user via a user terminal;

receiving a user search results selection corresponding to the video sequence;

retrieving the video sequence based at least in part on the user selection;

15 retrieving related data from a computer aided dispatch system database; and

transmitting at least a portion of the second video file and related data to the user terminal.

41. The method as defined in Claim 24, further comprising:

20 transmitting at least a portion of the results of the search to the user via a user terminal;

receiving a user search results selection corresponding to the video sequence;

retrieving the video sequence based at least in part on the user selection, wherein the video sequence is related to an incident reported to a government entity;

25 retrieving data related to a resource dispatched to respond to the incident, the data including one or more of an acknowledgement from the resource that the dispatch was received, and data indicating that the resource has arrived at the scene of the incident; and

30 transmitting at least a portion of the second video file and related data to the user terminal.

42. The method as defined in Claim 24, wherein the video is recorded using intracoded frames, predicted frames, and bi-directional frames, wherein at least a first

quantity of intracoded frames are generated when at least 25% of pixels change in at least one of luminance and chrominance relative to a previous intracoded frames.

43. The method as defined in Claim 24, wherein the video sequence is received at 6 FPS (frames per second) with a resolution of 160 x 120 pixels.

5 44. The method as defined in Claim 24, wherein the video sequence is received 15 FPS with a resolution of 320 x 240 pixels.

45. The method as defined in Claim 24, wherein the video sequence is received at 30 FPS with a resolution of 352 x 240 pixels.

10 46. The method as defined in Claim 24, wherein the video sequence is received as streaming video.

47. An apparatus for storing and providing video data, the apparatus comprising:
a storage device configured to store data including a video sequence and
synchronized meta-data;

15 a first instruction configured to generate at least a first string searchable data structure based at least in part on the meta-data;

a second instruction receive a user search query; and

a third instruction configured to conduct a search of information in the first string searchable data structure based at least in part on the user search query.

48. The apparatus as defined in Claim 47, further comprising a recorder system
20 configured to be mounted in a vehicle, wherein the recorder is configured to wirelessly transmit the video sequence for storage on the storage device.

49. The apparatus as defined in Claim 47, further comprising a recorder system configured to record data in non-volatile memory in response to an event trigger.

50. The apparatus as defined in Claim 47, further comprising a recorder system
25 wherein when the recorder system comes into proximity with a designated network, the recorder system is interrogated for new records, and if the recorder contains new records, uploads the new records to a recipient.

51. The apparatus as defined in Claim 47, further comprising a recorder system configured to receive and record a plurality of closed circuit television channels.

30 52. The apparatus as defined in Claim 47, further comprising a video camera.

53. The apparatus as defined in Claim 47, further comprising a light bar on/off detector input.

54. The apparatus as defined in Claim 47, further comprising a weapon rack sensor input.

55. The apparatus as defined in Claim 47, further comprising a weapon discharge sensor input.

5 56. The apparatus as defined in Claim 47, further comprising a vehicle speed sensor input.

57. The apparatus as defined in Claim 47, further comprising a tachometer sensor input.

58. The apparatus as defined in Claim 47, further comprising a radar sensor input.

59. The apparatus as defined in Claim 47, further comprising a vehicle door status input.

60. The apparatus as defined in Claim 47, further comprising a fuel level detector input.

15 61. The apparatus as defined in Claim 47, further comprising at least one of a heartbeat sensor input and a pulse rate sensor input.

62. The apparatus as defined in Claim 47, further comprising a chemical weapons sensor input.

20 63. The apparatus as defined in Claim 47, further comprising a GPS signal input.

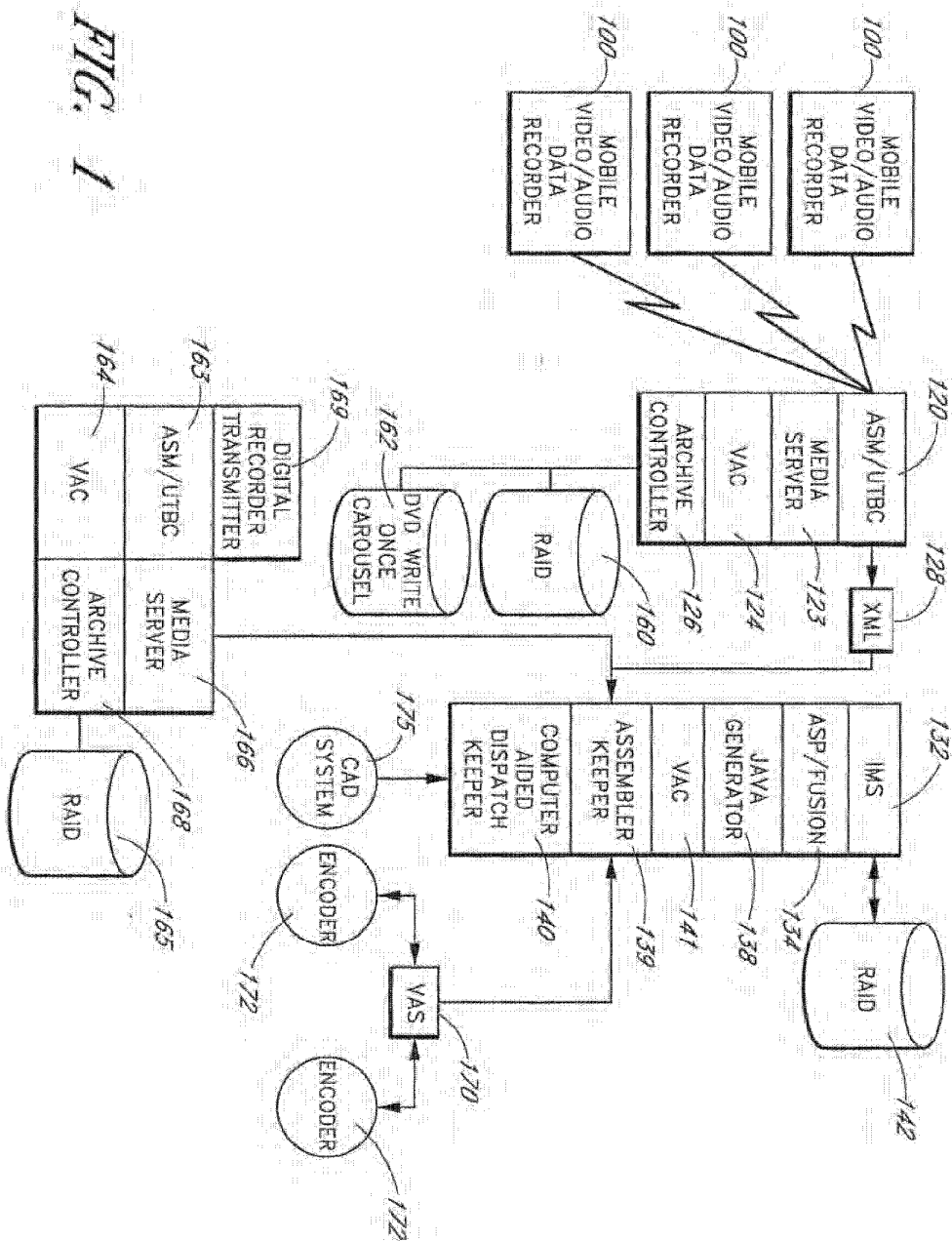


FIG. 1

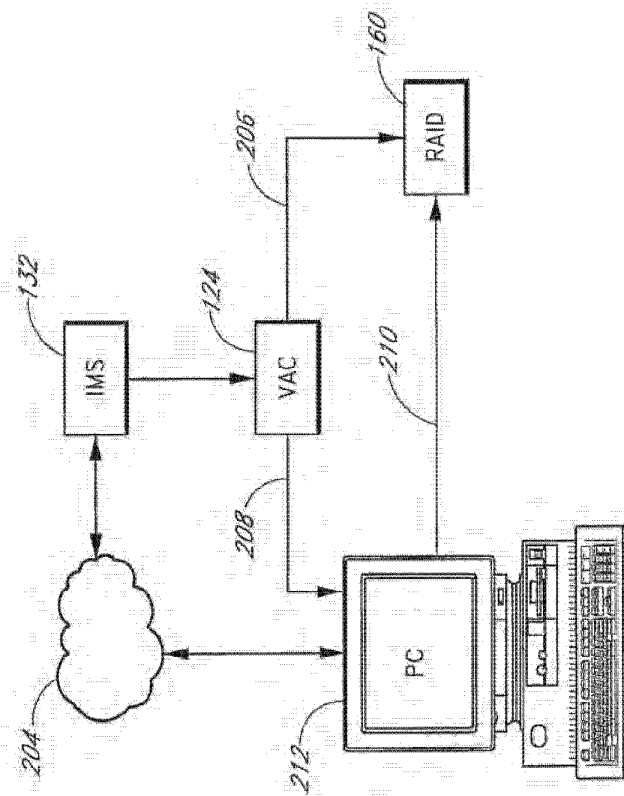


FIG. 2

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FIG. 3

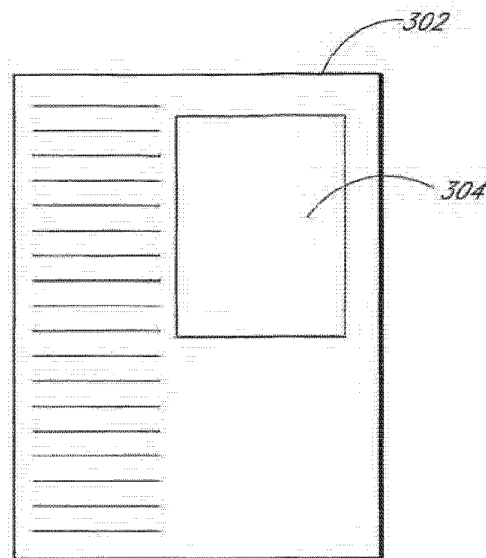


FIG. 4A

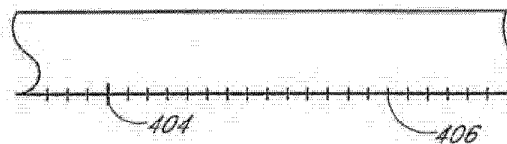


FIG. 4B

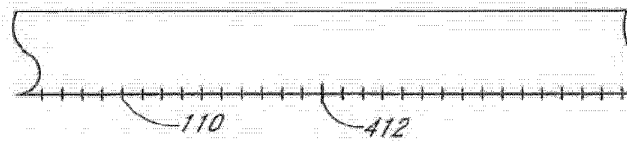


FIG. 4C

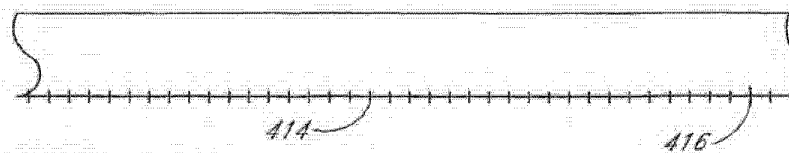
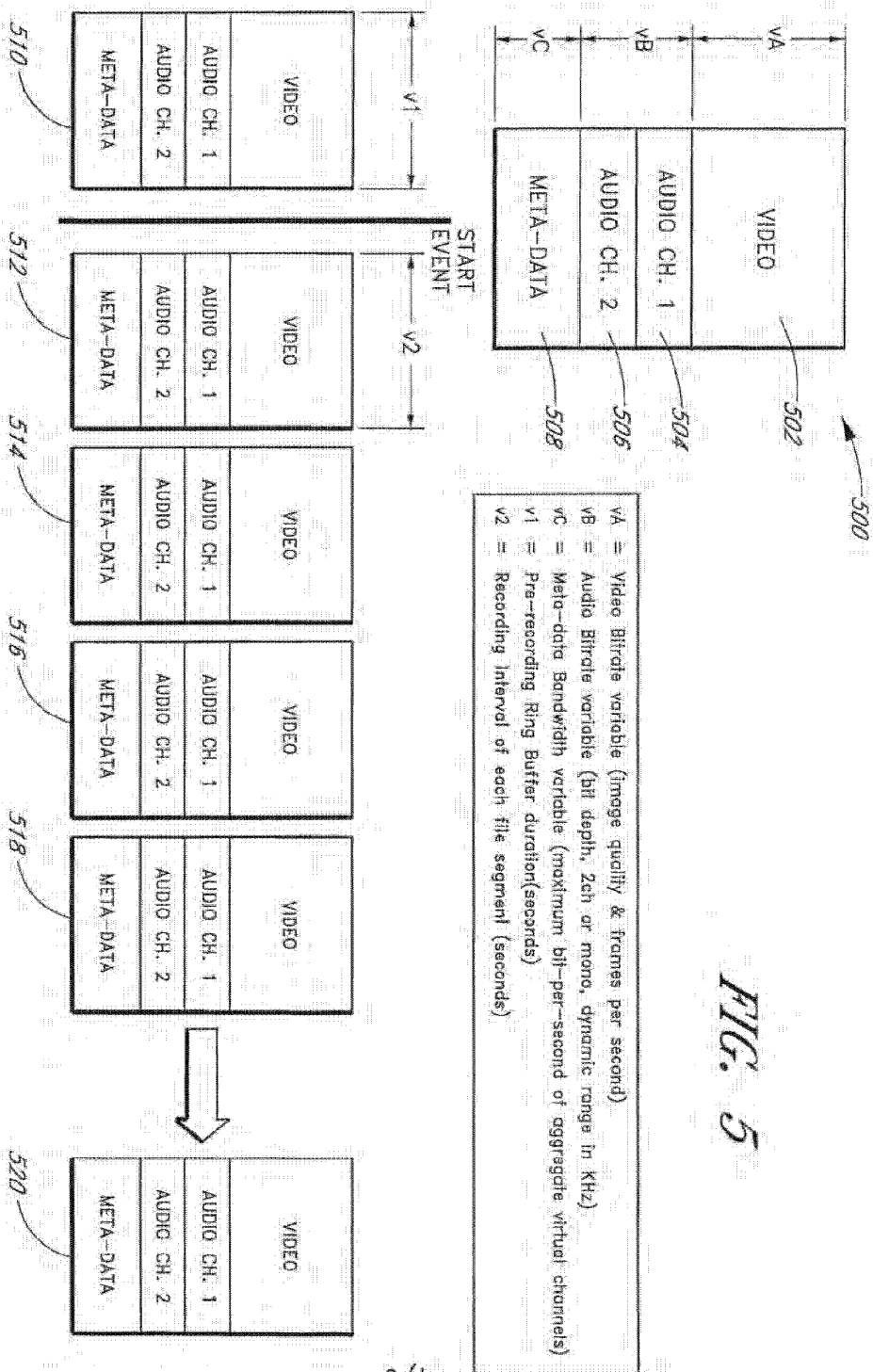
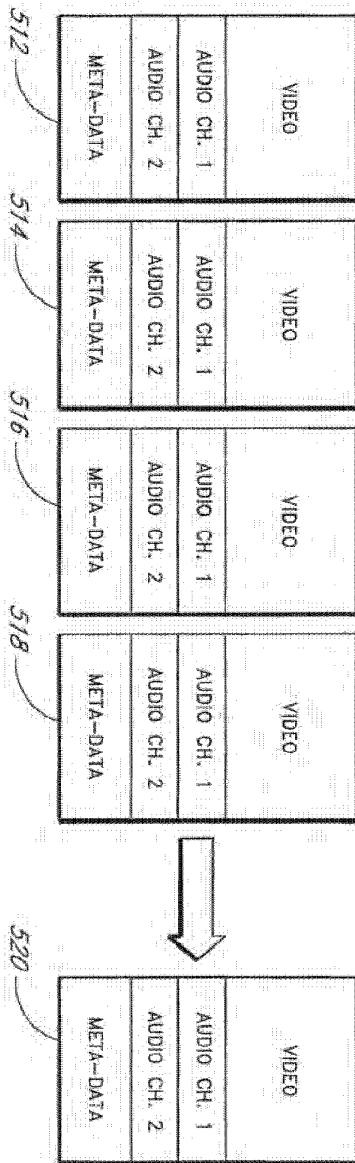


FIG. 5



ASSEMBLER FILE CONVERSION

FILE SEQUENCE (Each Event)



COMPLETED FILE SEQUENCES (Each Event)

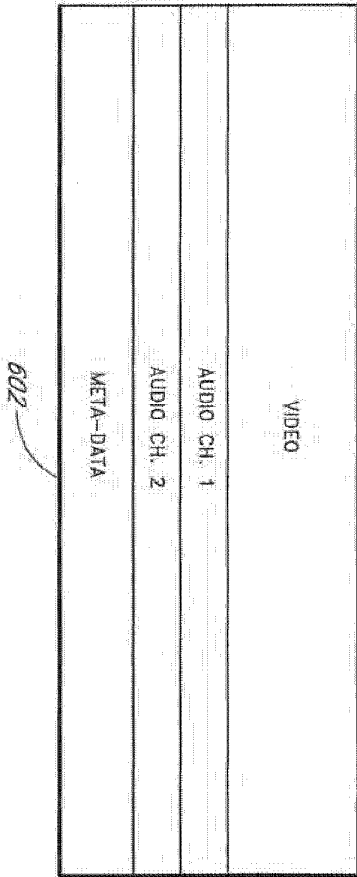
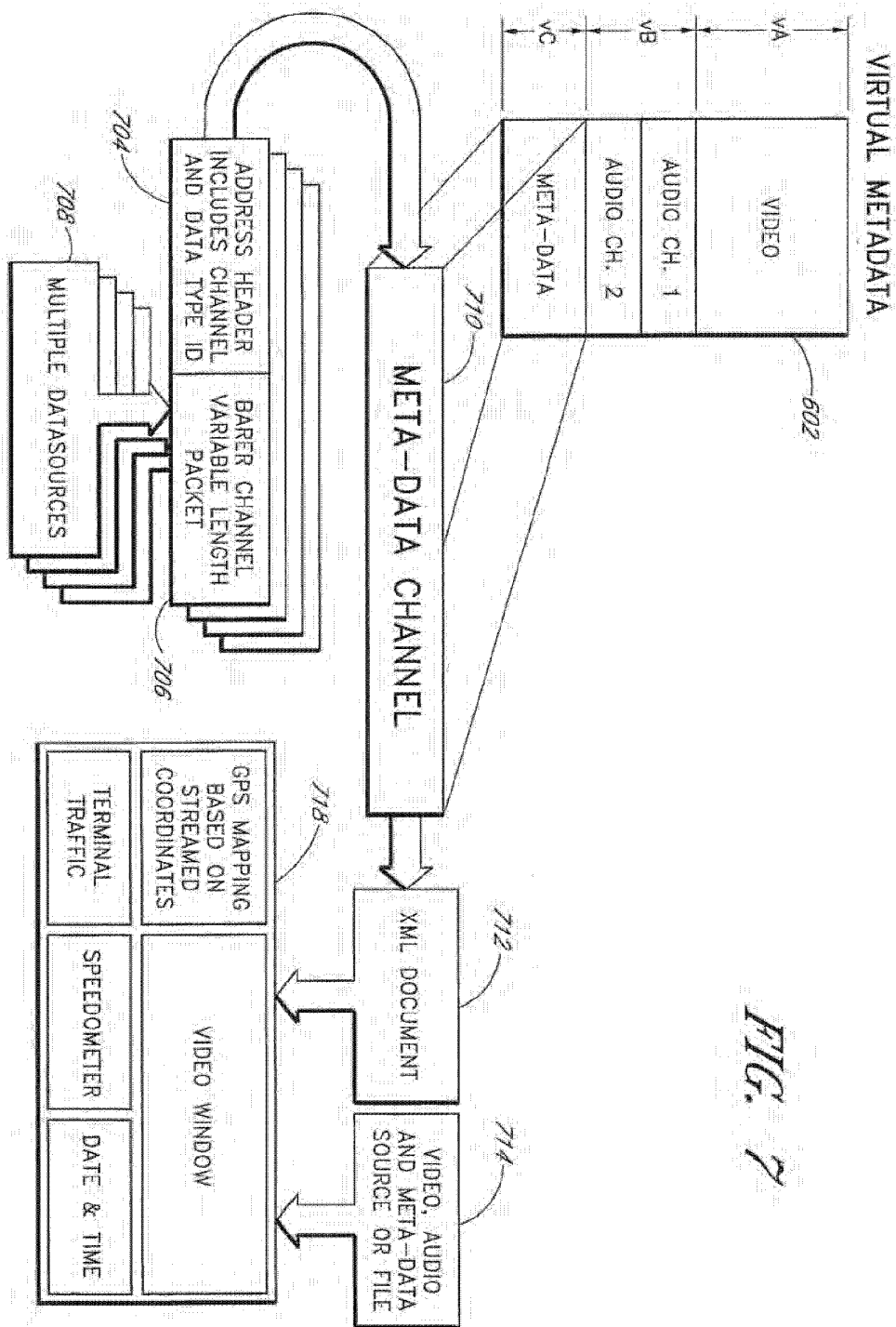


FIG. 6

FIG. 7



Find/Locate Document

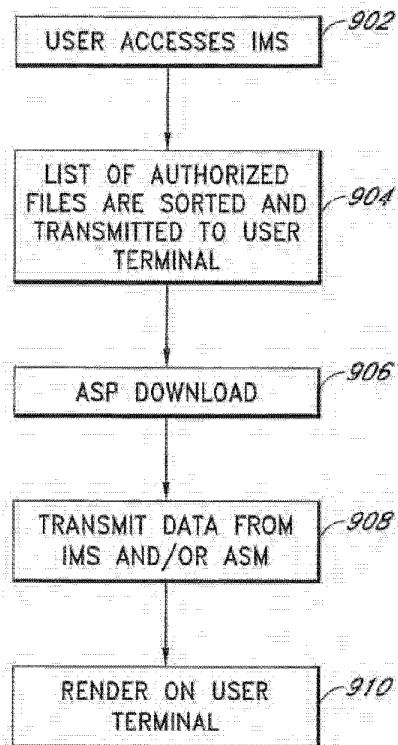
Use the input fields to enter your search criteria. To enter additional criteria, click the "Add" button. Select an "AND" or an "OR" operator to combine the criteria. Once all the criteria have been entered, click the Find button to submit the search. The search results are confined to the current folder. To expand the search to the current folder's subfolders, click the "Recurse into subfolders" check box. Click the New Search button to clear the current entries and create a new query string. Click Cancel to return to the System Documents page. Note: use the % character to do wildcard searches when using the "like" operator. Enter dates in the form dd-mm-yyyy. For example 03-FEB-1989

NOTE: The active folder is the Root\ folder. If the "Recurse into subfolders" checkbox is checked, ALL folders in the system will be searched.

Property	Operator	Value	<input type="text" value="hidden"/>	<input type="button" value="Find"/>	<input type="checkbox"/>	Recurse into subfolders
			<input type="button" value="New Search"/>			
			<input type="button" value="Cancel"/>			
(none)	▼	=	▼			
NEW CRITERIA: <input type="text" value="1"/> <input type="button" value="Add"/>						

FIG. 8

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*FIG. 9*

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MULTI-STREAM ENCODING PROCESS

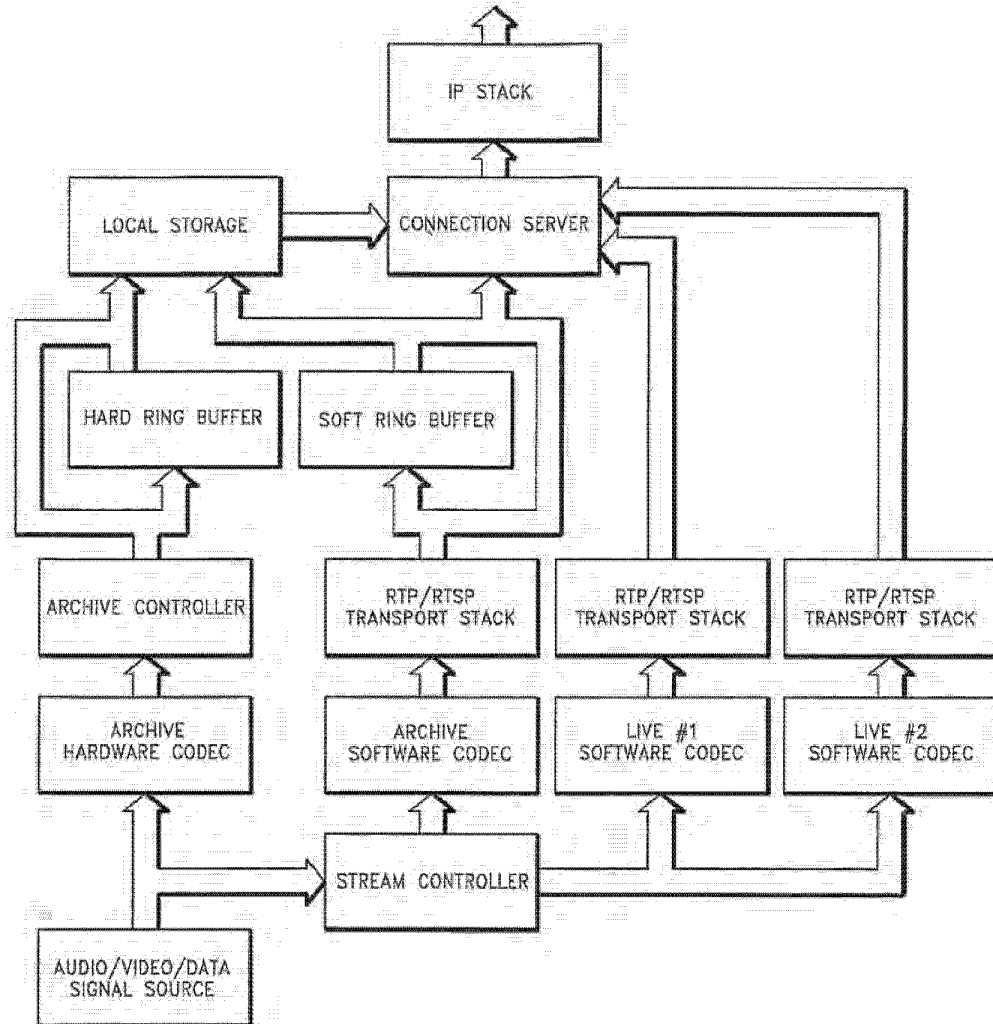


FIG. 10



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- (71) **Applicant (for all designated States except US):** CONTOUR, INC. [US/US]; 3131 Western Avenue, Suite 410, Seattle, Washington 98121 (US).
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(54) **Title:** PORTABLE DIGITAL VIDEO CAMERA CONFIGURED FOR REMOTE IMAGE ACQUISITION CONTROL AND VIEWING

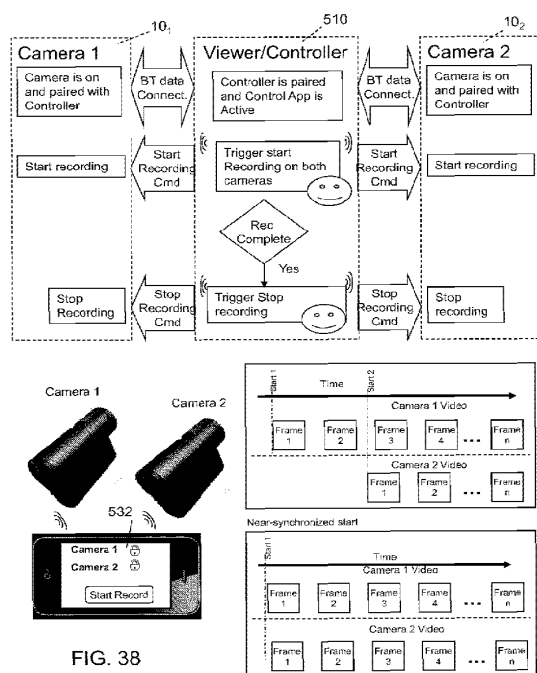


FIG. 38

(57) **Abstract:** A wearable digital video camera (10) is equipped with wireless connection protocol and global navigation and location positioning system technology to provide remote image acquisition control and viewing. The Bluetooth® packet-based open wireless technology standard protocol (400) is preferred for use in providing control signals or streaming data to the digital video camera and for accessing image content stored on or streaming from the digital video camera. The GPS technology (402) is preferred for use in tracking of the location of the digital video camera as it records image information. A rotating mount (300) with a locking member (330) on the camera housing (22) allows adjustment of the pointing angle of the wearable digital video camera when it is attached to a mounting surface.



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PORTABLE DIGITAL VIDEO CAMERA CONFIGURED FOR REMOTE IMAGE
ACQUISITION CONTROL AND VIEWING

Technical Field

[0001] This disclosure relates to point-of-view (POV) video cameras or camcorders and, in particular, to an integrated hands-free, POV action sports video camera or camcorder that is configured for remote image acquisition control and viewing.

Background Information

[0002] First-person video cameras are a relatively new product category that have been adapted to capture POV video by action sports enthusiasts in a hands-free manner. Conventional first-person video cameras primarily comprise a lens that must be tethered to a separate digital video recorder or camcorder. FIGS. 1A and 1B present pictorial views of prior art first-person video cameras requiring a tethered lens approach to capturing first-person video recording. FIG. 1A presents a Twenty20™ device, and FIG. 1B presents a Viosport™ device. FIGS. 1C and 1D present pictorial views of prior art video cameras tethered to camcorders for implementing the tethered lens approach to capturing first-person video recording. FIG. 1C and FIG. 1D present Samsung™ devices.

[0003] These products are not generally hands-free products, and consumers have been employing their own unique mounting techniques to permit “hands-free” video recording of action sports activities. FIG. 1E presents a pictorial view of a tethered camera attempting to facilitate hands-free POV video recording. FIG. 1E presents a Blackeye™ device. These recent devices attempt to convey image data from “tethered” cameras to separate camcorders through IR signals to eliminate the tethering cables.

[0004] More recently, integrated hands-free, POV action sports video cameras have become available. FIGS. 2A and 2B present pictorial views of two prior art

products implementing integrated solutions to first-person video recording. These products are still in their infancy and may be difficult to use well.

Summary of the Disclosure

[0005] Preferred embodiments of a portable digital video camera or camcorder (hereinafter collectively, "video camera") are equipped with global positioning system (GPS) technology for data acquisition and wireless connection protocol to provide remote image acquisition control and viewing. A wireless connection protocol, such as the Bluetooth® packet-based open wireless technology standard protocol, is used to provide control signals or stream data to a wearable video camera and to access image content stored on or streaming from a wearable video camera. Performing intelligent frame analysis of the image content enables picture setup optimization on one or more cameras simultaneously to enable multi-angle and three-dimensional video. A GPS receiver integrated in the video camera enables tracking of the location of the video camera as it acquires image information. The GPS receiver enables periodic capture of location once every few seconds with near pinpoint accuracy to bring together video and mapping. The inclusion of GPS technology introduces a new level of context to any video, making location, speed, time, and outside world conditions as important as the scene recorded. GPS capability makes it relatively easy to capture video within the action and share it online in seconds. For example, a user can watch an epic run down any mountain while tracking progress, speed, and elevation on a map. The GPS data, together with high definition video images, can be readily edited to organize video content, configure the video camera, and post stories online.

[0006] GPS ground plane customization and electrical coupling to the housing or other metal components of the video camera improves reception and performance. The ground plane is maximized by coupling it with an aluminum case that houses the video camera. The result is higher antenna gain and consequent enhanced signal reception when the video camera is mounted in multiple positions.

[0007] The video camera is configured with a signal path that allows for provision of a separate signal security module for use with only those applications that require the separate security module. An iPhone™ security module is packaged separately in a small subscriber identity module (SIM) card form factor.

[0008] Simplified mounting of the wearable video camera is accomplished by rotating the horizon 180° so that the video camera can be mounted fully upside down

as the picture remains in the proper orientation. Rotation of the horizon may be accomplished electrically or mechanically. A rotating mount with a locking feature that allows adjustment of the angle of the video camera when it is attached to a mounting surface uses an adhesive, a strap, or another connection option. The video camera housing is equipped with a scissor spring to assist in moving a slide switch actuator over a long travel range. A user wearing the video camera uses the slide switch actuator to initiate video image recording.

[0009] The portable digital video camera includes a camera housing and a lens.

[0010] Some embodiments of the portable digital video camera comprise an integrated hands-free, POV action sports digital video camera.

[0011] Some embodiments of the portable digital video camera or the integrated hands-free, POV action sports digital video camera include an image sensor for capturing image data.

[0012] Some embodiments of the portable digital video camera or the integrated hands-free, POV action sports digital video camera include a manual horizon adjustment control for adjusting an orientation of a horizontal image plane recorded by the image sensor with respect to a housing plane of the camera housing.

[0013] Some embodiments of the portable digital video camera or the integrated hands-free, POV action sports digital video camera include a laser alignment system with one or more laser sources capable of projecting light emissions to define a horizontal projection axis that is coordinated with orientation of the horizontal image plane.

[0014] Some embodiments of the portable digital video camera or the integrated hands-free, POV action sports digital video camera include a microphone and a manually operable switch for controlling one or both of audio and video data capturing operations, the switch having an activator that may cover the microphone whenever the switch is in the OFF position.

[0015] Some embodiments of the portable digital video camera or the integrated hands-free, POV action sports digital video camera include a "quick-release" mounting system that can be used in conjunction with the laser alignment system to adjust the image capture orientation for pitch, yaw, and roll.

[0016] Additional aspects and advantages will be apparent from the following detailed description of preferred embodiments, which proceeds with reference to the accompanying drawings.

Brief Description of the Drawings

- [0017]** FIGS. 1A, 1B, 1C, 1D, and 1E constitute a set of pictorial views of five prior art products implementing a tethered lens approach to capturing first-person video recording.
- [0018]** FIGS. 2A and 2B constitute a set of pictorial views of two prior art products implementing integrated solutions to first-person video recording.
- [0019]** FIGS. 3A, 3B, 3C, 3D, 3E, and 3F are, respectively, front perspective, back perspective, side elevation, front elevation, back elevation, and top plan views of an embodiment of an integrated hands-free, POV action sports digital video camera.
- [0020]** FIG. 4A is a front perspective view of an embodiment of an integrated hands-free, POV action sports digital video camera, showing alternative positioning of a switch and representative alternative rotation of a rotary horizontal adjustment controller.
- [0021]** FIG. 4B is a back perspective view of an embodiment of an integrated hands-free, POV action sports digital video camera, showing a representative alternative number of rail cavities and an optional detent within a rail cavity.
- [0022]** FIG. 5 is a cross-sectional side view of an embodiment of an integrated hands-free, POV action sports digital video camera.
- [0023]** FIG. 6 is an exploded view of mechanical components of an embodiment of an integrated hands-free, POV action sports digital video camera.
- [0024]** FIG. 7 is an exploded view of optical and mechanical components of an integrated hands-free, POV action sports digital video camera.
- [0025]** FIGS. 8A and 8B are fragmentary cross-sectional views of the lens system of the camera of FIG. 7, showing, respectively, a standard lens and the standard lens fitted with a lens filter.
- [0026]** FIG. 9 is a partly exploded view of a versatile mounting system demonstrating ease of adjustment of camera mount orientation coupled with ease of camera detachment with retention of the mount orientation.
- [0027]** FIG. 10 is a front perspective view of a standard mount, employing a rail plug having two rails and two detents.
- [0028]** FIGS. 11A, 11B, 11C, and 11D are, respectively, back elevation, front elevation, side elevation, and top plan views of the versatile mounting system,

demonstrating the matable relationship between the camera of FIGS. 3A-3E with the standard mount shown in FIG. 10.

[0029] FIG. 12 is a perspective view of an alternative mount, employing two mounting rails and two detents.

[0030] FIG. 13A is a front perspective view of a pole mount system, employing the mount of FIG. 12.

[0031] FIGS. 13B and 13C are cross-sectional side views of a pole mount system showing, respectively, unlocked and locked configurations.

[0032] FIGS. 13D and 13E are front perspective views of a pole mount system showing, respectively, unlocked and locked configurations about a handle bar.

[0033] FIG. 14A is a front perspective view of an alternative pole mount system, employing the mount of FIG. 12 and a strap.

[0034] FIGS. 14B and 14C are respective side and front views of the alternative pole mount of FIG. 14A.

[0035] FIG. 14D is a front perspective view of the alternative pole mount of FIG. 14A locked about a pole.

[0036] FIG. 15A is a front perspective view of a goggle mount, employing a strap entrance facing in the opposite direction of the mounting rails.

[0037] FIG. 15B is a side elevation view of an alternative goggle mount, employing a strap entrance facing in the same direction of the mounting rails.

[0038] FIG. 15C is a fragmentary front perspective view of the alternative goggle mount of FIG. 15B mounted upon a goggle strap.

[0039] FIG. 16 is a front perspective view of a vented helmet mount, adapted for employing a strap for attachment to a vented helmet.

[0040] FIG. 17 is a front perspective view of another alternative goggle mount, adapted for employing a strap for attachment to a goggle strap.

[0041] FIG. 18 is a front perspective view of an alternative pole mount system, employing the rail plug of FIG. 10.

[0042] FIGS. 19 and 20 are, respectively, perspective and top plan views of a mounting system comprising a rotating circular rail plug set in a base mount configured with a locking feature.

[0043] FIGS. 21 and 22 are, respectively, perspective and top plan views of the base mount of FIGS. 19 and 20.

[0044] FIGS. 23A, 23B, 23C, 23D, and 23E, are, respectively, perspective, top plan, end elevation, side elevation, and bottom plan views of a slidable lockable member installed in the base mount of FIGS. 21 and 22.

[0045] FIG. 24 is an exploded view of the mounting system of FIGS. 19 and 20, to which is attached an attaching mechanism.

[0046] FIGS. 25A, 25B, 25C, and 25D are front perspective views of the digital video camera of FIGS. 4A and 4B, showing its lens set in a vertical position, with the camera housing rotated 90° counter-clockwise, not rotated, rotated 90° clockwise, and rotated 180° to an inverted position, respectively, relative to the vertical position. FIG. 25E is a front elevation view of the digital video camera in the orientation of FIG. 25B annotated with dimension lines indicating ranges of angular displacement of a horizontal image plane achievable by manual rotation of the rotary horizontal adjustment controller.

[0047] FIGS. 26A and 26B are, respectively, front perspective and top plan views of the digital video camera of FIGS. 4A and 4B with its slidable switch activator in a recording ON slide setting position; and FIGS. 27A and 27B are, respectively, front perspective and top plan views of the digital video camera of FIGS. 4A and 4B with its slidable switch activator in a recording OFF slide setting position.

[0048] FIG. 28 is a partly exploded view of the digital video camera of FIGS. 26A, 26B, 27A, and 27B.

[0049] FIGS. 29A and 29B show, respectively, perspective and exploded views of a GPS assembly that includes a GPS patch antenna and GPS receiver module to provide GPS functionality in the digital video camera of FIGS. 26A, 26B, 27A, and 27B.

[0050] FIG. 30 is a simplified block diagram showing a preferred implementation of wireless technology in the digital video camera of FIGS. 26A, 26B, 27A, and 27B.

[0051] FIG. 31 is a flow diagram showing the pairing of two devices by Bluetooth® wireless connection.

[0052] FIG. 32 is a flow diagram showing an example of pairing a Bluetooth® - enabled microphone and the digital video camera of FIGS. 26A, 26B, 27A, and 27B.

[0053] FIG. 33 is a flow diagram showing a preferred camera mounting position adjustment procedure carried out by a helmet-wearing user to align a helmet-mounted digital video camera of FIGS. 26A, 26B, 27A, and 27B.

[0054] FIG. 34 is a flow diagram showing a preferred manual lighting level and color settings adjustment procedure carried out by a user upon completion of the camera mounting position adjustment procedure of FIG. 33.

[0055] FIG. 35 is a flow diagram showing a preferred automatic lighting level and color settings adjustment procedure carried out by a user after completing the camera mounting position adjustment of FIG. 33.

[0056] FIG. 36 shows two of the digital video cameras of FIGS. 26A, 26B, 27A, and 27B aimed at a common color chart.

[0057] FIG. 37 is a flow diagram showing the digital video camera of FIGS. 26A, 26B, 27A, and 27B and a mobile controller device paired by Bluetooth® wireless connection and cooperating to accomplish without security the pass-through of data from a second Bluetooth®-enabled digital video camera.

[0058] FIG. 38 is a hybrid flow diagram and pictorial illustration of a mobile controller device paired by Bluetooth® wireless data and control command connection to two digital video cameras of FIGS. 26A, 26B, 27A, and 27B to implement a remote Start/Stop capability for multiple cameras.

[0059] FIG. 39 is a flow diagram showing an example of pairing two digital video cameras of FIGS. 26A, 26B, 27A, and 27B by Bluetooth® wireless connection through a mobile controller device.

[0060] FIG. 40 is a block diagram showing the post-processing procedure of synchronizing audio data produced by a wireless microphone and hard-wired microphone incorporated in the digital video camera of FIGS. 26A, 26B, 27A, and 27B.

[0061] FIG. 41 is a simplified block diagram showing the processing of a single track of data from one data source.

[0062] FIG. 42 is a simplified block diagram showing the processing of multiple tracks of data from multiple data sources.

Detailed Description of Preferred Embodiments

[0063] FIGS. 3A, 3B, 3C, 3D, 3E, and 3F are, respectively, front perspective, back perspective, side elevation, front elevation, back elevation, and top plan views of an embodiment of an integrated hands-free, POV action sports digital video camera 10, and FIGS. 4A and 4B are front and back perspective views of, respectively, an alternative configuration and an alternative embodiment of digital video camera 10. For purposes of this description, the term “camera” is intended to

cover camcorder(s) as well as camera(s). An example of such a digital video camera 10 is included in the Contour 1080P™ system, marketed by Contour, Inc., of Seattle, Washington.

[0064] FIGS. 5, 6, 7, 8A, and 8B show optical and mechanical components of digital video camera 10. With reference to FIGS. 3A-3F, 4A, 4B, 5, 6, 7, 8A, and 8B, some embodiments of digital video camera 10 include a manual horizon adjustment control system 12 including a manual horizon adjustment control for adjusting an orientation of a horizontal image plane 16 of an image recorded by an image sensor 18 with respect to a housing plane 20 (along a vertical cross-section) of a camera housing 22. An exemplary image sensor 18 may be a CMOS image capture card that provides for minimum illumination of 0.04 Lux @ f/1.2 and offers high sensitivity for low-light operation, low fixed pattern noise, anti-blooming, zero smearing, and low power consumption.

[0065] With reference to FIGS. 3A, 3C, 3F, 4A, 6, and 7, in some embodiments, the manual horizon adjustment control is a rotary controller 14 that rotates about a control axis 24 such that manual rotation of rotary controller 14 changes the orientation of horizontal image plane 16 with respect to housing plane 20. The manual horizon adjustment control can be used to offset horizontal image plane 16 with respect to the pitch, yaw, and roll of the mounting position of camera housing 22.

[0066] In some preferred embodiments, rotary controller 14 is positioned about a lens 26 and cooperates with a lens shroud 32 to support lens 26 within camera housing 22 such that manual rotation of rotary controller 14 rotates lens 26 with respect to camera housing 22. In other embodiments, lens 26 may remain fixed with respect to camera housing 22 even though rotary controller 14 rotates around lens 26. In some embodiments, lens 26 is a 3.6 mm focal length, four-element glass lens with a 135° viewing angle and a focal length covering a large range, such as from arm's length (e.g., 500 mm) to infinity, which focuses visual information onto image sensor 18 at a resolution such as at 1920 x 1080. Skilled persons will appreciate that a variety of types and sizes of suitable lenses are commercially available.

[0067] In some preferred embodiments, image sensor 18 is supported in rotational congruence with the orientation of rotary controller 14 such that manual rotation of rotary controller 14 rotates image sensor 18 with respect to housing

plane 20 of camera housing 22. When image sensor 18 has a fixed relationship with the orientation of rotary controller 14, the image data captured by image sensor 18 do not require any post-capture horizon adjustment processing to obtain play back of the image data with a desired horizontal image plane 16. In particular, rotary controller 14 can be set to a desired horizontal image plane 16, and image sensor 18 will capture the image data with respect to the orientation of horizontal image plane 16. In some embodiments, image sensor 18 may remain fixed with respect to camera housing 22 even though rotary controller 14 rotates around image sensor 18.

[0068] With reference to FIGS. 6, 7, 8A, and 8B, in some embodiments, an exemplary optical assembly 34 shows how image sensor 18 and lens 26 may be supported in rotational congruence by the cooperation of lens shroud 32, an internal rotation controller 36, and rotary controller 14. In some preferred embodiments, rotary controller 14 may be separated from camera housing 22 by a gap 37 to facilitate the rotation of rotary controller 14 with respect to camera housing 22.

[0069] A lens cap holder 38 may be secured to rotary controller 14 by screw threads and cooperates with an O-ring 40a and to provide support for a lens cover 42 (such as a piece of glass). A lens holder 44 and a lens assembly holder 46 may also be employed to support lens 26 in a desired position with respect to the other components in optical assembly 34. Lens assembly holder 46 may be secured to lens cap holder 38 by screw threads and an O-ring 40b. An O-ring or bearings 43 may be employed between lens assembly holder 46 and a main housing 100 to facilitate the rotation of lens assembly holder 46 about control axis 24 with respect to main housing 100. A set screw 45 may be employed to secure lens assembly holder 46 of optical assembly 34 to main housing 100 without impeding the rotation of lens assembly holder 46 or the components within it. In some embodiments, rotary controller 14, lens cap holder 38, O-ring 40a, lens cover 42, lens shroud 32, laser sources 48, lens 26, lens holder 44, image sensor 18, internal rotation controller 36, O-ring 40b, and lens assembly holder 46 of optical assembly 34 may rotate together. Skilled persons will appreciate that several of these components may be fixed with respect to camera housing 22 or their synchronized rotation may be relaxed. For example, lens cover 42, lens 26, and lens holder 44 need not rotate.

[0070] With reference to FIG. 8B, rotary controller 14 may support a lens filter or other lens component, or rotary controller 14 may include screw threads or other means to enable attachment of additional or alternative lens components.

[0071] In some embodiments, rotary controller 14 cooperates with an encoder to orient image sensor 18 to a desired horizontal image plane 16. Alternatively, the encoder could guide post-capture horizon adjustment processing to adjust horizontal image plane 16 of the captured image so that it is transformed to play back the image data with the encoded horizontal image plane 16.

[0072] In some embodiments, rotary controller 14 is positioned in one or both of an arbitrary location away from lens 26 and an arbitrary relationship with the position of image sensor 18. For example, rotary controller 14 may be positioned on a side 28 of camera housing 22 or on a back door 30, and rotary controller 14 may remotely control the orientation of image sensor 18 or may control an encoder. Skilled persons will appreciate that an arbitrarily located manual horizon adjustment control need not be of a rotary type and may be of an electronic instead of a mechanical type.

[0073] In some embodiments, rotary controller 14 provides greater than or equal to 180° rotation of horizontal image plane 16 with respect to housing plane 20 of camera housing 22 in each of the clockwise and counterclockwise directions. In one example, rotary controller 14 provides 180° plus greater than or equal to 6° of additional rotation in each direction, providing a 360° rotation of horizontal image plane 16 with respect to housing plane 20. This adjustability includes embodiments in which the orientation of rotary controller 14 is in congruence with the orientation of image sensor 18, as well as embodiments employing an encoder. Preferably, both lens 26 and image sensor 18 rotate together 360° within a pivoting hermetically sealed capsule. This means that, no matter how an operator mounts digital video camera 10, image sensor 18 can be rotated to capture a level world.

[0074] With reference to FIGS. 4A and 4B, in some embodiments, a rotation indicator 54 is provided on an exterior surface 56 of rotary controller 14. Rotation indicator 54 may take the form of a horizontal notch or raised bar that may be of a different color from the color of camera housing 22. Camera housing 22 may have set in a fixed position a notch or raised bar 58 that is similar to or smaller than rotation indicator 54. Rotation indicator 54 and notch or raised bar 58 may be of the same color or of different colors. The angular extent of dislocation between rotation indicator 54 and notch 58 provides a physical indication of the amount that rotary controller 14 is displaced from its "home" position with respect to camera housing 22.

[0075] In some preferred embodiments, rotation indicator 54 and horizontal notch 58 are in a collinear alignment (in the “home” position) when horizontal image plane 16 is perpendicular to housing plane 20. Thus, if digital video camera 10 were set on a level horizontal surface and the two notches were collinear, horizontal image plane 16 would be horizontal.

[0076] With reference to FIGS. 3A, 3C, 3D, 3F, 4A, 7, and 8 in preferred embodiments, one or more laser sources 48 are fitted within rotary controller 14, are oriented with horizontal image plane 16, and are capable of projecting light emission(s) to define a horizontal projection axis or plane 52 that is parallel to or coplanar with horizontal image plane 16. Thus, manual rotation of rotary controller 14 changes the orientation of horizontal projection axis 52 with respect to housing plane 20 as the orientation of horizontal image plane 16 is changed with respect to horizontal projection axis 52. The beam(s) of light forming horizontal projection axis 52 can be used as a guide by an operator to facilitate adjustment of horizontal image plane 16 by simple rotation of rotary controller 14 after camera housing 22 has been mounted.

[0077] In some embodiments, a single laser source 48 may employ beam shaping optics and or a beam shaping aperture, filter, or film to provide a desired beam shape such as a line, lines of decreasing or increasing size, or a smiley face. In some embodiments, only a single beam shape is provided. In some embodiments, multiple beam shapes are provided and can be exchanged such as through manual or electronic rotation of a laser filter. Skilled persons will appreciate that two or more laser sources 48 may be outfitted with beam shaping capabilities that cooperate with each other to provide horizontal projection axis 52 or an image that provides horizontal projection axis 52 or other guidance tool.

[0078] In some embodiments, two laser sources 48 (or two groups of laser sources) are employed to project two beams of light that determine horizontal projection axis 52. Two laser sources 48 may be mounted on opposite sides of lens 26 such that their positions determine a laser mounting axis that bisects lens 26. In some embodiments, lens shroud 32 provides support for laser sources 48 such that they are positioned to emit light through apertures 60 in lens shroud 32 (FIG. 7). In some embodiments, an alternative or additional optical support barrel 32a may support laser source 48 and the other optical components.

[0079] Laser sources 48 may be diode lasers that are similar to those used in laser pointers. Laser sources 48 preferably project the same wavelength(s) of light. In some embodiments, an operator may select between a few different wavelengths, such as for red or green, depending on contrast with the background colors. In some embodiments, two wavelengths may be projected simultaneously or alternately. For example, four laser sources may be employed with red and green laser sources 48 positioned on each side of lens 26 such that red and green horizontal projection axes 52 are projected simultaneously or alternately in the event that one of the colors does not contrast with the background.

[0080] In some embodiments, laser sources 48 may be responsive to a power switch or button 64, which in some examples may be located on back door 30 of camera housing 22. A rotation of horizon adjustment control system 12 or rotary controller 14 may provide laser sources 48 with an ON condition responsive to a timer, which may be preset such as for five seconds or may be a user selectable time period. Alternatively, a single press of button 64 may provide laser sources 48 with an ON condition with a second press of button 64 providing an OFF condition. Alternatively, a single press of button 64 may provide an ON condition responsive to a timer, which may be preset such as for five seconds or may be a user selectable time period. Alternatively, button 64 may require continuous pressure to maintain laser sources 48 in an ON condition. Button 64 may also control other functions such as standby mode. Skilled persons will appreciate that many variations are possible and are well within the domain of skilled practitioners.

[0081] Skilled persons will also appreciate that any type of video screen, such as those common to conventional camcorders, may be connected to or be a part of camera housing 22. Such video screen and any associated touch display may also be used as feedback for orientation in conjunction with or separately from laser sources 48. Skilled persons will appreciate that the video screen may take the form of a micro-display mounted internally to camera housing 22 with a viewing window to the screen through camera housing 22 or may take the form of an external LCD screen.

[0082] With reference to FIGS. 3A, 3B, 3C, 3F, 4A, 4B, 5, and 6, in preferred embodiments, digital video camera 10 has a manually operable switch activator 80 that controls one or both of the recording condition of image sensor 18 and conveyance of the acquired image data to a data storage medium, such as on a two-

gigabyte MicroSD card. In some embodiments, digital video camera 10 is designed to use pulse power to conserve battery life while monitoring switch activator 80. When switch activator 80 is positioned to the ON position, the pulse power system is instructed to provide full power to the electronics and begin recording immediately; similarly, when switch activator 80 is positioned to the OFF position, the pulse power system is instructed to cut power to the electronics and stop recording immediately.

[0083] In some preferred embodiments, when switch activator 80 is slid or toggled, it moves a magnetic reed that is recognized from an impulse power sensor. Once the sensor recognizes the magnetic reed has been toggled to the ON position, the pulse power system is then triggered to power up most or all of the electronics of digital video camera 10, including all of the electronics required for recording as well as selected other electronics or simply all the electronics. Once full power is provided to the system electronics, a feed from image sensor 18 begins encoding and writing to the data storage medium. As soon as the first frames are written to the data storage medium, a signal is sent to an LED 82 to indicate via a light pipe 84 that digital video camera 10 is recording. Thus, activation of switch activator 80 initiates recording nearly instantaneously.

[0084] In some embodiments, switch activator 80 powers up the electronics and initiates recording from a standby mode such as after button 64 has been pushed to activate the pulse power mode. In other embodiments, switch activator 80 powers up the electronics and initiates recording directly without any pre-activation. In some embodiments, a video encoder that cooperates with image sensor 18 and a microprocessor provides instructions to the video encoder. In some embodiments, switch activator 80 is adapted to substantially simultaneously control supply of power to the microprocessor, image sensor 18, and the video encoder, such that when switch activator 80 is placed in the ON position the microprocessor, image sensor 18, and the video encoder all receive power substantially concurrently and thereby substantially instantaneously initiate a video data capturing operation.

[0085] In some embodiments, an audio encoder cooperates with a microphone 90, and the microprocessor provides instructions to the audio encoder. In some embodiments, switch activator 80 is adapted to substantially simultaneously control the supply of power to microphone 90 and the audio encoder such that when switch activator 80 is placed in the ON position, the microprocessor, microphone 90, and

the audio encoder all receive power substantially concurrently and thereby substantially instantaneously initiate an audio data capturing operation.

[0086] In some embodiments, when switch activator 80 is placed in the OFF position, the microprocessor, image sensor 18, and the video encoder all cease to receive power substantially concurrently and thereby substantially instantaneously cease the video data capturing operation. In some embodiments, when switch activator 80 is placed in the OFF position, the microprocessor, microphone 90, and the audio encoder all cease to receive power substantially concurrently and thereby substantially instantaneously cease the audio data capturing operation.

[0087] In some embodiments, the microprocessor, image sensor 18, the video encoder, microphone 90, and the audio encoder all receive power substantially concurrently and thereby substantially instantaneously initiate the video data and audio data capturing operations. In some embodiments, the microprocessor, image sensor 18, the video encoder, microphone 90, and the audio encoder all cease to receive power substantially concurrently and thereby substantially instantaneously cease the video data and audio data capturing operations.

[0088] In some embodiments, switch activator 80 controls supply of power to additional electronics such that the additional electronics are deactivated when switch activator 80 is in the OFF position and such that the additional electronics are activated when switch activator 80 is in the ON position.

[0089] Skilled persons will appreciate that switch activator 80 may be designed to have more than two slide settings. For example, in addition to ON and OFF settings for recording, switch activator 80 may provide an intermediate setting to activate laser sources 48, to activate one or more status indicators, or initiate other functions in digital video camera 10.

[0090] The use of a magnetic reed switch as an embodiment for switch activator 80 prevents water or other fluids from entering through the camera housing 22. Skilled persons will appreciate that other waterproof ON/OFF switch designs are possible. In preferred embodiments, digital video camera 10 also employs a waterproof microphone 90, such as an omni-directional microphone with a sensitivity (0dB = 1V/Pa, 1KHz) of -44 ± 2 dB and a frequency range of 100-10,000 Hz, for capturing audio data and providing them to the data storage medium or to a second data storage medium. Alternatively, camera housing 22 may include breathable, watertight materials (such as GoreTexTM) to prevent the egress of water without

requiring a waterproof microphone 90. Skilled persons will appreciate microphones with a large variety of operational parameters that are suitable for microphone 90 are commercially available or can be manufactured to suit desired criteria.

[0091] In some embodiments, microphone 90 is positioned beneath switch activator 80 such that switch activator 80 covers microphone 90 whenever switch activator 80 is in the OFF position and such that switch activator 80 exposes microphone 90 whenever switch activator 80 is in the ON position. The audio data capturing operation is preferably deactivated when switch activator 80 is in the OFF position and that the audio data capturing operation is preferably activated when switch activator 80 is in the ON position. The ON and OFF conditions of the audio data capturing operation may be controlled by switch activator 80 in conjunction with the ON and OFF conditions of the video capturing operation.

[0092] With reference to FIGS. 5 and 6, in some embodiments, camera housing 22 includes main housing 100 that supports switch activator 80, a front and bottom trim piece 106, and back door 30 which is connected to main housing 100 through a hinge 102. In some embodiments, back door 30 may be removable through its hinge 102 to allow connection of accessories to main housing 100 for extended functionality. Back door 30 may provide an area of thinner material to permit compression of button 64. Gaskets 114 may be seated between main housing 100 and back door 30 to provide waterproofing. A housing cover 108 may be connected to main housing 100 through a rubber gasket 110 that also enhances the waterproof characteristics of camera housing 22.

[0093] Side caps 112 may be ultrasonically welded to the exterior surfaces of housing cover 108 and the lower portion of main housing 100, which form the lower portions of sides 28 of camera housing 22. In some embodiments camera housing 22 is made from brushed aluminum, baked fiberglass, and rubber. In particular, main housing 100, housing cover 108, and side caps 112 may be made from aluminum. Front and bottom trim piece 106 may also be ultrasonically welded to main housing 100.

[0094] With reference to FIGS. 3A, 3B, 4A, 4B, 6, and 9, in preferred embodiments, digital video camera 10 includes part of a mounting system 120 that has two or more housing rail cavities 122 and two or more interleaved housing rails 124 on each side 28 of camera housing 22 for engaging a versatile mount 126. An

example of such a mounting system 120 is the TRail™ mounting system, marketed by Contour, Inc, of Seattle, Washington.

[0095] Housing rail cavities 122 and housing rails 124 may be formed by cut outs in side caps 112 that are mounted to main housing 100. In some embodiments, digital video camera 10 is bilaterally symmetrical and has an equal number of housing rail cavities 122 on each of side caps 112 and an equal number of housing rails 124 on each of side caps 112. In some embodiments, digital video camera 10 may for example provide two housing rail cavities 122 (such as shown in FIGS. 3A and 3B) or three housing rail cavities 122 in each side cap 112 (such as shown in FIGS. 4A and 4B). Skilled persons will appreciate, however, that in some embodiments, digital video camera 10 need not be symmetrical and may have an unequal number of rail cavities 122 on its side caps 112.

[0096] In some embodiments, rail cavities 122 have a “T”-like, wedge-like, or trapezoid-like cross-sectional appearance. Skilled persons will appreciate that the dimensions of the stem or lateral branches of the “T” can be different. For example, the stem can be thicker than the branches, or one or more of the branches may be thicker than the stem; similarly, the stem can be longer than the branches, and one or more of the branches may be longer than the stem. The cross-sectional shapes may have flat edges or corners, or the edges or corners may be rounded. Skilled persons will also appreciate that numerous other cross-sectional shapes for rail cavities 122 are possible and that the cross-sectional shapes of different housing rail cavities 122 need not be the same whether in the same side cap 112 or in different side caps 112. Similarly, housing rail cavities 122 may have different lengths and housing rails 124 may have different lengths. The bottom of trim piece 106 may be alternatively or additionally fitted with housing rails 124.

[0097] In some embodiments, one or more of housing rail cavities 122 may contain one or more bumps or detents 128. In some embodiments, each side 28 of camera housing 22 contains at least one bump or detent 128. In some embodiments, each housing rail cavity 122 contains at least one bump or detent 128. In some examples, however, only a single housing rail cavity 122 on each side 28 contains a bump or detent 128. Skilled persons will appreciate that the different sides 28 need not contain the same number of bumps or detents 128.

[0098] FIG. 9 shows a base mount 130 and a rail plug 132 that fit together to form a flat surface mount 134 shown in FIG. 10. FIGS. 11A-11D (FIG. 11) depict different

views of camera housing 22 mated with flat surface mount 134. With reference to FIGS. 9-11, rail plug 132 contains one or more mount rails 136 that are adapted to mate with housing rail cavities 122 on camera housing 22. Similarly, rail plug 132 contains one or more mount rail cavities 138 that are adapted to mate with housing rails 124 on camera housing 22. Mount rails 136 may have the same or different cross-sectional shapes as those of housing rails 124, and mount rail cavities 138 may have the same or different cross-sectional shapes as those of housing rail cavities 122. In some preferred embodiments, rails 124 and 136 and cavities 122 and 138 have the same cross-sectional profiles.

[0099] In some embodiments, one or more of mount rails 136 on rail plug 132 may contain one or more detents or bumps 140. In some embodiments, each mount rail 136 contains at least one detent or bump 140. In some examples, however, only a single mount rail 136 contains a detent or bump 140. The detents or bumps 140 are adapted to mate with bumps or detents 128 such that if camera housing 22 has detents 128 then rail plug 132 has bumps 140 or if camera housing 22 has bumps 128 then rail plug 132 has detents 140. Skilled persons will appreciate that in some alternative embodiments, housing rails 124 have bumps or detents 128 and mount rail cavities 138 have detents or bumps 140.

[0100] The versatile mounting system 120 provides for ease of mounting and orientation of digital video camera 10 with ease of detachment of digital video camera 10 with retention of the mounted orientation. In some embodiments, base mount 130 may have a very small footprint and may be attached to a surface with an adhesive pad designed for outdoor use. After base mount 130 has been attached to a surface, rail plug 132 can be detached from base mount 130.

[0101] In some embodiments, rail plug 132 has a circumferential sawtoothed edge 142 that is mated to a sawtooth-receiving inside edge 144 of a base mount cavity 146 adapted to receive rail plug 132. In some embodiments, rail plug 132 has a compression fit within base mount 130. In some embodiments, hook and loop double-toothed VelcroTM may be used instead of or in addition to a compression fit technique to further secure rail plug 132 within base mount 130.

[0102] Mount rails 136 of rail plug 132 can slide into housing rail cavities 122 of camera housing 22 as mount rail cavities 138 of rail plug 132 slide onto housing rails 124 of camera housing 22 as indicated by a direction arrow 148 (FIG. 9) to secure rail plug 132 to camera housing 22. The mated detents and bumps 128 and 140 can

be engaged to prevent unintended lateral movement of rail plug 132 with respect to camera housing 22. Rail plug 132 with the attached digital video camera 10 can be rotated from zero to 360 degrees about an axis perpendicular to base mount 130 to capture a desired viewing angle. Then, rail plug 132 can be inserted or re-inserted into base mount 130 as indicated by a direction arrow 150 (FIG. 9). FIG. 11 shows from several different views how digital video camera 10, rail plug 132, and base mount 130 appear when they are mated together.

[0103] In some embodiments, rail plug 132 and base mount 130 may be made from a hard, but flexible material such as rubber or a polymer with similar properties, but skilled persons will appreciate that rail plug 132 and base mount 130 may be made from a hard or soft plastic. Because base mount 130 can be flexible, it can be attached to a variety of surfaces such as, for example, the surfaces of helmets, snowboard decks, skis, fuel tanks, windows, doors, and vehicle hoods. The type and flexibility of the material of flat mount 126 may provide a “rubber” dampening effect as well as enhance rail sliding, rail engagement, and plug engagement. Mounting system 120 may also include a runaway leash (not shown).

[0104] When recording of an activity is completed, rail plug 132 with the attached digital video camera 10 may be disengaged from base mount 130 for safe storage or data uploading. Base mount 130 can be left attached to the surface and need not be re-attached and/or re-adjusted. Alternatively, camera housing 22 may be disengaged from rail plug 132, leaving rail plug 132 engaged with base mount 130 so that the original orientation of mount rails 136 of rail plug 132 is maintained to permit quick reattachment of digital video camera 10 without requiring its orientation to be re-adjusted to base mount 130 or the person, equipment, or vehicle to which base mount 130 is mounted.

[0105] FIG. 12 shows an alternative rail plug 132a; and FIGS. 13A, 13B, 13C, 13D, and 13E (FIG. 13) show several views of rail plug 132a with an alternative base mount 130a, including locked and unlocked configurations, to form a pole mount 126a for mounting on a pole 160 such as handle bars. With reference to FIGS. 12 and 13, rail plug 132a may be used as a standalone mount with an adhesive backing, or it may be used in conjunction with or integrated into one or more varieties of base mounts 130a. Rail plug 132a may be attached to base mount 130a through the use of an adhesive mounting, through the use of Velcro™, through the use of a screw, through the use of other conventionally known means, or combinations

thereof. Mount rails 136 may be formed to provide an aperture 162 to provide access for a screw and screwdriver to mount rail plug 132a onto base mount 130a.

[0106] Base mount 130a is configured to open and close around poles 160, particularly poles of standardized recreational equipment and especially such poles having small diameters of about 1-1.5 inches (2.5- 3.8 cm). In some embodiments, base mount 130a has a locking pin 164 with a head 166 that can be secured within a lock chamber 168. Locking pin 164 increases compression against pole 160 to prevent base mount 130a from rotating around pole 160 after its desired position is established. Base mount 130a may also be provided with a pin door cover 170 to prevent debris from accessing locking pin 164 or lock chamber 168.

[0107] FIGS. 14A, 14B, 14C, 14D, and 14E (FIG. 14) show several views of a rail plug 132b with an alternative base mount 130b, including a strap 172, to form a pole mount 126b for mounting on a pole 160b such as a roll cage, a windsurfing mast, or a hang glider support. With reference to FIG. 14, in some embodiments, strap 172 is large enough to accommodate poles 160b having a diameter up to 4 inches (12 cm) or larger. In some embodiments, a dial 174 may be employed to tighten and loosen strap 172. In other embodiments, dial 174 controls the swivel of rail plug 132b with respect to base mount 130b so that the side-to-side angle of digital video camera 10 can be adjusted. As with rail plug 132a, rail plug 132b may be attachable to base mount 130b or may be integrated with it.

[0108] FIGS. 15A, 15B, and 15C (FIG. 15) show several views of a rail plug 132c attached to or integrated with alternative base mounts 130c and 130e of respective band or strap mounts 126c and 126e for mounting on a belt, strap, or band 180, such as a band 180 of a pair of goggles 182. With reference to FIG. 15A, base mount 130e has a dampener 184a and a strap entrance 186a on an interior side of the base mount 130e, i.e., facing in the direction opposite to that mount rails 136 face. Dampener 184a may be made from rubber or other suitable cushioning material to cushion a user's head away from digital video camera 10.

[0109] With reference to FIG. 15B, a dampener 184b is provided on an interior side of base mount 130c, i.e., facing in the direction opposite to that mount rails 136 face. However, a strap entrance 186b is provided on an exterior side of base mount 130c, i.e., facing in the same direction that mount rails 136 face. FIG. 15C shows base mount 130c of FIG. 15B mounted upon strap 180 of goggles 182. Skilled persons will appreciate that the rail plug 132a can be substituted for rail plug 132c.

[0110] FIG. 16 shows a rail plug 132d with an alternative base mount 130d of a helmet mount 126d for mounting on a vented helmet. Helmet mount 126d includes one or more slots 190 through which a strap can be used to secure base mount 130d to a helmet through vent slots in the helmet. Skilled persons will appreciate that rail plug 132a can be substituted for rail plug 132d.

[0111] FIG. 17 is a front perspective view of another alternative goggle base mount 130f, adapted for employing a strap 192 for attachment to goggle band 180 (FIG. 15C). Strap 192 can be looped through buckles 194 and 196 to secure base mount 130f to goggle band 180. Base mount 130f is adapted to receive circular rail plug 132 (FIG. 10) that permits 360-degree rotation of mount rails 136. Such embodiments permit a user adjust the angle of digital video camera 10 to be different from the vertical viewing angle of the user. For example, the user can be viewing down at the ground while digital video camera 10 (and its image sensor 18) captures images straight ahead. In some embodiments, base mount 130f may include pads 198 and 202 to dampen against vibrations and may include retaining tabs 200 to prevent rail plug 132 from being inadvertently jarred loose. Strap 192 may also or alternatively include pads 204 and 208.

[0112] Skilled persons will appreciate that base mounts 130a through 130d can also alternatively be configured to receive a round rail plug 132 (of FIG. 10) that permits 360-degree rotation of mounting rails 136. For example, FIG. 18 shows an alternative pole mount 126g having a base mount 130g adapted to receive circular rail plug 132 that permits 360-degree rotation of mount rails 136. Such embodiments can facilitate compensation for handle bars or other poles 160 or 160b that may be angled backward or forward.

[0113] In some embodiments, base mount 130g has a different locking mechanism from that of base mount 130a (FIG. 13). For example, in some embodiments, a locking pin 210 is attached by a hinge 212 to base mount 130g, and locking pin 210 is attached at its other end to a pin door cover 214 through a hinge 216. Locking pin 210 cooperates with hinge door cover 214 to increase compression against pole 160 to prevent base mount 130g from rotating around pole 160 after its desired position is established. Skilled persons will appreciate that base mount 130a may alternatively employ this locking mechanism. In some embodiments, base mounts 130a and 130g include a pole grip 218 to help maintain a preferred orientation of base mounts 130a and 130g with respect to pole 160. In some

embodiments, base mounts 130 and 130a-130g may include a leash ring 220 adapted to receive a lease line that may be attached to an associated rail plug 132 and 132a-132d, digital video camera 10, or the operator.

[0114] FIGS. 19 and 20 are, respectively, perspective and top plan views of a mounting system 300 that comprises rotatable circular rail plug 132 set in a base mount 130h configured with a locking feature that allows adjustment of digital video camera 10 when it is attached to a mounting surface. FIGS. 21 and 22 are, respectively, perspective and top plan views of base mount 130h. Base mount 130h is of generally rectangular shape and includes in its top wall 302 a large diameter circular opening 304 and in its bottom wall 306 a smaller diameter circular opening 308. Base mount 130h has opposite side walls 310 and 312 through which aligned, generally rectangular slots 314 of the same size are formed and opposite side walls 316 and 318 on the inner surfaces of which spatially aligned sawtooth-receiving edges 144 are formed. The inner surfaces of side walls 310, 312, 316, and 318 include arcuate segments that are sized to permit bidirectional ratcheted rotational motion of circular rail plug 132 when it is set through circular opening 304 in base mount 130h with sawtooth-receiving edges 144 in matable relationship with circumferential sawtoothed edge 142.

[0115] FIGS. 23A, 23B, 23C, 23D, and 23E are, respectively, perspective, top plan, end elevation, side elevation, and bottom plan views of a slidable locking member 330 of generally rectangular shape. Slidable locking member 330 is sized to fit within each slot 314 and slidably extend through and project outside either one of side walls 310 and 312 when inserted in both of slots 314 in base mount 130h. Locking member 330 is a unitary structure that includes a generally planar center portion 332 positioned between a locking end piece 334 and a nonlocking end piece 336. Center portion 332 constitutes a recessed area that is bounded by raised end pieces 334 and 336 and into which circular rail plug 132 is inserted when mounting system 300 is assembled. Center portion 332 includes an oblong hole 338 having opposite circular segments 340 separated by straight line segments 342. U-shaped slots 344 cut in center portion 332 on either side of oblong hole 338 provide downwardly depending the locking tabs 346. Locking tabs 346 are sized and configured to slide across and fit into corresponding grooves 350 in a floor 352 of base mount 130h. Locking end piece 334 has a serrated arcuate inner surface 354, and nonlocking end piece 336 has a smooth arcuate inner surface 356. The

curvatures of arcuate inner surfaces 354 and 356 are complementary to the curvature of circular rail plug 132.

[0116] FIG. 24 is an exploded view of mounting system 300 to which is attached an exemplary attaching mechanism. When mounting system 300 is assembled, locking member 330 is installed in base mount 130h with end pieces 334 and 336 fitted for sliding movement in slots 314. A plug 360 composed of a top disk 362 and two downwardly depending legs 364 secures locking member 330 to and limits its range of travel within slots 314 in base mount 130h. Top disk 362 fits in a recess in and thereby receives rail plug 132, and flanges 366 extending from the free ends of legs 364 secure plug 360 in base mount 130h when the free ends of legs 364 are pushed through circular opening 308.

[0117] Mounting system 300 operates in the following manner. A user adjusts the angular position of digital video camera 10, which is operatively connected to mounting rails 136, by rotating rail plug 132 within base mount 130h. To permit such rotation, the user pushes nonlocking end piece 336 to slide locking member 330 so that serrated inner surface 354 moves away from and does not engage sawtoothed edge 142 of rail plug 132. Legs 364 of plug 360 contact the boundary of oblong hole 338 and thereby stop the sliding motion of locking member 330 with its locking end piece 334 projecting outwardly from its associated slot 314. Locking tabs 346 fit in their corresponding grooves 350 to releasably hold locking member 330 in its unlocked position. Rotation of rail plug 132 provides audible, tactile feedback to the user because of the meshing relationship between sawtooth-receiving edges 144 and sawtoothed edge 142.

[0118] Upon completion of angular position adjustment of digital video camera 10, the user locks rail plug 132 in place by pushing locking end piece 334 to slide locking member 330 so that serrated inner surface 354 engages sawtoothed edge 142 of rail plug 132. The sliding motion of locking member 330 stops with its nonlocking end piece 336 projecting outwardly from its associated slot 314. Locking tabs 346 fit in their corresponding grooves to releasably hold locking member 330 in its locked position.

[0119] Base mount 130h can be directly mounted to a mounting surface with use of an adhesive. Base mount 130h also may be mated to a variety of mounting surfaces by adding a custom connecting plate, such as strap-connecting plate 370, with screws 372 or another technique such as adhesive bonding or welding. These

connecting plates may alter the shape of base mount 130h to better connect to shaped surfaces or may include a variety of attaching mechanisms, such as, for example, a strap 374 or a hook.

[0120] With reference again to FIGS. 3B, 3E, 4B, and 5, button 64 (or an additional button 388) may control one or more status indicators such as LED 82 that indicates via light pipe 84 that digital video camera 10 is recording. Button 64 (or additional button 388) may, for example, also control operation of an LED 390 that indicates through a light pipe 392 the power status of a battery (not shown). In some embodiments, a single push controls two or more status indicators (or all of the status indicators, and may control laser sources 48 and a recording standby mode as well).

[0121] In some embodiments, the status indicators may provide a different color depending on the status of the item in question. In some embodiments, green, yellow, and red LEDs are used to indicate whether the battery is completely charged, half-charged, or nearly depleted. Similarly, in some embodiments, green, yellow, and red LEDs are used to indicate whether the SD memory card is nearly empty, half-empty, or nearly full. In other embodiments, green light indicates greater than or equal to 80% space or charge, yellow light indicates greater than or equal to 30% space or charge, and red light indicates less than 30% space or charge. Skilled persons will appreciate that the number and meaning of colors can be varied. Camera housing 22 may provide symbols indicating what items light pipes 84 and 392 designate, such as a battery symbol 394 and a memory card symbol 396 on back door 30.

[0122] To facilitate an easier and more manageable process for the video once it has been recorded, digital video camera 10 may be designed to automatically segment the video into computer and web-ready file sizes. The segment can be automatically determined by the hardware during the recording process without intervention by the user. In some embodiments, software will automatically close a video file and open a new file at predefined boundaries. In some embodiments, the boundaries will be time-based, for example, ten minutes for each segment, or size-based, for example 10 MB for each segment. Additionally, the segmentation process may be designed so that file boundaries are based on preset limits or so that the user can adjust the segment length to the user's own preferred time. In some embodiments, the video encoder (hardware or software based) will optimize

the file boundary by delaying the boundary from the nominal boundary position until a period of time with relatively static video and audio, i.e., when there are minimal changes in motion. Skilled persons will appreciate, however, that in some embodiments, such segmentation may be implemented via software or hardware.

[0123] Digital video camera 10 is an all-in-one, shoot and store digital video camcorder and is designed to operate in extreme weather conditions and in a hands-free manner. Digital video camera 10 is wearable and designed for rugged environments (water, heat, cold, extreme vibrations), and the Contour 1080P™ system includes application mounts 126 to attach to any person, equipment, or vehicle. The internal components of digital video camera 10 may be silicon treated, coated, or otherwise insulated from the elements, keeping digital video camera 10 operational, no matter the mud, the dirt, the snow, and the rain.

[0124] Preferred embodiments of digital video camera 10 are equipped with wireless connection protocol and global navigation and location determination, preferably global positioning system (GPS), technology to provide remote image acquisition control and viewing. The Bluetooth® packet-based open wireless technology standard protocol is used to provide control signals or stream data to digital video camera 10 and to access image content stored on or streaming from digital video camera 10. The GPS technology enables tracking of the location of digital video camera 10 as it records image information. The following describes in detail the implementation of the Bluetooth® protocol and GPS technology in digital video camera 10.

[0125] Preferred embodiments of digital video camera 10 permit the mounting of camera housing 22 upside down while retaining the proper orientation of the video images by mechanical or electrical 180° rotation of lens 26. The mechanical rotation is shown in FIGS. 25A, 25B, 25C, 25D, and 25E. FIGS. 25A, 25B, 25C, and 25D are front perspective views of digital video camera 10 showing lens 26 set in a vertical position, with camera housing 22 of digital video camera 10 rotated 90° counter-clockwise, not rotated, rotated 90° clockwise, and rotated 180° to an inverted position, respectively, relative to the vertical position. FIG. 25E is a front elevation view of digital video camera 10 in the orientation of FIG. 25B annotated with dimension lines indicating 185° counter-clockwise and 95° clockwise ranges of angular displacement of horizontal image plane 16 achievable by manual rotation of rotary controller 14. The orientation may be flipped prior to signal processing by

simply altering the pixel selection or can be flipped during signal processing by simply altering the interpretation of the pixels. The orientation can be automatically controlled by sensing the orientation of camera housing 22 using a variety of sensors and altering the pixels based on these data.

[0126] FIGS. 26A and 26B, FIGS. 27A and 27B, FIG. 28, and FIGS. 29A and 29B show the configuration of digital video camera 10 in which Bluetooth® wireless protocol and GPS technology are implemented to enable remote image acquisition control and viewing. FIGS. 26A and 27A are front perspective views of digital video camera 10 with slidable switch activator 80 in its respective recording ON and recording OFF slide setting positions; and FIGS. 26B and 27B are top plan views of the digital video camera 10 with slidable switch activator 80 in its respective recording ON and recording OFF slide setting positions. A portion of switch activator 80 is broken away in these drawing figures to reveal the placement of certain internal component parts described in greater detail below.

[0127] FIG. 28 is a partly exploded view of digital video camera 10, showing the placement and mounting arrangement of component parts implementing Bluetooth® wireless protocol and GPS receiver technology in main housing 100 shown in FIGS. 5 and 6. A Bluetooth® wireless module 400 is installed in main housing 100 at a location proximal to rotary controller 14. A GPS assembly 402 is installed in main housing 100 at a location proximal to back door 30 of camera housing 28. Optical support barrel 32a having an open ended slot 404 fits over main housing 100 in an orientation such that Bluetooth® wireless module 400 and the upper end of GPS assembly 402 fit and are thereby exposed within slot 404. Switch activator 80 provided with a two-dimensional array of circular openings 406 fits over and slides within slot 404 between the recording ON slide setting position shown in FIGS. 26A and 26B and the recording OFF slide setting position shown in FIGS. 27A and 27B. Openings 406 provide an audible sound passageway to facilitate pickup by microphone 90 of spoken words or other sound effects.

[0128] Common implementations for sliding switches that have long travel entail use of a magnet to pull and hold the switch in its final position or use of a switch mechanism continuously pressed by the user over the full travel distance and provided with a holding mechanism in place in the ON and OFF positions. Digital video camera 10 is equipped with a slide switch mechanism that solves the problems associated with long travel distance. A scissor spring 408 assists in actuating

slidable switch activator 80 over the long travel range between the recording ON and OFF slide setting positions.

[0129] FIGS. 26B, 27B, and 28 show a preferred shape of scissor spring 408 and the manner in which it cooperates with the geometric features of inner side wall surfaces 410 and an inner end wall surface 412 formed in an underside cavity 414 of switch activator 80. Scissor spring 408 is a one-piece wire member including multiple bends that form a U-shaped center portion 420 having rounded distal ends 422 from each of which a leg portion 424 upwardly extends back toward center portion 420. U-shaped center portion 420 includes a base member 426 and two generally parallel side members 428 that terminate in rounded distal ends 422. Upwardly extending leg portions 424 diverge generally outwardly away from side members 428 and terminate in ends 430 that are inwardly bent toward side members 428 and do not extend beyond center portion 420. A curved section 432 in each leg portion 424 forms its inwardly directed bend and provides a bearing surface that contacts an inner side wall surface 410 of switch activator 80.

[0130] FIGS. 26A, 26B, 27A, and 27B show the geometric features in inner side wall surfaces 410 and inner end wall surface 412 of switch activator 80. Each side wall surface 410 includes an inwardly directed beveled portion 440 having an apex 442 and a proximal end 444 and a distal end 446 located respectively nearer to and farther from end wall surface 412.

[0131] Installation of scissor spring 408 in main housing 100 entails placement of U-shaped center portion 420 with its base member 426 and side members 428 against a raised block 450 on a top surface 452 of a printed circuit board (PCB) 454 of GPS assembly 402. The length of base member 426 is chosen to establish a snug fit of raised block 450 within U-shaped center portion 420 to keep scissor spring 408 stationary during sliding motion of switch activator 80. As shown in FIGS. 26A and 26B, whenever switch activator 80 is in the recording ON slide setting position, curved sections 432 of scissor spring leg portions 424 rest in shallow notches formed at distal ends 446 of beveled portions 440. As shown in FIGS. 27A and 27B, whenever a user slides switch activator 80 from the recording ON slide setting position to the recording OFF slide setting position, curved sections 432 exit the shallow notches at distal ends 446, slide along entire lengths of beveled portions 440, and come to rest at shallow notches formed at proximal ends 444 of beveled

portions 440. Curved sections 432 of leg portions 424 are of complementary shape to curved sections 448 of inner end wall surface 412.

[0132] The shaping of scissor spring 408 imparts resistance to prevent the initial sliding motion of switch activator 80 in either direction, but in response to user applied pressure overcoming the resistance, switch activator 80 automatically travels to the stopping position without effort by the user. Scissor spring 408 exerts passive resistance to any motion and therefore holds switch activator 80 in the proper position until the user again moves switch activator 80. The shape of scissor spring 408 can be varied based upon, for example, the geometry of switch activator 80, the length of travel, and desired holding force.

[0133] The above-described spring solution is uniquely resistant to vibration and is well-suited for a high vibration environment. Scissor spring 408 is an improvement over magnetic sliding switch movements because the former does not introduce magnetic interference that may affect other functions in digital video camera 10. Scissor spring 408 is also an improvement over a double detent implementation because the user is confident switch activator 80 is in the proper position. This spring solution could be expanded to include a combination of springs to provide specialized motion or specific force profiles. This spring design can also control linear or circular motion.

[0134] FIGS. 29A and 29B show respective perspective and exploded views of GPS assembly 402 separate from main housing 100, in which GPS assembly 402 is installed for operation in digital video camera 10. GPS assembly 402 includes a GPS passive patch antenna 456 and a GPS receiver module 458 to provide GPS functionality to digital video camera 10. A GPS ground plane 460 in the form of a stepped, generally U-shaped aluminum shroud is positioned between patch antenna 456 and GPS printed circuit board 454 and affixed to top surface 452 of the latter by GPS ground plane mounting tape 462. GPS receiver module 458 is mounted to GPS printed circuit board 454 on its bottom surface 464. A preferred GPS patch antenna 456 is a Model PA1575MZ50K4G-XX-21, which is a high gain, customizable antenna available from INPAQ Technology Co., Ltd., Taiwan. GPS patch antenna 456 is custom tuned to its peak frequency to account for detuning effects of the edges of optical support barrel 32a. A preferred GPS receiver module 458 is a Model NEO-6 module available from u-blox AG, Switzerland.

[0135] FIGS. 29A and 29B show that GPS ground plane 460 is physically shaped to complement or mirror the curved shape of optical support barrel 32a of housing 22 so that the ground plane area can be maximized as the shape of the ground plane conforms to, i.e., without altering, the shape of camera housing 22. Additionally, GPS patch antenna 456 is supported by its own internal ground plane, which is arranged such that it overlaps the inside of the existing aluminum case. This overlap allows RF currents to pass between the aluminum case and GPS ground plane 460 through capacitive coupling and hence have the effect of increasing the size of the overall ground plane area. This increased ground plane area further improves the GPS reception. Moreover, GPS patch antenna 456 is tuned with these components coupled for optimal reception by the overall system. The ground plane customization and electrical coupling to camera housing 22 or other metal components of digital video camera 10 improve performance by achieving higher antenna gain and consequent enhanced signal reception when digital video camera 10 is mounted in multiple positions.

[0136] When recording video or taking photographs in a sports application, digital video camera 10 is often mounted in a location that does not permit the user to easily see the camera. Implementing digital video camera 10 with a wireless connection protocol enables remote control of the operation of and remote access to image data stored in digital video camera 10. In preferred embodiments, the integration of Bluetooth® wireless technology in the wearable digital video camera 10 facilitates implementation of several features, including remote control, frame optimization, multi-camera synchronization, remote file access, remote viewing, data acquisition (in combination with GPS capability), and multi-data sources access (in combination with GPS capability).

[0137] Implementing Bluetooth® wireless technology in digital video camera 10 enables the user to control it remotely using a telephone, computer, or dedicated controller. This allows digital video camera 10 to remain sleek, with few buttons and no screen. Additionally, a lack of need for access to a screen or controls provides more flexibility in mounting digital video camera 10.

[0138] The remote control device (i.e., telephone, computer, dedicated viewer, or other Bluetooth®-enabled device) can access files stored on digital video camera 10 to allow the user to review the content in such files and manage them on the camera.

Such access can include file transfer or file playback in the case of video or audio content.

[0139] Using a wireless signal transfer, the remote device can access data streaming from digital video camera 10. Such data can include camera status, video, audio, or other data (e.g., GPS data) collected. Standard video can exceed the bandwidth of a Bluetooth® connection. To resolve any quality of service issues, a fast photo mode is used to simulate video. In this case, photographs are taken in succession, then streamed and displayed in sequence to simulate video playback. Firmware in a main processor captures and streams the photographs, and the receiving application is designed to display photographs in quick succession. To be space efficient, the photographs may be stored in a FIFO buffer so that only limited playback is available.

[0140] Alternative implementations of a remote viewer include one or more of reduced resolution or frame rate, file sectioning, frame sampling, and Wi-Fi to media server. Reduced resolution or frame rate entails recording video in two formats, high quality and low quality, in which the lower quality file is streamed or played back after the recorded action has taken place. For streaming implementation, wireless connection bandwidth can be monitored to adapt to the available bandwidth the resolution, bit rate, and frame rate on the secondary recording. Additionally, buffering can be used in conjunction with adaptive bit rate control. File sectioning entails breaking a recording into small files and transferring each file upon completion to allow for viewing via a wireless device in near real time. File transfer may be delayed so as to limit interruptions that result from bandwidth limitations. Frame sampling entails real time video frame sampling (e.g., video compression intraframes (I-frames) only). Wi-Fi to media server entails use of Wi-Fi to establish the camera as a media server on selected networks, allowing other devices to read and play content accessed from the device.

[0141] FIG. 30 is a simplified block diagram showing a preferred implementation of wireless technology in digital video camera 10. FIG. 30 shows digital video camera 10 with built-in Bluetooth® wireless module 400 that responds to a Contour Connect Mobile App application software executing on an operating system for mobile devices such as smartphones and tablet computers to enable such a mobile device to become a wireless handheld viewfinder. A Contour Connect Mobile App that is compatible for use with an iOS mobile operating system of Apple®, Inc. is

available on the iPhone App Store and that is compatible for use on an Android mobile operating system of Google Inc. is available on the Android Market. The firmware of a main processor 500 stores an updated version of compatible software to respond to the Contour Connect Mobile App executing on a mobile device. This wireless connection capability enables a user to configure camera settings in real time and preview what digital video camera 10 sees. Specifically, a user can check the camera angle on the wireless device screen and without guesswork align the camera shot and adjust video, light level, and audio settings before beginning the activity he or she wants to record.

[0142] The functionality permitted across industry standard interfaces is often limited by the receiving or transmitting device based on its permissions. This means that one device may refuse to permit certain functionality if the other device does not have proper certificates or authentications. For example, the Apple® iPhone and similar products require certain security authentication on data signals transmitted using the Bluetooth® interface. The security requirements on such interfaces vary by product and the manufacturer. Oftentimes the same product is intended to connect with a variety of devices, and it is not desirable to integrate the security component for all possible features or external devices.

[0143] In preferred embodiments, the signal path is designed such that the presence of this security integrated circuit is not required for full functionality for such other devices. However, by including a connector in this signal path, a security module can be added by the user after manufacturing to allow connection with such controlled devices. By including such a connector in the signal path, the relevant signal security module may be provided separately for only those applications that require such security authentication. Additionally, in preferred embodiments, the Apple® security card is packaged separately as a self-contained card. The circuit is designed to retain the authentication integrity but to interface with the controlling device through a standard connector. FIG. 30 also shows placement of a Contour Connect View (security) Card 502 in a card slot and connector 504 of digital video camera 10 to enable connection with a supported Apple® iOS device. A Contour Connect View Card is available from Contour, Inc., the assignee of this patent application.

[0144] FIG. 31 is a flow diagram showing the pairing of two devices by Bluetooth® wireless connection. Main processor 500 of digital video camera 10

stores a data file identifying a Bluetooth®-enabled viewer/controller device 510. (An appearance of a smiley face icon in the flow diagrams indicates action by or display of status information to a user.) A user presses a wireless connection activator button (preferably located near switch activator 80 but not shown in the drawings) on camera housing 22 to turn on Bluetooth® module 400, which transmits a Bluetooth® (“BT”) Connection Request signal to Bluetooth® connection-enabled viewer/controller 510. Viewer/controller 510 receives the Bluetooth® Connection Request signal, determines whether there is a Bluetooth® ID connection match pair, and upon recognition of a match pair, determines whether viewer/controller 510 is iOS or Android implemented. If it is Android implemented and therefore Apple® security is not required, viewer/controller 510 allows and launches the Contour Connect Mobile App to perform Bluetooth® data transfer to and from digital video camera 10. If it is iOS implemented and Apple® security is required, viewer/controller 510 sends a Security Challenge signal for passage through Bluetooth® module 400 and main processor 500 to an Apple® coprocessor 514 mounted on Apple® security card 502. Apple® coprocessor 514 sends security codes for passage through main processor 500 and Bluetooth® module 400 to viewer/controller 510, which confirms the security codes and allows and launches the Contour Connect Mobile App to perform Bluetooth® data transfer to and from digital video camera 10.

[0145] The use of a data file to identify the Bluetooth® ID of a device allows two devices to pair when neither device has a display screen. FIG. 32 is a flow diagram showing an example of pairing Bluetooth® microphone 90 and digital video camera 10, neither of which has a display screen. Digital video camera 10 and a controller 510' are initially paired by Bluetooth® wireless data connection, and the Contour Connect Mobile App is active, as described above with reference to FIG. 31. Viewer/controller 510 and controller 510' are of similar construction, except that the latter has no display screen. A user slides switch activator 80 to its ON position to supply power to microphone 90 and transmit a Pair Request signal to digital video camera 10, which detects and forwards to controller 510' a Microphone Pair Request signal for confirmation. The user responds to the pairing request by manipulating an actuator associated with controller 510'. If user actuation indicates refusal of the pairing request, controller 510' concludes the pairing process. If user actuation indicates acceptance of the pairing request, controller 510' transmits to digital video

camera 10 a Confirmation signal, together with a passcode if one is required by microphone 90. Upon receipt of the Confirmation signal, digital video camera 10 transmits a Confirmation signal and any passcode to microphone 90 and thereby completes the pairing by initiating audio data capture and recording by the audio encoder in digital video camera 10.

[0146] FIG. 33 is a flow diagram showing a preferred camera position adjustment procedure carried out by a helmet-wearing user, such as a bicycle or snowboard rider or skier, to align digital video camera 10 mounted on the user's helmet. Digital video camera 10 and viewer/controller 510 are initially paired by Bluetooth® wireless data connection, and the Contour Connect Mobile App is active, as described above with reference to FIG. 31. A launch control/viewer application instruction causes transmission of a fast photo transfer Data Request signal to Bluetooth® data transfer-enabled digital video camera 10, which responds by enabling the taking of photographs in rapid succession (e.g., five photographs each second) of the scene to which camera lens 26 is pointed. A mounting activity sequence 520 indicated in FIG. 33 represents user activity of mounting digital video camera 10 on the helmet, assuming a riding position, and adjusting the position and angle of digital video camera 10 by selecting its mounting surface location on the helmet and rotating rail plug 132 within base mount 130h of mounting system 300. The angle/position mounting adjustment performed by the user causes the taking of photographs of the scene in rapid succession and transmitting them for near real-time display to the user observing the display screen of viewer/controller 510. Successive iterations of angle/position mounting adjustment, picture taking in rapid succession, and user observation of the displayed scene continue until the user is satisfied with the position of the scene displayed, whereupon the mounting position adjustment of digital video camera 10 on the helmet is complete.

[0147] Frame optimization can be accomplished with a remote control device or within digital video camera 10, if it is equipped with a screen and controls. Frame optimization may entail one or both of lighting and color optimization and frame alignment, either manually or automatically.

[0148] FIG. 34 is a flow diagram showing a preferred manual lighting level and color settings adjustment procedure followed by the user after completing the mounting position adjustment described above with reference to FIG. 33. The manual lighting level and color setting procedure shown in FIG. 34 differs from the

mounting position adjustment procedure of FIG. 33 in that 1) mounting activity sequence 520 does not apply, 2) a settings OK decision block replaces the Position OK decision block in viewer/controller 510, and 3) the manual angle/position mounting adjustment causing the taking of photographs of the scene in rapid succession is replaced by transmission of a new settings instruction produced in response to user-manipulation of an alter lighting level and color settings actuator associated with viewer/controller 510. The manual lighting level and color adjustment procedure entails the user observing the successive photographs on the display screen and manipulating the alter lighting level and color settings actuator associated with viewer/controller 510 until the user is satisfied with the lighting level and color displayed, whereupon the manual setting adjustment is complete.

[0149] Automatic lighting and color optimization uses video or photographic analysis in controlling the device. FIG. 35 is a flow diagram showing a preferred automatic lighting level and color settings adjustment procedure followed by the user after completing the mounting position adjustment described above with reference to FIG. 33. The automatic lighting level and color settings procedure shown in FIG. 35 differs from the manual lighting level and color settings procedure shown in FIG. 34 in that an Auto Adjust iterative loop replaces the Settings OK decision block of FIG. 33. Specifically, a Start Auto Adjust process block initiates an iterative Auto Adjust loop of programmed analysis of photograph color, lighting level, and position followed by a Quality Optimization decision query based on a set of programmed quality standards. The Auto Adjust loop iteratively performs the analysis and causes transmission of a new settings instruction to digital video camera 10 to take additional photographs for display and analysis by viewer/controller 510. The automatic lighting level and color adjustment procedure entails the automatic internal analysis of the photographs on the display screen and preprogrammed automatic adjustment of the lighting level and color settings until the Quality Optimized decision block indicates that image quality meets preprogrammed optimum quality standards and the final Quality Optimized decision block indicates that the user is satisfied by user manipulation of an actuator indicating the automatic setting adjustment is complete. Viewer/controller 510 can implement tuning algorithms to analyze frames, adjust settings, and reanalyze the frames to optimize lighting level and color settings. Small and fine alignment adjustments can be made automatically by altering the pixels used to define the frame. These adjustments can be made by redefining the

center pixel or by redefining the bounding box. These adjustments can be horizontal, vertical, and rotational, including rotating a full 180° to allow for digital video camera 10 to be positioned upside down, as shown in FIG. 25D. For more precise optimization, digital video camera 10 may be pointed at a predefined chart to allow the automatic adjustments to achieve more precise and consistent settings.

[0150] Use of the many-to-many nature of Bluetooth® wireless technology enables a user to control multiple cameras. Multi-camera control allows for the controller to coordinate the lighting level and color settings on all cameras, provide guides for alignment of camera positions, and synchronize the videos on multiple cameras with synchronous start/stop or synchronous “alignment” on-screen display (OSD) frames or audio sound that can be embedded in the video to facilitate editing and post-processing. Use of wireless connection allows one camera to provide a synchronization signal to another camera so that videos can be synchronized in post-processing. The OSD frames may be stored in advance in the memory of digital video camera 10 and be simply triggered by a frame sync pulse to limit transmission bandwidth requirements and any associated errors or delays. This synchronization may include information such as, for example, video file name and camera identity of the primary camera. To improve accuracy of synchronization timing, the wireless transfer rate can be calibrated by pinging a secondary device and listening for response. To further improve accuracy, this ping/response cycle is repeated multiple times.

[0151] A separate remote device can be used to pair two cameras in which neither camera has a screen. FIG. 36 shows a (Master) Camera 1 and a (Slave) Camera 2 of the same type as digital video camera 10 aimed at a common chart 530. The relative camera mounting can be adjusted to align the images in the Z-axis. The lighting level and color settings can be adjusted so that they are matched. Aligning the images and adjusting lighting level and color settings eliminate a need for post-processing when combining videos from multiple cameras at multiple angles or three-dimensional views. FIG. 36 shows an iPhone paired to Cameras 1 and 2 implemented with remote Start/Stop capability, which is described below. Master Camera 1 sends an OSD frame sync pulse to Slave Camera 2. Master Camera 1 analyzes photographs from Slave Camera 2 and adjusts settings to match the alignment and settings of Master Camera 1.

[0152] FIG. 36 presents two illustrations of a display screen 532 of viewer/controller 510 of an iPhone type showing for user observation side-by-side images produced by Cameras 1 and 2 viewing chart 530. Upper illustration 534 and lower illustration 536 show the comparative relationship between the position and color matching, respectively, before and after correction. Illustration 534 shows Z-axis misalignment of the two camera images and color imbalance, and illustration 536 shows post-correction image position alignment and color matching.

[0153] By controlling multiple cameras, the user is able to coordinate shots from different angles and ensure the color and lighting settings are similar to allow for seamless switching in playback. The preferred embodiments could be expanded so that in the event there were multiple devices daisy-chained together, they could use a single authentication. For example, if there were two cameras that were connected via Bluetooth® to a device that required such authentication, the signal from one camera could route through the other to use its security and the intermediary device would be the only device that requires such security provision. This security component may also be able to become a standalone component that is simply inserted into the security path as a pass-through that adds the authentication or approval required only for the receiving device and performs any translation required for the response to be interpreted properly.

[0154] FIG. 37 shows an exemplary user application to allow the user to change lighting level and color settings and immediately see the resulting changed video. FIG. 37 is a flow diagram showing Camera 1 and an iOS mobile phone or tablet computer device 510 paired by Bluetooth® wireless connection and cooperating to accomplish without security the pass-through of Camera 2 data. A user pushes the wireless connection activator button on Camera 2 to transmit a Pair Connection Request signal to Bluetooth®-enabled Camera 2, which detects the request, confirms the pairing, and transmits a signal to Camera 2 to complete the pairing. Camera 2 responds by taking photos in rapid succession and transmitting them together with status information to Camera 1 for pass-through transmission to device 510 for display as Camera 2 image and data on display screen 532. A user manipulates an actuator associated with device 510 to change lighting level and color settings by causing transmission to Camera 1 a New Settings command signal for pass-through transmission to Camera 2, which responds by changing its lighting and color settings.

[0155] Data acquisition and data synchronization in the use of wireless communication, preferably in cooperation with GPS capability, can be accomplished by one of several techniques. When capturing video during an activity, data may be used to better describe the activity as well as used for editing and optimizing either during recording or in post-processing. Typically, these data would be embedded in the video as user data or in the file as a data track (in accordance with MPEG specifications). In a first alternative, the data may be written to a text track in the file. These data are ignored by players unless text display is turned on. Post-processing algorithms extract these data for analysis. Generally, the text track survives editing. In a second alternative, the data may be written to a separate file, and the file name for the data may be written as metadata on the video file so that post-processing applications can properly associate the data with the video. Optimally, the data are synchronized with the video, but they need not be frame synchronized. In the event the data are stored in a separate file, a timestamp could be used to synchronize the video. This marker may be embedded in the data file to tag the file at a single time (e.g., beginning, middle, end, or upon designation by the user), tag the file with every video frame, or tag periodically.

[0156] FIG. 38 shows a hybrid flow diagram and pictorial illustration of iPhone viewer/controller 510 paired by Bluetooth® wireless data and control command connection to Cameras 1 and 2 to implement a remote Start/Stop capability for multiple cameras. (Cameras 1 and 2 are also identified by the respective reference numerals 10₁ and 10₂ to indicate they are of the same type as digital video camera 10.) The flow diagram shows iPhone viewer/controller 510 paired to Cameras 1 and 2 and Contour Connect Mobile App in its active operating mode. The pictorial view of iPhone viewer/controller 510 shows on its display screen 532 a Start Record actuator.

[0157] The user wanting to start a recording session taps the Start Record actuator to transmit to Bluetooth®-enabled Cameras 1 and 2 a Start Recording command signal. The flow diagram shows Cameras 1 and 2 recording video data in response to the Start Recording command signal. Bluetooth® wireless module 400 in each of Cameras 1 and 2 is configured to respond to the Start Recording command signal, irrespective of the OFF state of switch activators 80 of Cameras 1 and 2.

[0158] The user wanting to complete a recording session taps a Stop Record actuator (not illustrated in FIG. 38) on display screen 532 to transmit to Cameras 1 and 2 a Stop Recording command signal. The flow diagram shows Cameras 1 and 2 stopping video recording in response to the Stop Recording command signal.

[0159] FIG. 38 also shows upper and lower timing diagrams illustrating the timing sequences of video frame acquisition by Cameras 1 and 2 when they are, respectively, manually started asynchronously in response to user-positioning of switch activators 80 and started nearly synchronously in response to user-tapping of the Start Record actuator on display screen 532 of iPhone controller/viewer 510. The lower timing diagram shows the benefit of wireless connection in accomplishing near synchronous acquisition of streams of video data from multiple cameras.

[0160] FIG. 39 is a flow diagram showing an example of pairing Camera 1 and Camera 2 by Bluetooth® wireless data and control command connection through either viewer/controller 510 or controller 510', the latter of which is illustrated in FIG. 39. FIG. 39 shows Camera 1 paired by Bluetooth® wireless connection to controller 510' and Contour Connect Mobile App in its active operating mode. A user presses the wireless connection activator button on Camera 2 to turn on its Bluetooth® module 400, which transmits a Bluetooth® Pair (connection) Request signal to Camera 1. Camera 1, which is already paired with controller 510', detects the Pair Request signal and transmits a Camera Pair Request signal to controller 510'. Controller 510' presents a pairing request to the user, who manipulates an actuator to refuse the requested pairing connection, and thereby stop the pairing process, or manipulates an actuator to accept the requested pairing connection, and thereby transmit and pass through Camera 1 to Camera 2 a Confirm Pairing signal to complete the pairing connection.

[0161] A synchronization calibration sequence 540 performed between Cameras 1 and 2 calibrates transmission delays between them. Camera 1 transmits to Camera 2 a Sync Calibration signal, to which Camera 2 responds by transmitting a Sync Response signal. Camera 1 determines a calibration delay representing the amount of delay from transmission of the Sync Calibration signal to receipt of the Sync Response signal. This process is repeated a number of times until successive measured calibrated delays are within an operational tolerance.

[0162] A synchronized video recording process 542 starts upon completion of synchronization calibration sequence 540. Camera 1, operating as the master

camera and in response to a user-controlled trigger signal, transmits a Start Recording signal to Camera 2, which responds by starting to record video data. Camera 1 starts to record video data after expiration of the calibrated delay determined by the synchronization calibration sequence 540 to achieve a synchronized start of recording video data by Cameras 1 and 2.

[0163] An on-screen display (“OSD”) sync pulse insertion process 544 facilitates video frame synchronization in video and audio post-processing. Camera 1 transmits a Trigger OSD Sync signal to Camera 2 in response to the start of video data recording by Camera 1. Camera 2 responds to the Trigger OSD Sync signal by inserting an OSD Sync pulse overlay in the stream of video frames Camera 2 acquires. After expiration of the calibrated delay determined by synchronization calibration sequence 540, Camera 1 inserts an OSD Sync pulse overlay in the stream of video frames Camera 1 acquires. The time base for computing calibration delay and OSD Sync pulse insertion is preferably provided by a GPS date/time clock available to GPS receiver 458.

[0164] A video and audio post-processing procedure 546 entails performing a search of the streams of video frames for the OSD Sync pulses and shifting the timing of the stream of video frames of Camera 2 to match the OSD Sync pulses of Camera 1. The frame center, color, audio volume, and other parameters of the Camera 2 video and audio data are adjusted using the OSD Sync pulse so that the streams of video and audio data can be combined for multi-angle shots, three-dimensional images, or other effects.

[0165] FIG. 40 is a block diagram showing the post-processing procedure of synchronizing audio data produced by a wireless microphone 550 and wired microphone 90 incorporated in digital video camera 10. Audio data produced by microphone 90 are compressed by an audio codec 552. An audio signal produced by wireless microphone 550 is received by Bluetooth® wireless module 400, converted to digital form by an analog-to-digital convertor 554, and compressed by an audio codec 556. Video data produced by image sensor 18 is compressed by a video codec 558, which resides in main processor 500 of digital video camera 10. An Audio 1 Track of hard-wired audio data, an Audio 2 Track of wireless audio data, and a Video Track of video data delivered from the respective outputs of audio codec 552, audio codec 556, and video codec 558 are combined and contained as parallel tracks in an original video file 560 and stored in an SD memory card 562.

[0166] Wireless microphone 550 introduces a delay in the Audio 2 Track. FIG. 40 illustrates this delay by showing a one-frame temporal offset between corresponding frames of the Audio 1 and 2 Tracks. The above-described OSD Sync pulse functions as an audio time stamp that can be used to correct for the delay and thereby synchronize the Audio 1 and 2 Tracks for automatic post-processing audio analysis. Post-processing is performed in a peripheral computer 570, which includes a video editor 572 having an audio tracks extraction module 574 that receives from SD card 562 the stored Video, Audio 1, and Audio 2 Tracks data from original video file 560. Audio tracks extraction module 574 separates the Audio 1 and 2 Tracks, and an audio synchronizer module 576 using the time stamp sync pulse synchronizes them. The synchronized Audio 1 and 2 Tracks, together with the Video Track, are combined in a video/audio combiner module 578 and delivered in proper temporal frame alignment to a new video file 580.

[0167] Data measurements performed depend on the type of data acquired. The most appropriate data varies based upon sport or type of motion recorded; therefore, ideally data sensors are tailored to the relevant sport. Additionally, the best location for measuring data is often not the ideal location for mounting a camera.

[0168] FIG. 41 is a simplified block diagram showing the processing of a single track of data from one data source. FIG. 41 shows digital video camera 10 including in its main processor 500 a video file 600 containing a Video Track, an Audio Track, and a Text Track. The Video and Audio Tracks correspond to, respectively, the Video and Audio 1 Tracks contained in original video file 560 of FIG. 40. The Text Track represents data that are produced by a subtitle generator 602 hardwired to main processor 500 and is presented for display on the video frames.

[0169] By using Bluetooth® with its many-to-many connections, multiple data sources can be recorded by the camera. These data sources can be customized to the specific application, for example for automobile racing, data relating to the automobile engine may be captured from on-board diagnostics and transmitted to digital video camera 10, where the data can be embedded in the video stream for later playback. Examples of multiple data sources include streaming data to one or more cameras from one or more data sources (e.g., GPS data from telephone or GPS collection device, and audio data from remote microphone) and storing such data as individual files or embedded in the video file as metadata, audio tracks, or text.

[0170] In post-processing, data associated with video content can be used in editing to correct for shade/lighting changes, to correct for video processing errors, and to enhance the story with information about the path taken, location of the video, speed, and other information. Location and time data embedded in video from sources such as GPS can be used to synchronize videos in post-processing generating a three-dimensional video. Speed, vibration, altitude, temperature, date, and location can be combined to determine the likely sport or activity as part of a post-processing suite. The recommendations can be tuned based on data gathered from a large body of videos in which the activity in the video has been identified. Data associated with video content may be used to associate and group videos from one or more users. The groupings may be based on any characteristic such as time, location, speed, and other factors. Videos that intersect in time or location may be linked so that the viewer can transition to a different camera or video when two videos cross in location or time. Additionally, the data can be used to correlate multiple cameras or videos to create multiple view angles for the same location or event. These data may also be used to correlate videos of the same location taken over time to document the changes in that location over extended durations (hours, days, weeks, years).

[0171] Multiple "language" tracks on video file can be used to capture different audio sources (including wireless microphone) from the video camera. This allows the user to select from the optimal audio source in post-processing or allows automatic correction for signal errors and synchronization issues. By storing multiple sources, users are post-processing algorithms and may select the most reliable track in the event there is a dropout resulting from signal quality issues caused by use of a wireless device. Additionally, audio may be captured from multiple sources and from different locations to provide different audio information so that the preferred audio may be selected in post-processing. In the event multiple audio tracks are not available, data tracks may be used and the data can be converted into an audio source in post-processing. In the event the wireless audio source cannot be channeled through the audio codec, the raw data can be stored and post-processing can modify these data to convert them to audio. Any delay introduced by the wireless connection can be corrected by synchronizing the wireless audio source to the primary audio source (internal microphone) using the audio waveforms.

[0172] The foregoing approach differs from the prior art technique of automatically switching between an internal microphone and an external microphone, where the external microphone is used when it exists and software automatically reverts to the internal microphone when the external microphone signal is unavailable. Automatic switching would, however, mix audio from different locations and not provide a seamless audio experience.

[0173] FIG. 42 is a simplified block diagram showing the processing of multiple tracks of data from multiple data sources. FIG. 42 shows digital video camera 10 including in its main processor 500 a video file 610 containing Video and Audio Tracks corresponding to those contained in video file 600 of FIG. 41 and five text tracks described below.

[0174] A data processing and calculations module 612 of main processor 500 receives data from GPS receiver 458, camera sensors 614, Bluetooth® wireless module 400 receiving data transmissions from Bluetooth® wireless connection-enabled sources, and a wired data module 614 and delivers these data as Text Track 1, Text Track 2, Text Track 3, Text Track 4, and Text Track 5, respectively.

[0175] Text Track 1 contains GPS data such as longitude, latitude, elevation, date/time, and other data available from GPS receiver 458. The date/time information enables associating acquired video and other data, including data on Text Tracks 2-5, to a certain time point in the video data stream. Peripheral computer 570 takes the time-stamped information and displays it by time point. The transmission delay calibration described with reference to FIG. 39 can be implemented using the GPS-provided date/time clock as a time standard.

[0176] Text Track 2 contains operating parameter data such as video resolution, compression rate, and frame rate information available from camera sensors 614 associated with digital video camera 10.

[0177] Text Tracks 3 and 4 contain data acquired from Bluetooth® wireless connection-enabled Data A and Data B transmission sources such as, for example, race car engine sensor data and race car driver heart rate monitor data. These data are typically periodically transmitted to Bluetooth® module 400. Another example of Data A and Data B sources is data sources transmitting data at different transmission rates.

[0178] Text Track 5 contains data produced from a text data module (e.g., subtitle generator 602 of FIG. 41) hardwired to data processing and calculations module 612.

[0179] It will be obvious to those having skill in the art that many changes may be made to the details of the above-described embodiments without departing from the underlying principles of the invention. For example, skilled persons will appreciate that subject matter of any sentence or paragraph can be combined with subject matter of some or all of the other sentences or paragraphs, except where such combinations are mutually exclusive. The scope of the present invention should, therefore, be determined only by the following claims.

Claims

1. An integrated point of view digital video camera, comprising:
 - a camera including a lens and an image sensor, the image sensor capturing light propagating through the lens and representing a scene, and the image sensor producing image data of the scene;
 - a processor for receiving the image data directly or indirectly from the image sensor;
 - a wireless connection protocol device operatively connected to the processor to send image content by wireless transmission to and receive control or data signals by wireless transmission from a wireless connection-enabled controller; and
 - firmware operating on the processor and configured to produce, for wireless transmission to the wireless connection-enabled controller, the image content corresponding to the image data representing a scene.
2. The digital video camera of claim 1, in which the processor is configured to adjust a set of camera parameters, and in which the firmware operating on the processor causes adjustment of selected ones of the set of camera parameters in response to control or data signals received from the wireless connection-enabled controller and produced in response to the image content received by the wireless connection-enabled controller.
3. The digital video camera of claim 2, in which the set of camera parameters includes lighting level and color settings.
4. The digital video camera of claim 1, in which the wireless connection-enabled controller includes a smartphone or a tablet computer.
5. The digital video camera of claim 1, further comprising a global navigation and location determination receiver operatively connected to the processor to provide a time standard that supports timing of the sending of the image content by wireless transmission and the receipt of control or data signals by wireless transmission.
6. The digital video camera of claim 5, in which the global navigation and location determination receiver is of a GPS type.
7. An integrated point of view digital video camera, comprising:
 - a camera including a lens and an image sensor, the image sensor capturing light propagating through the lens and representing a scene, and the image sensor producing image data of the scene;

a processor for receiving the image data directly or indirectly from the image sensor;

a global navigation and location determination device operatively connected to the processor to provide location tracking of the digital video camera as the image sensor produces image data of the scene; and

firmware operating on the processor and configured to produce digital video camera information in association with image content corresponding to the image data representing a scene.

8. The digital video camera of claim 7, in which the navigation and location determination device includes a GPS assembly.

9. The digital video camera of claim 8, further comprising a housing including an optical support barrel of curved shaped covering the lens; and in which the GPS assembly includes a metallic ground plane positioned between a GPS antenna and a GPS receiver module, the metallic ground plane being of complementary shape to the curved shape of the optical support barrel to provide an increased ground plane area that conforms to the shape of the optical support barrel.

10. The digital video camera of claim 9, in which the GPS antenna is of a passive patch antenna type.

11. An integrated point of view digital video camera, comprising:

a camera housing containing a lens and an image sensor, the camera housing having a length, and the image sensor capturing light propagating through the lens and representing a scene having a level orientation;

a mounting mechanism adaptable for secure mounting of the camera housing to a support having an off-axis orientation with respect to the level orientation of the scene, the mounting mechanism including first and second mounting pieces rotationally coupled to assume an adjustable orientation relative to each other and thereby provide rotational positioning adjustment of the camera housing;

one of the first and second mounting pieces comprising a rotatable plug mount having a circumferential edge, and the other of the first and second mounting pieces comprising a base mount having a circular opening and opposite side walls through which aligned slots are formed, the rotatable plug mount set through the circular opening in the base mount, and the circumferential edge of the plug mount and the opposite side walls of the base mount having circumferential sawtooth edges and sawtooth-receiving edges in matable relationship for bidirectional ratcheted

rotational motion of the plug mount when it is set through the circular opening in the base mount; and

a slidable locking member sized to fit within each of the slots in the base mount and, when inserted in the slots, slidably extend through and project outside of either one of the side walls, the locking member having a locking end piece with a serrated surface configured to engage and thereby lock the plug mount in place.

12. The digital video camera of claim 11, in which the plug mount is configured for coupling to the camera housing to provide for linear positioning adjustment of the plug mount along the length of the camera housing.

13. The digital video camera of claim 11, in which the base mount is configured for coupling to the support to provide the rotational positioning adjustment of the camera housing about a mount rotation axis that is transverse to the length of the camera housing to enable setting of the digital video camera to a desired viewing angle.

FIG. 1A
(Prior Art)



FIG. 1B
(Prior Art)

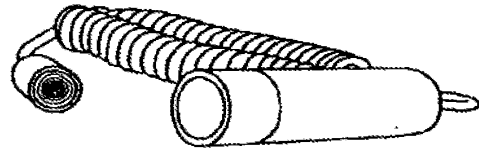


FIG. 1C
(Prior Art)

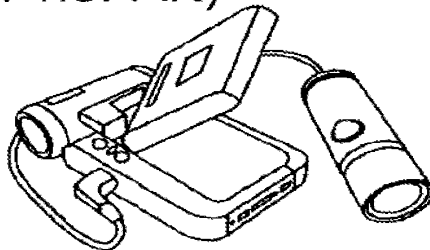


FIG. 1D
(Prior Art)

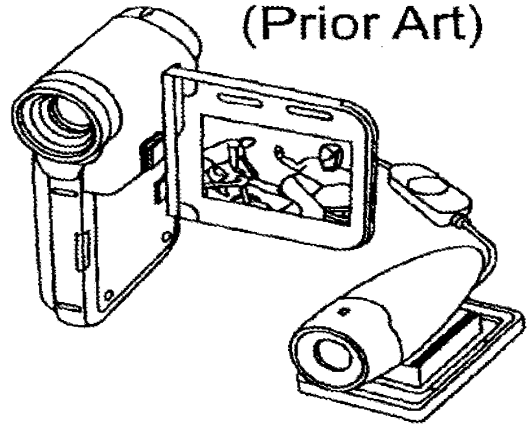


FIG. 1E
(Prior Art)



FIG. 2A
(Prior Art)

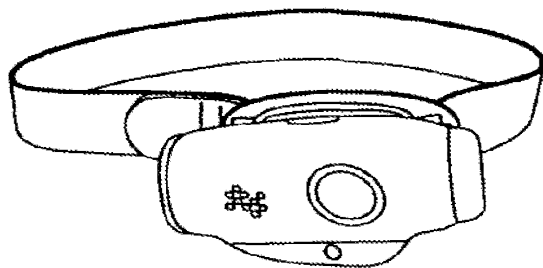
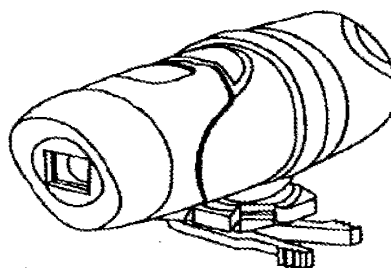
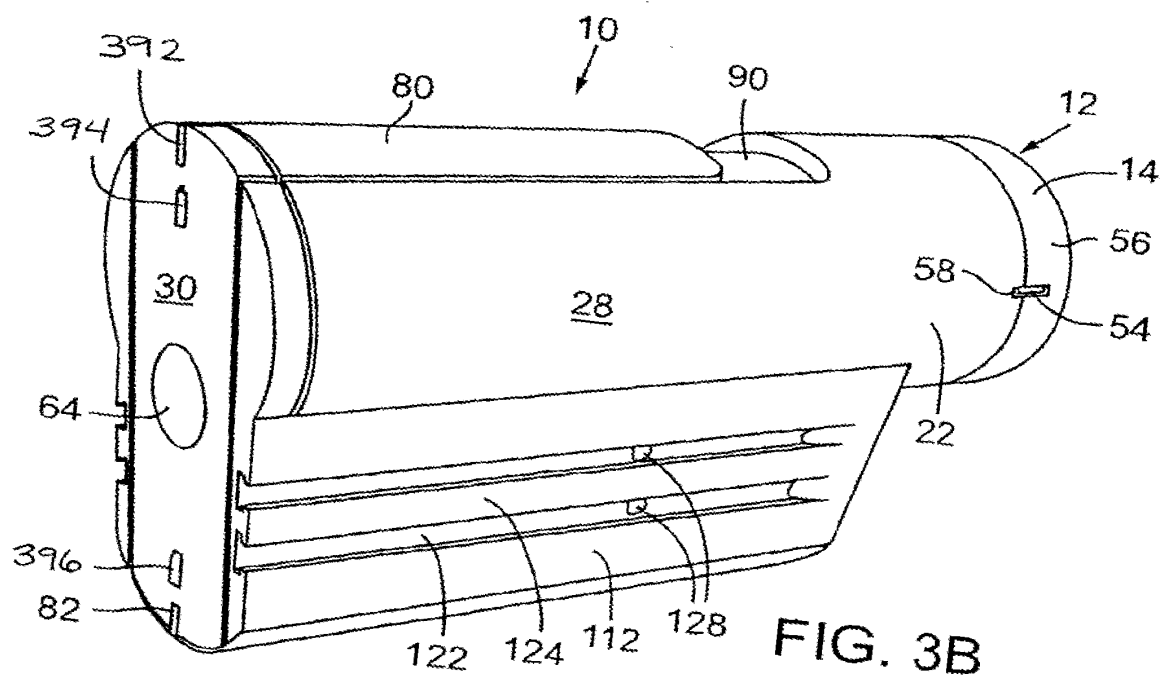
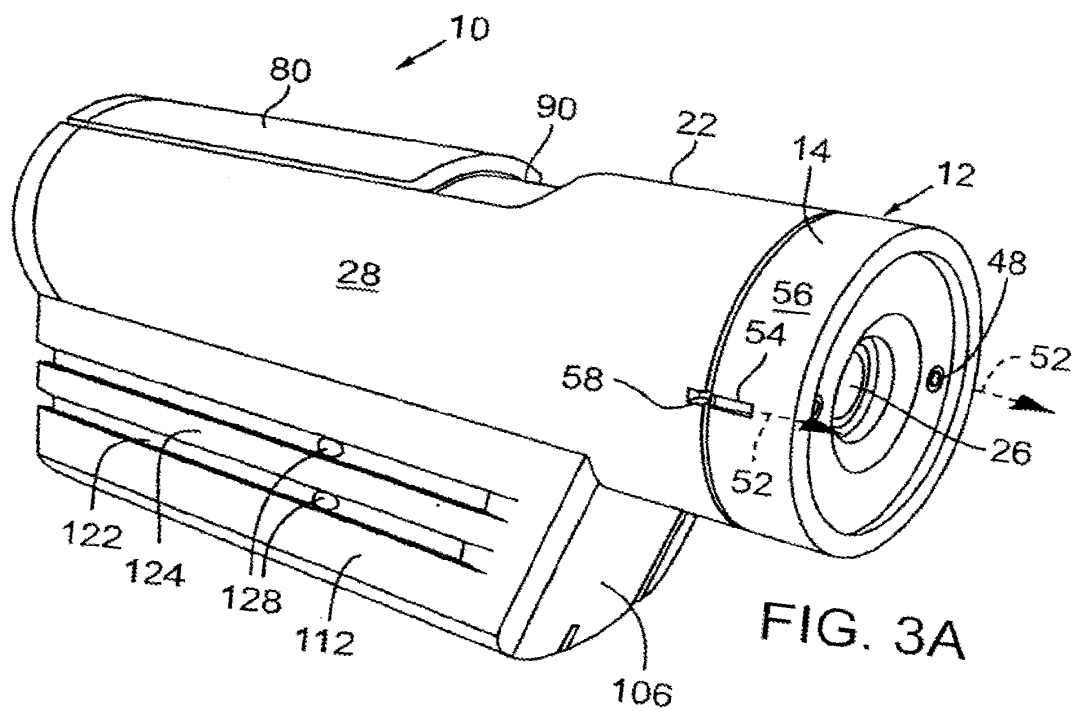
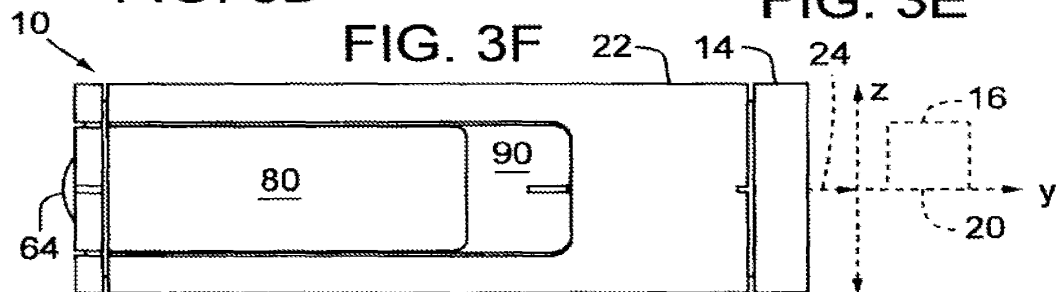
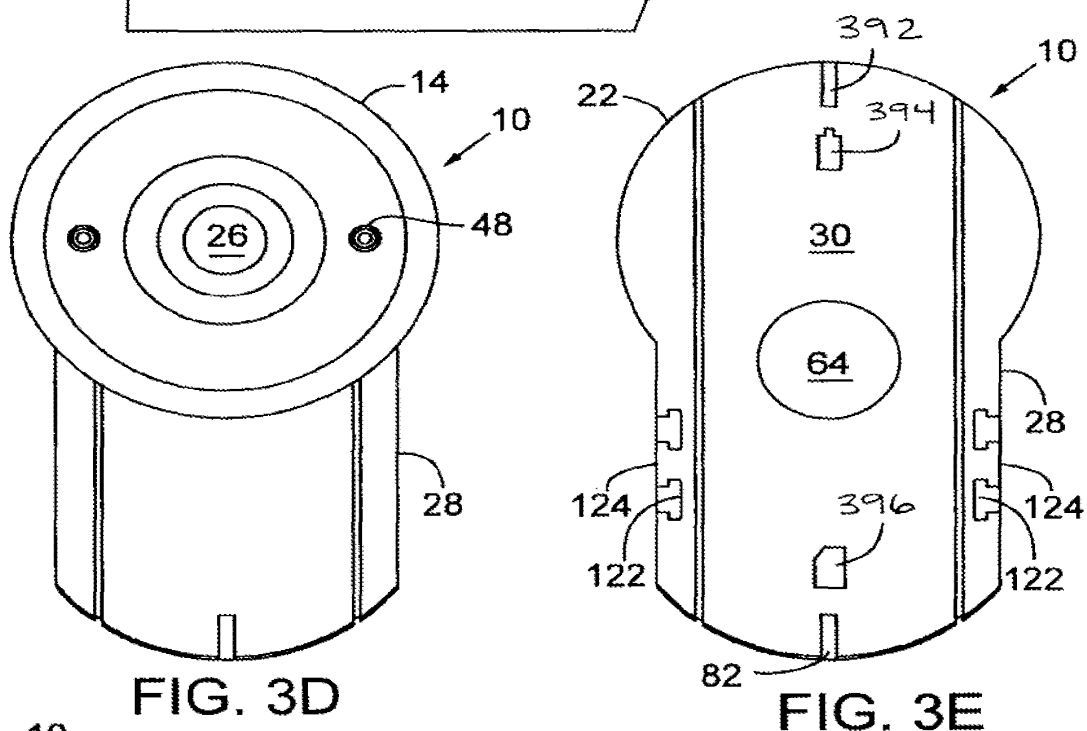
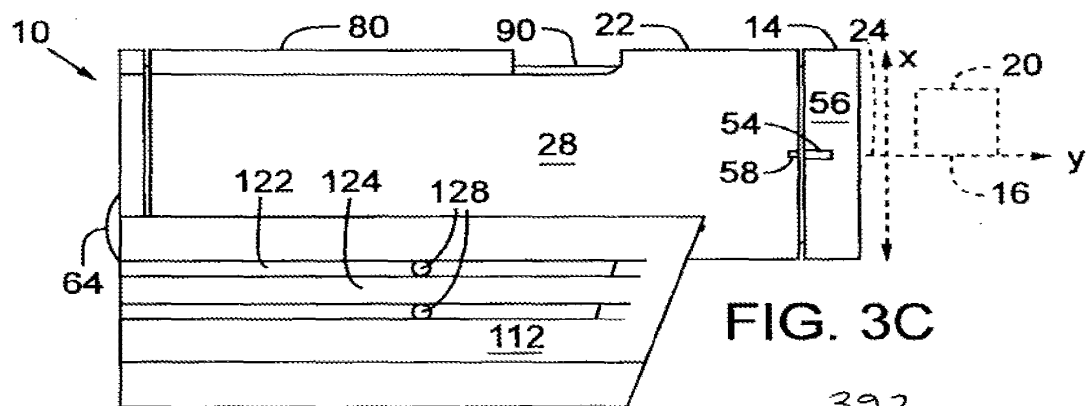
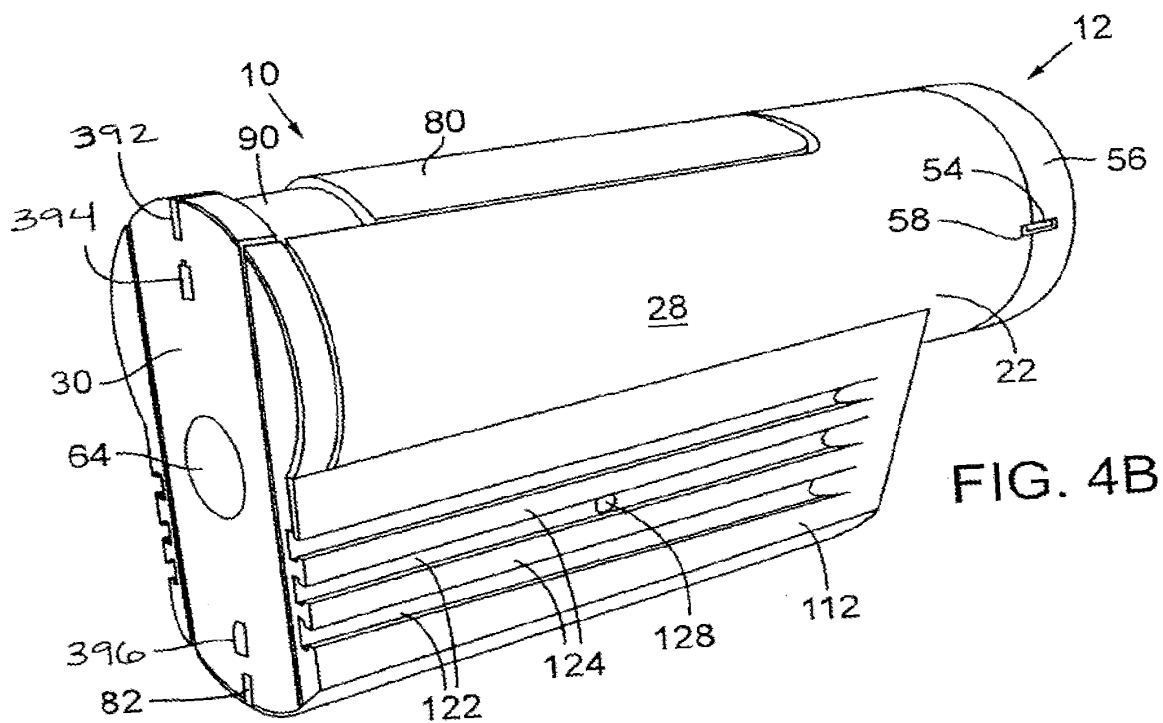
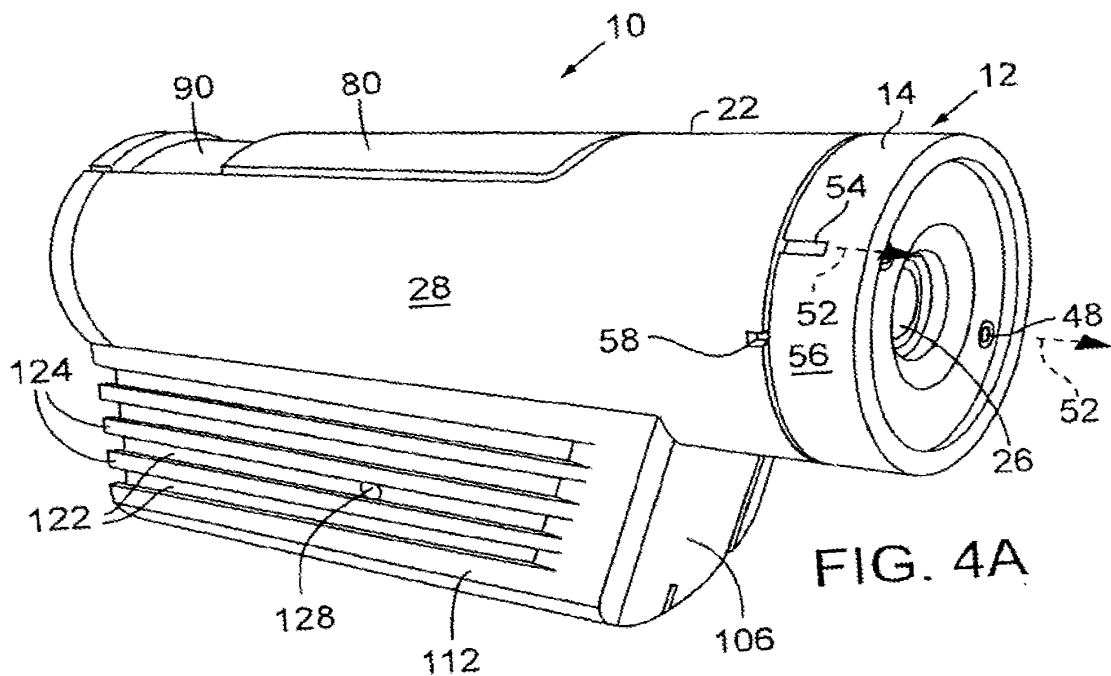


FIG. 2B
(Prior Art)









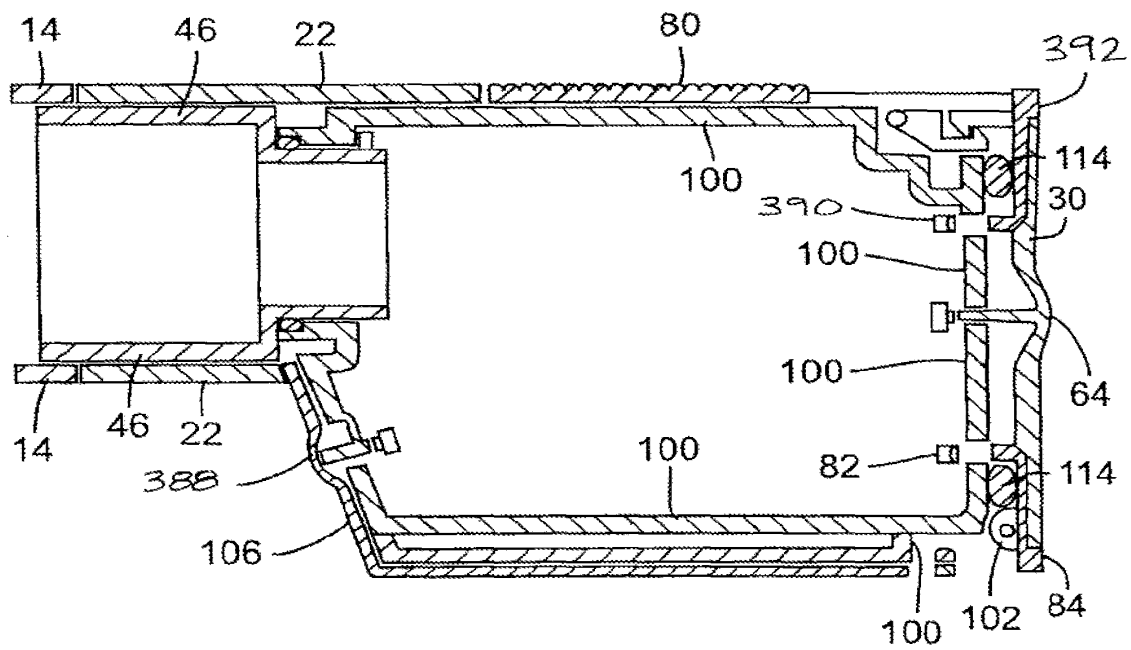


FIG. 5

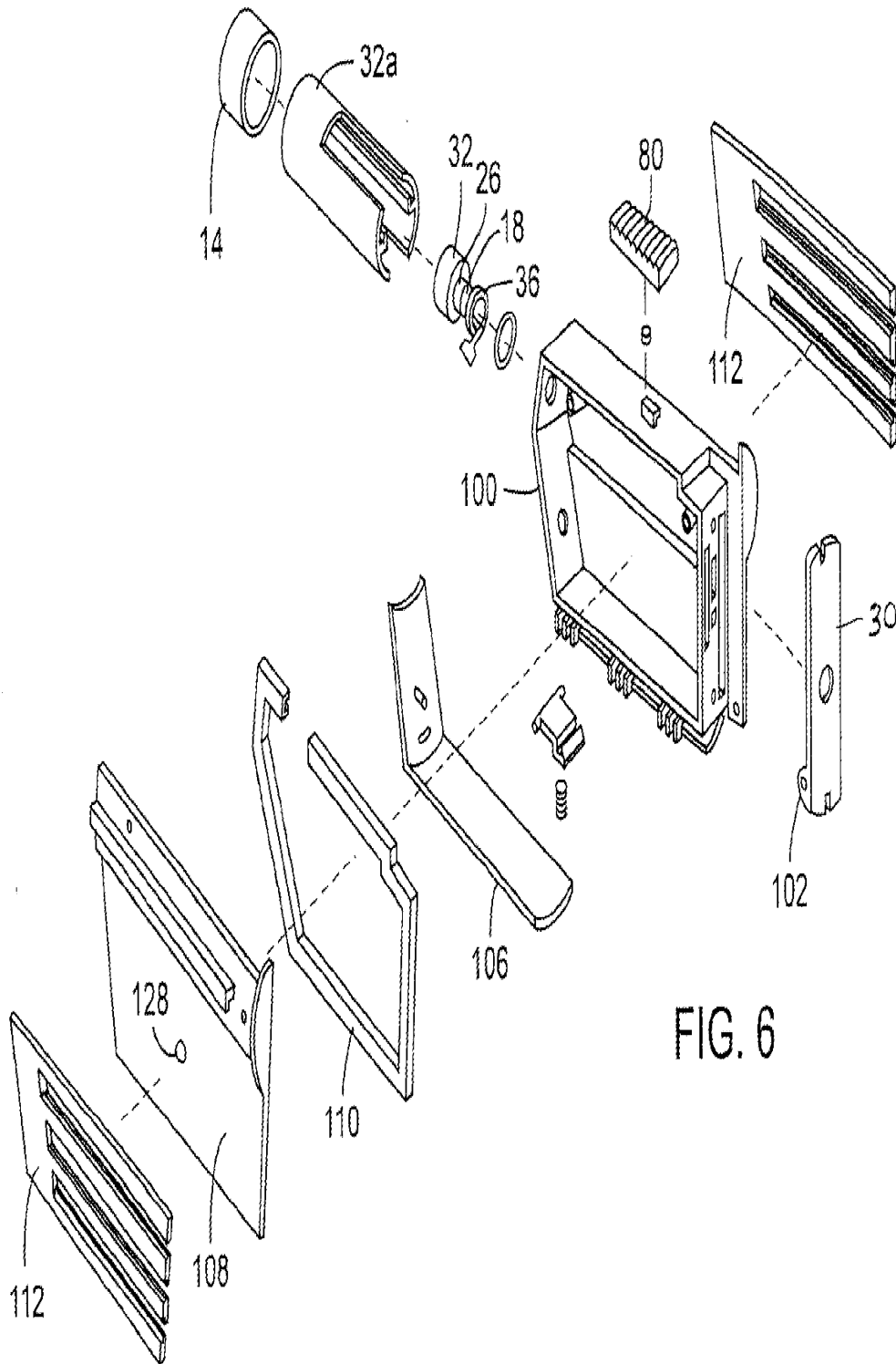


FIG. 6

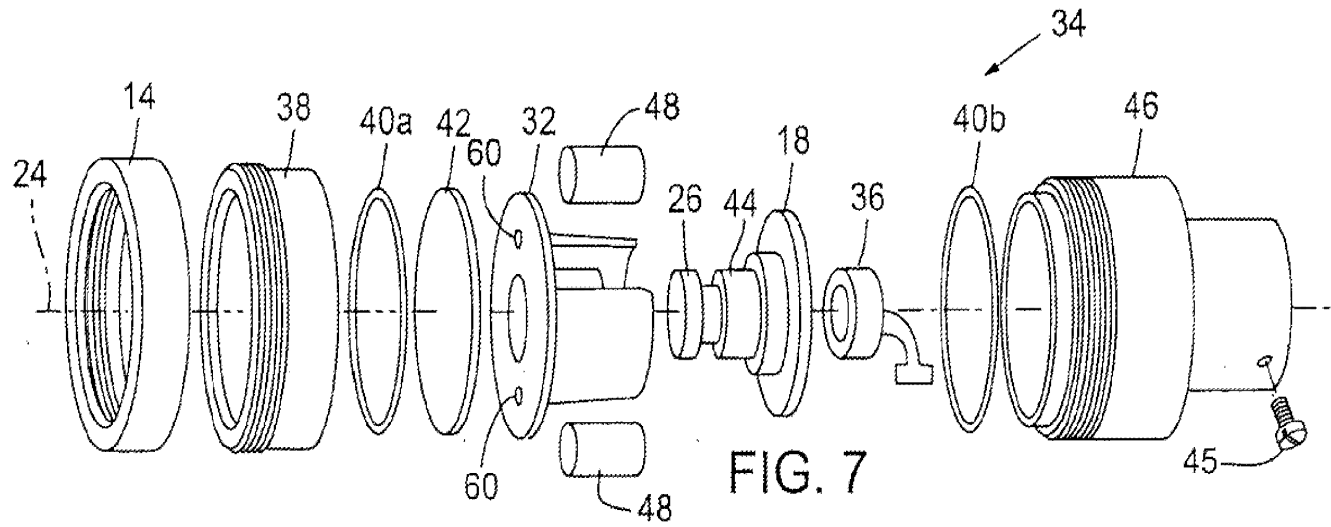


FIG. 7

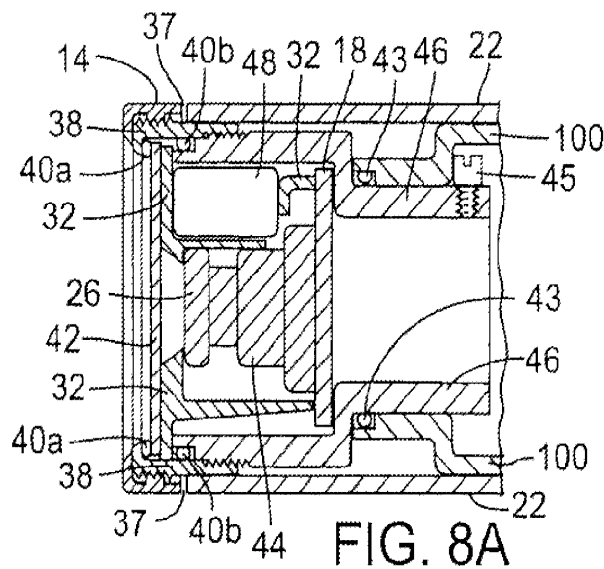


FIG. 8A

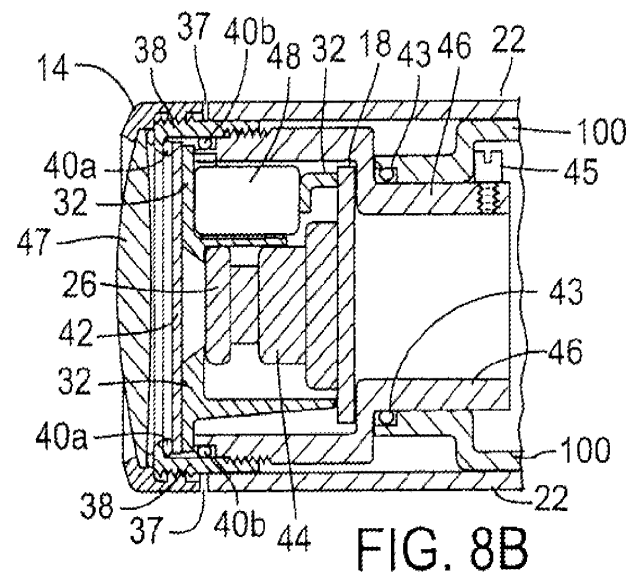


FIG. 8B

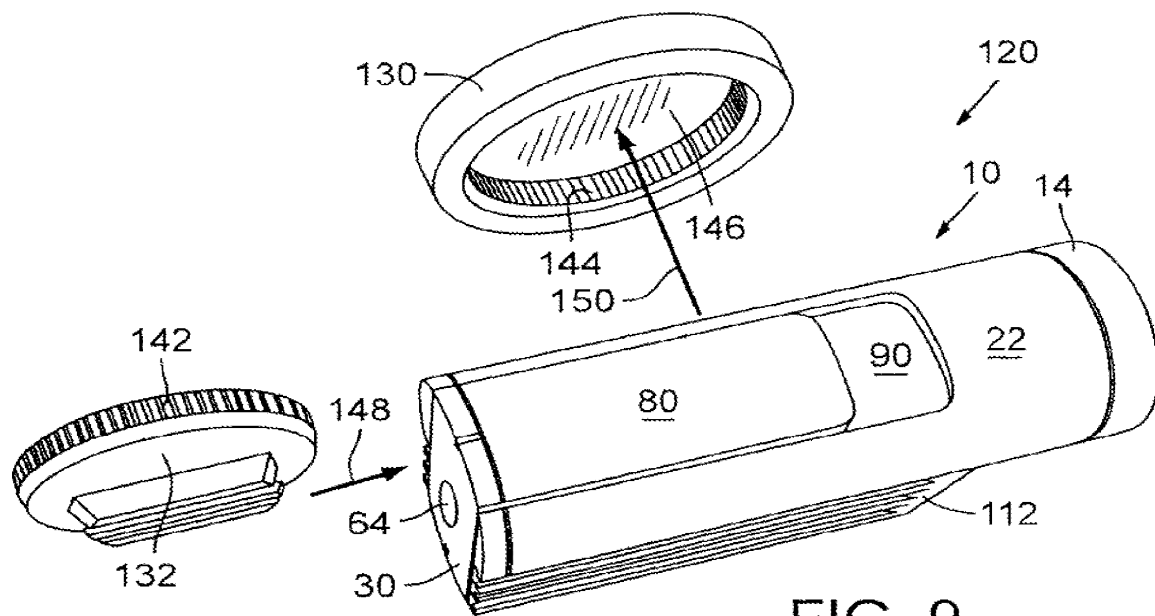


FIG. 9

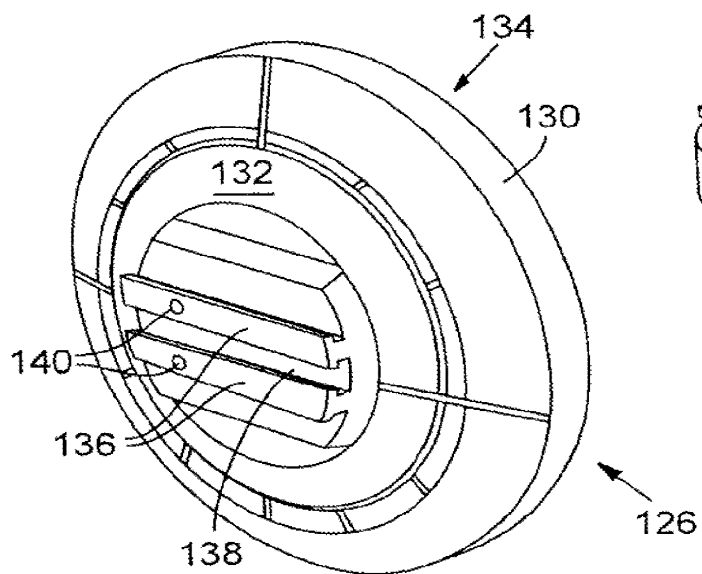


FIG. 10

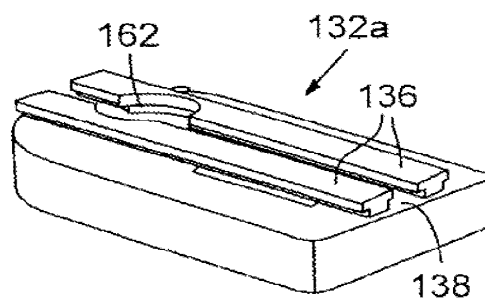
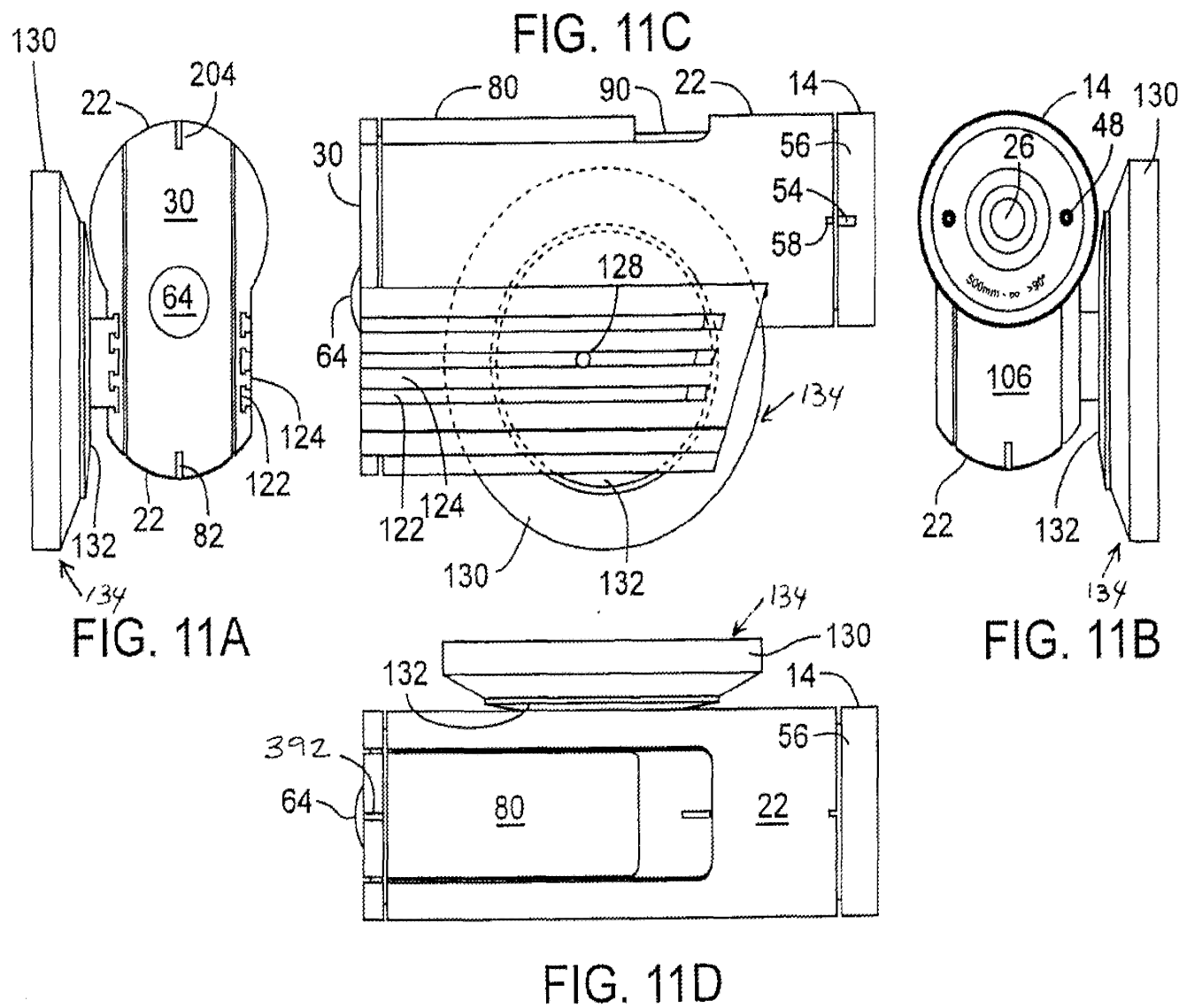


FIG. 12



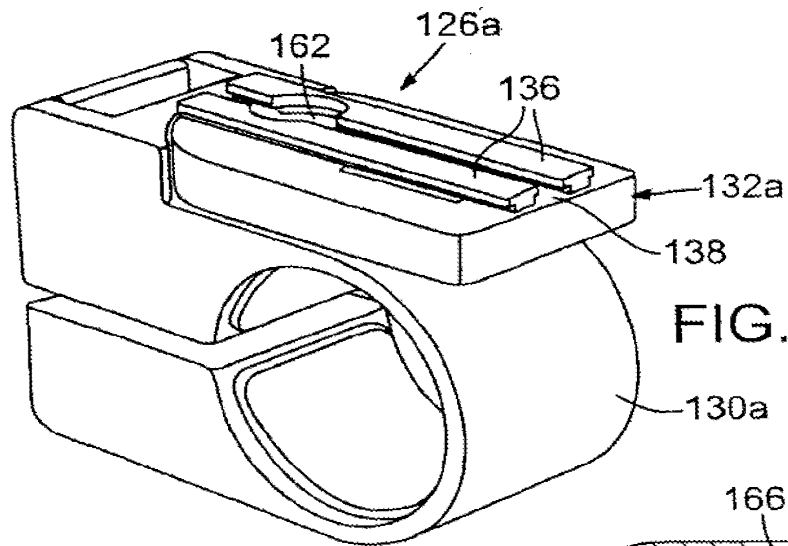


FIG. 13A

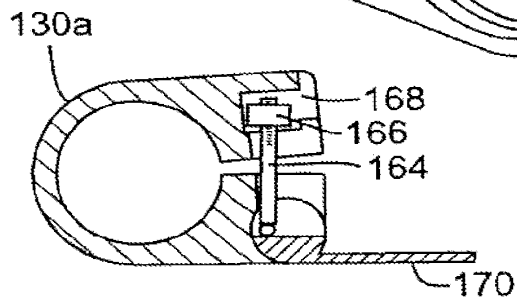


FIG. 13B

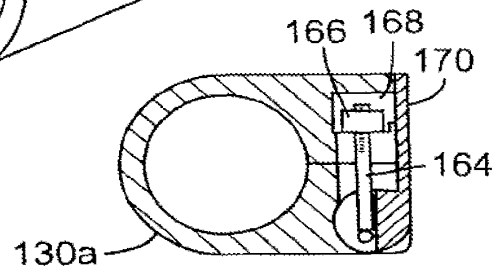


FIG. 13C

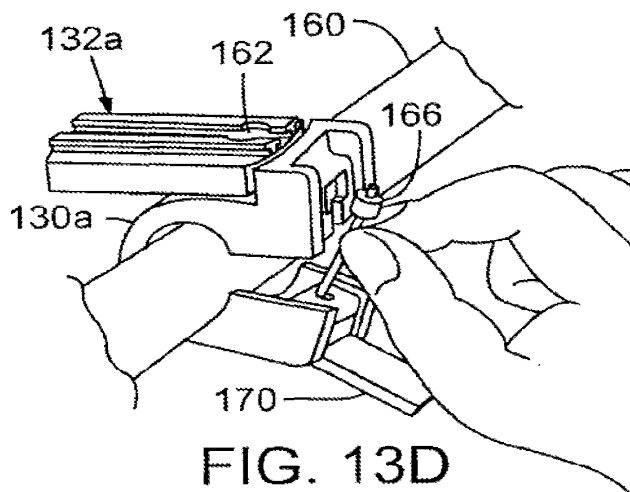


FIG. 13D

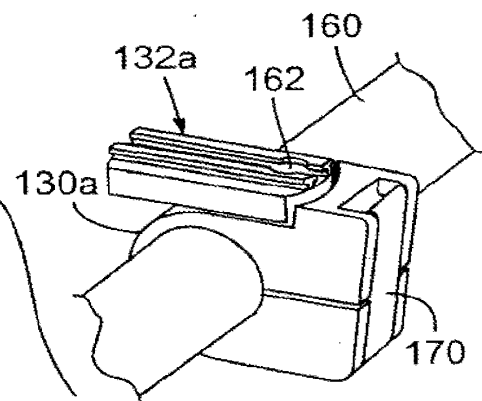


FIG. 13E

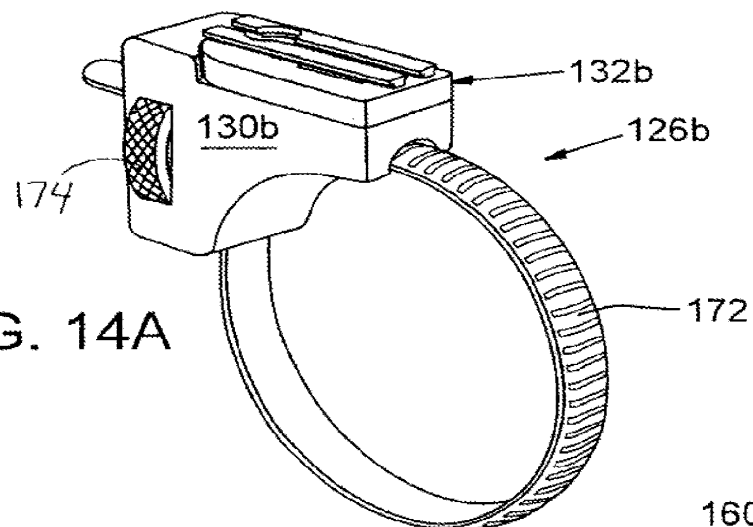


FIG. 14A

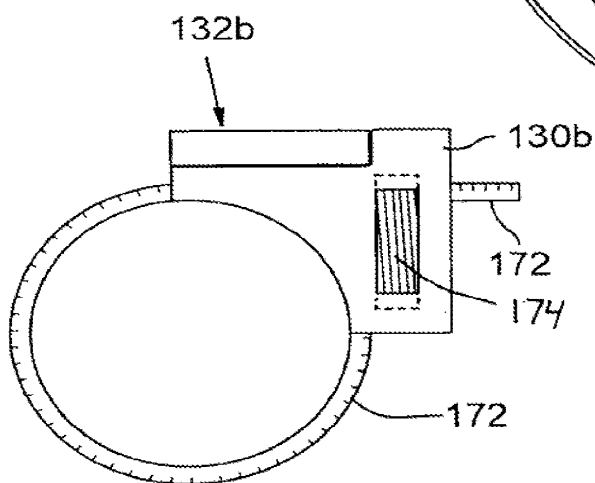


FIG. 14B

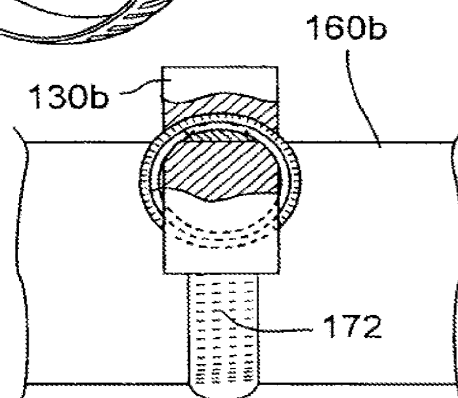


FIG. 14C

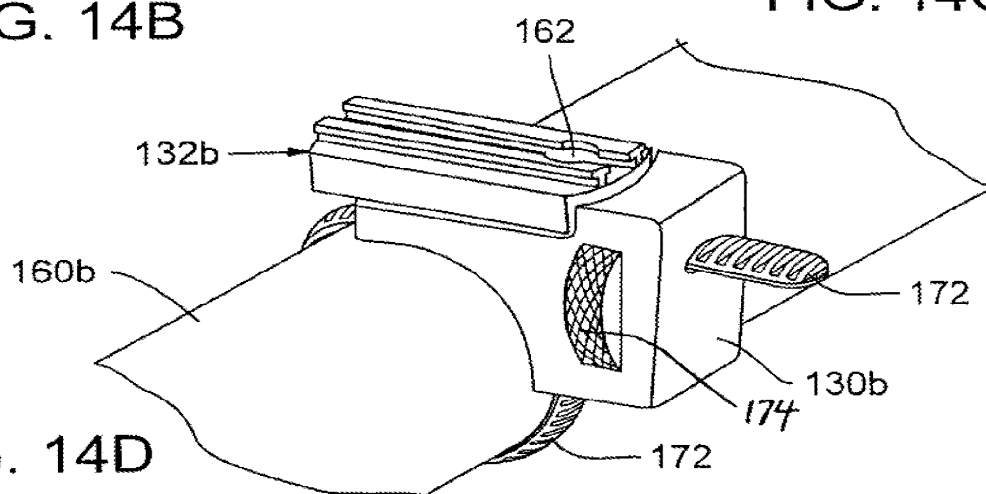


FIG. 14D

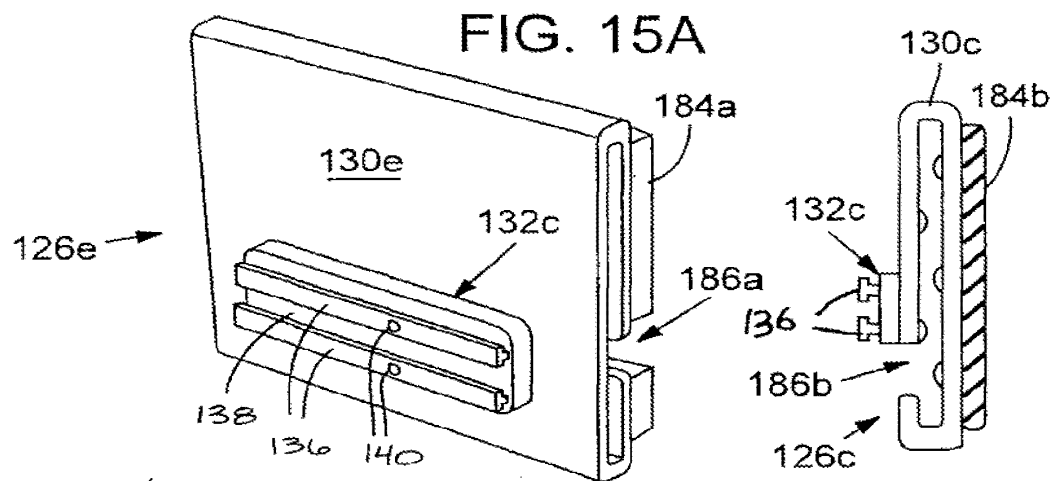


FIG. 15B

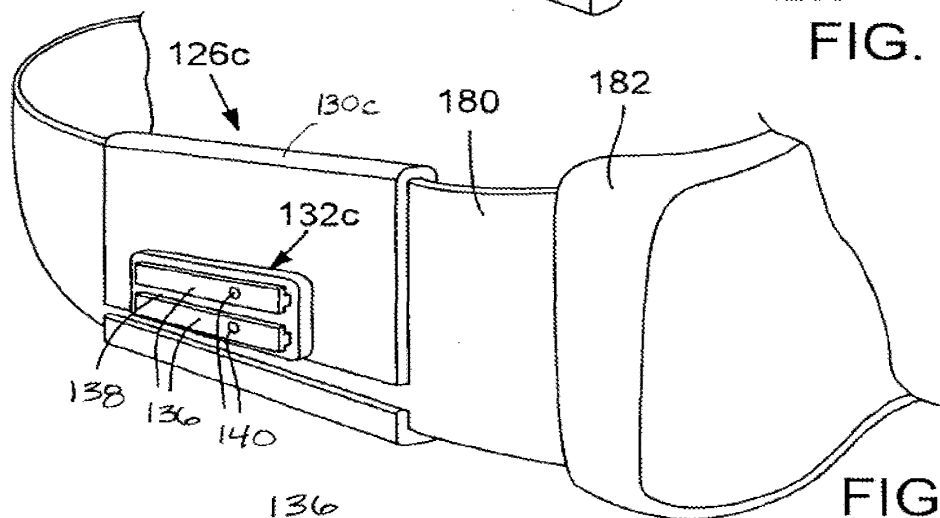
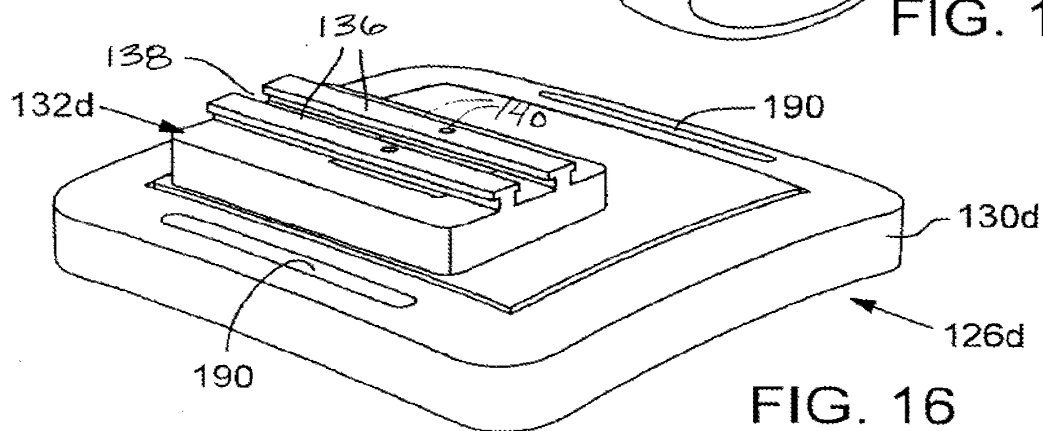


FIG. 15C



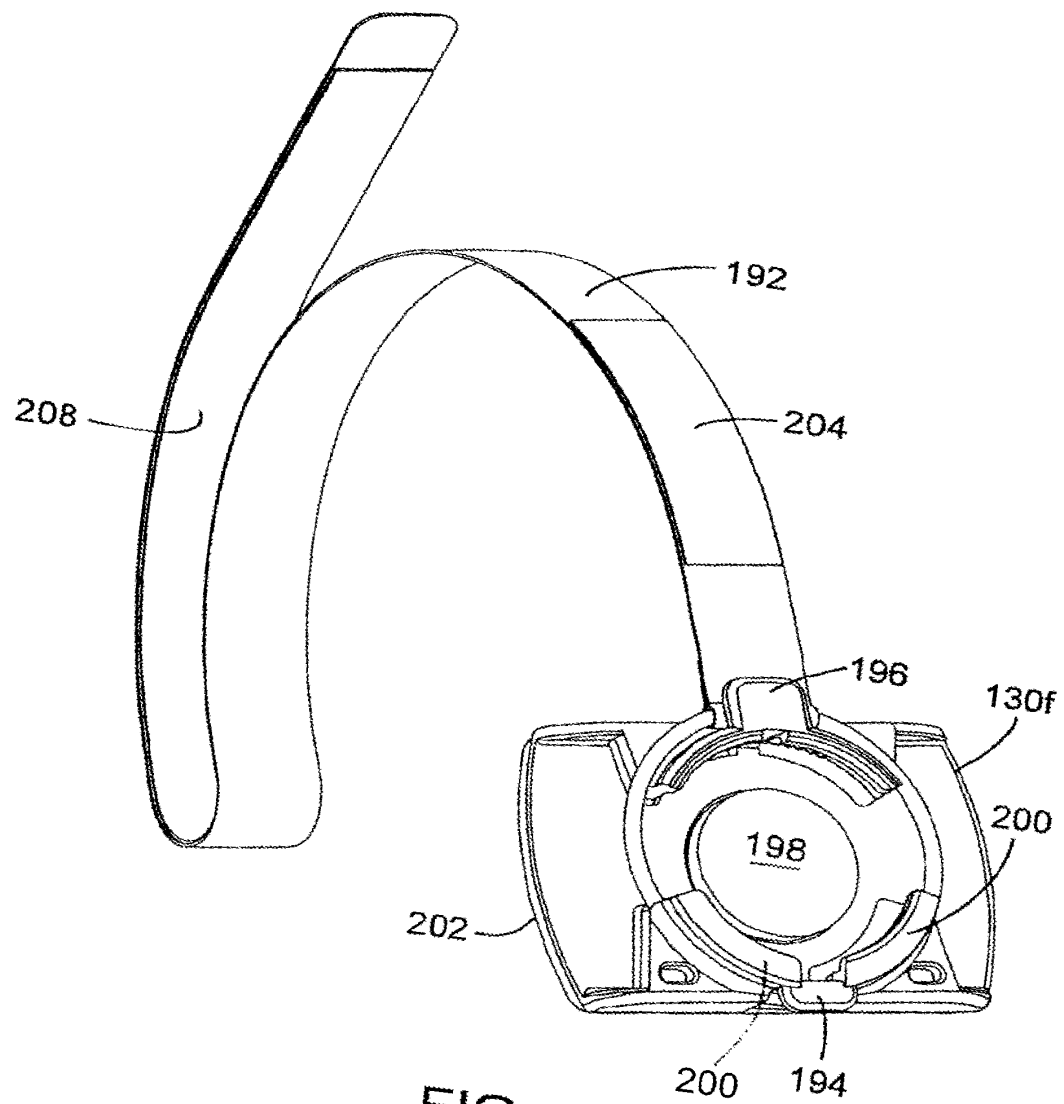


FIG. 17

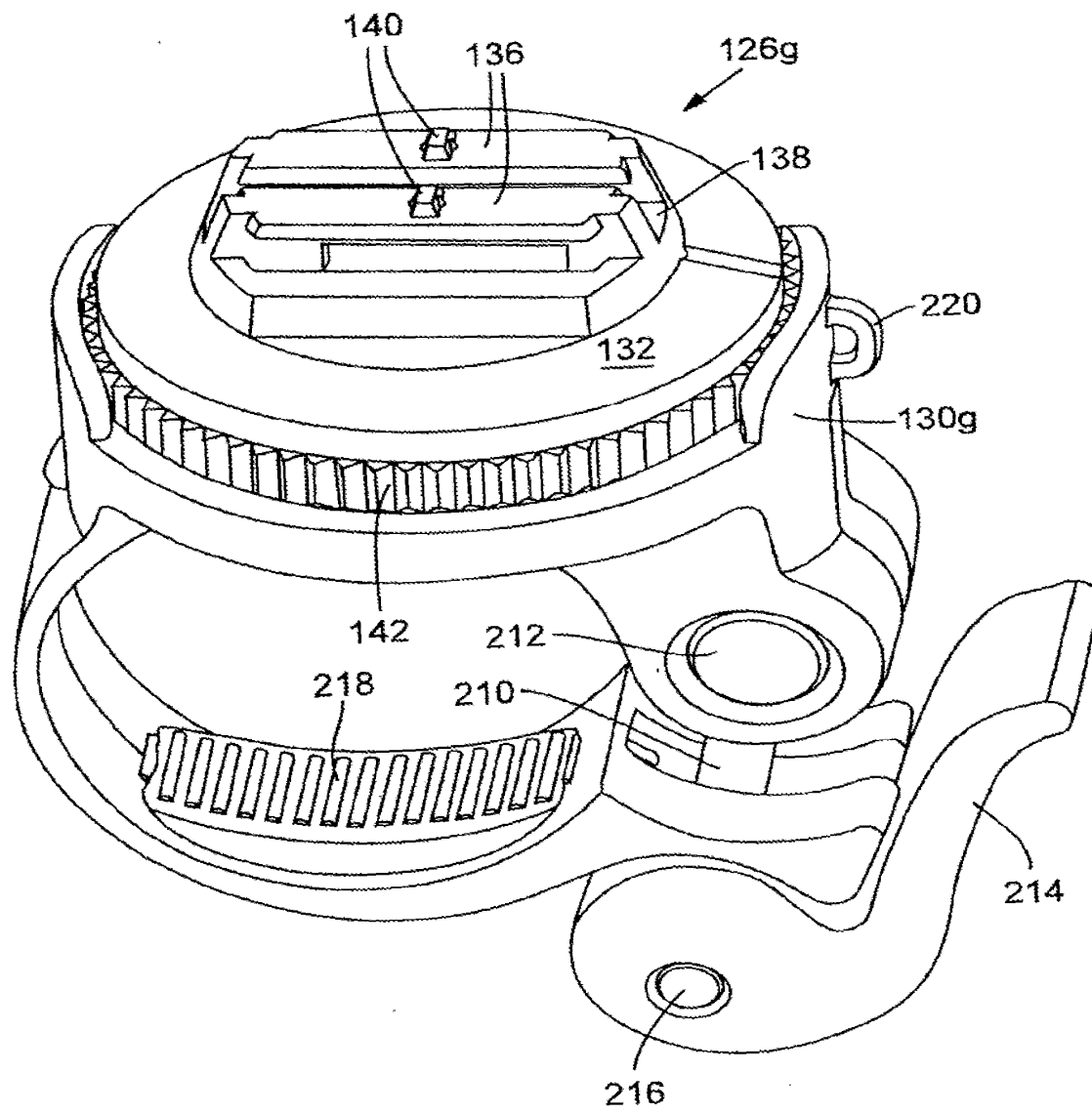
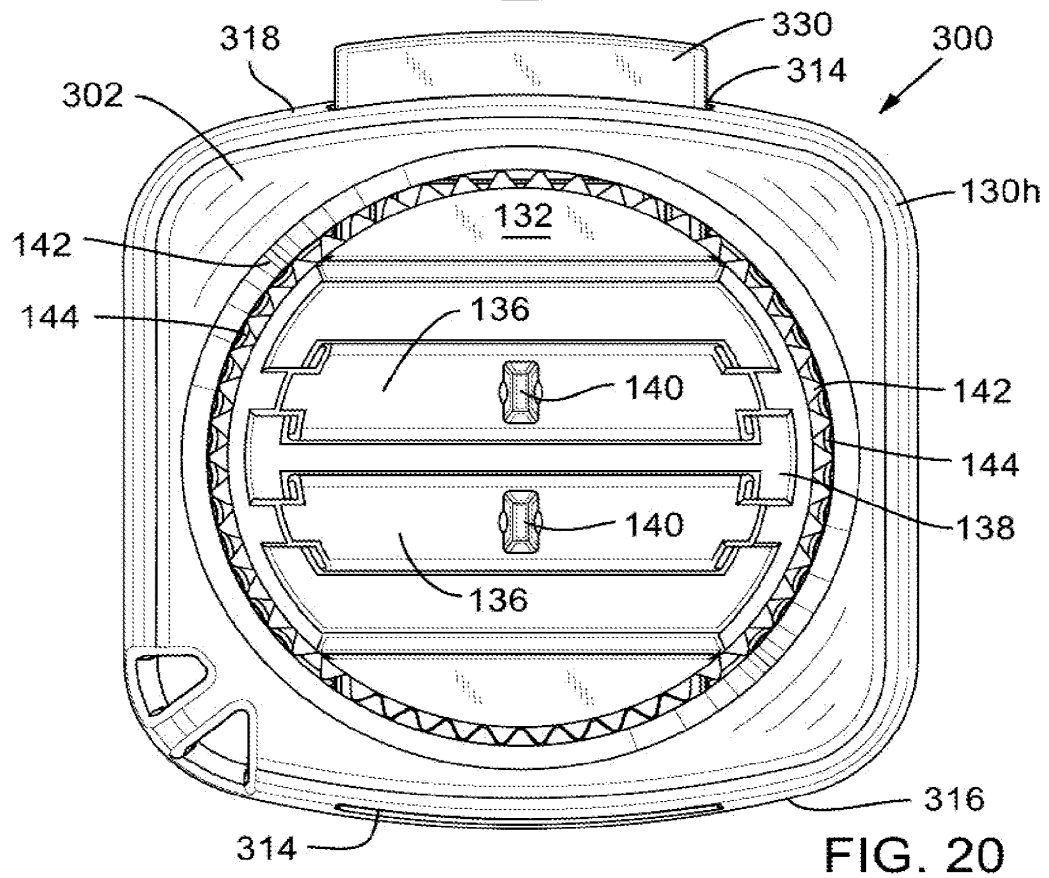
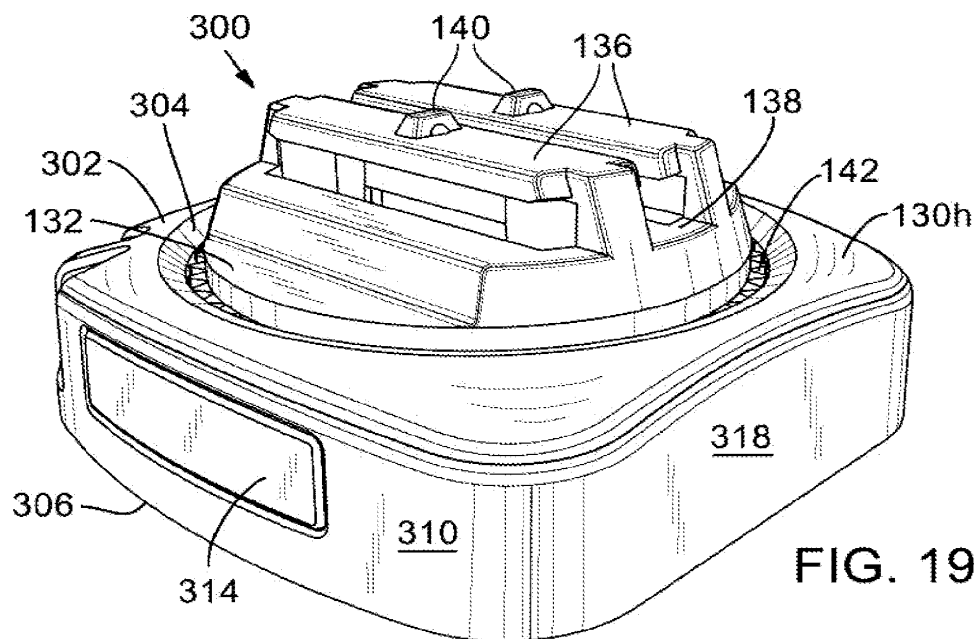


FIG. 18



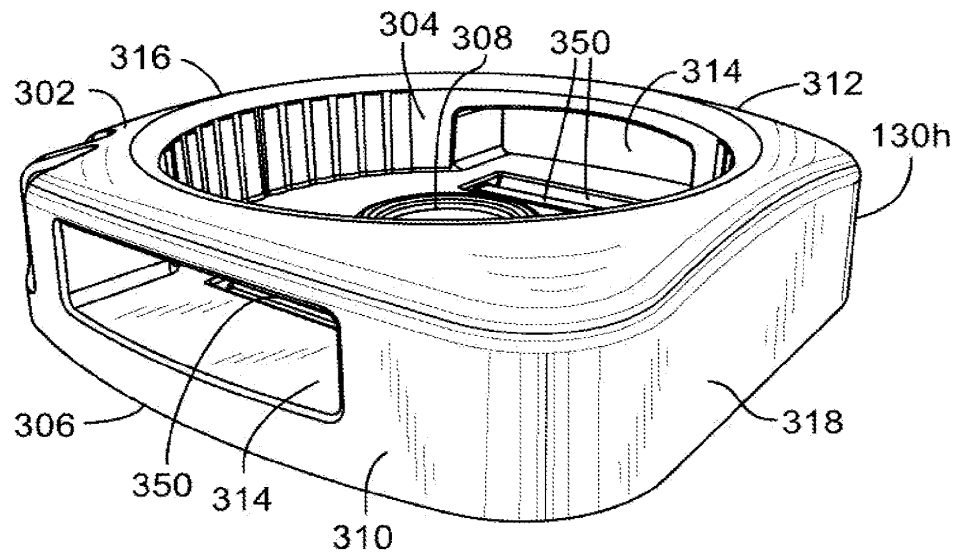


FIG. 21

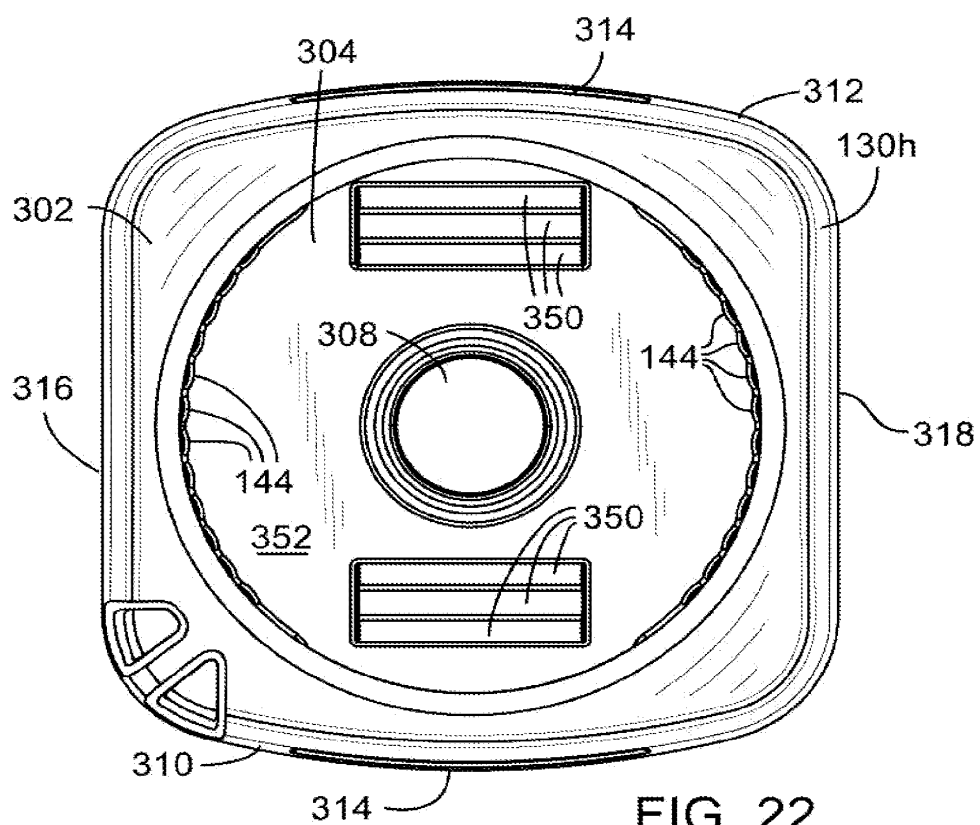


FIG. 22

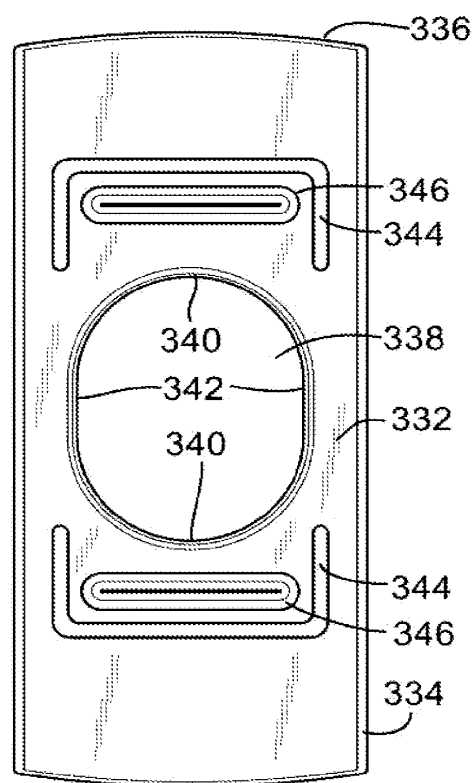
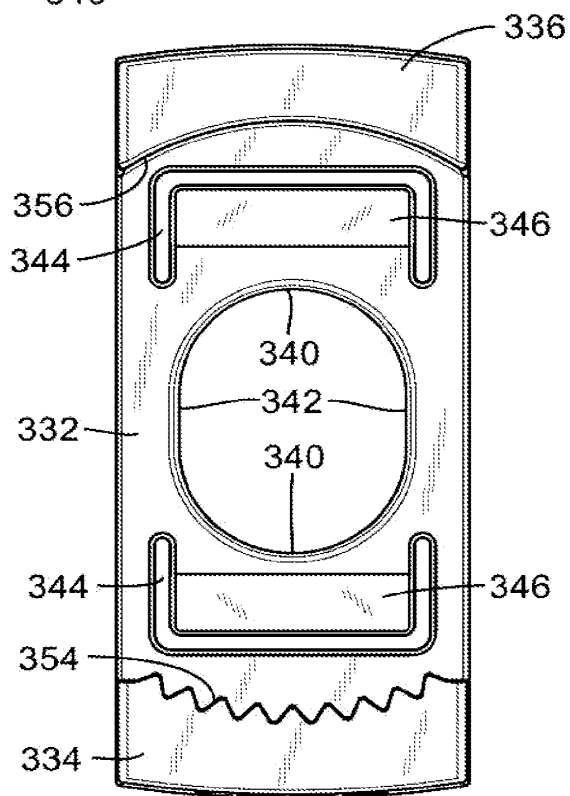
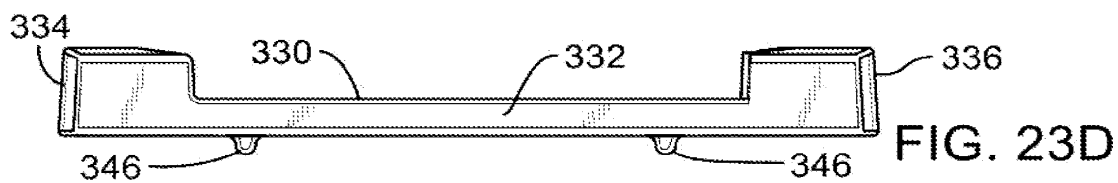
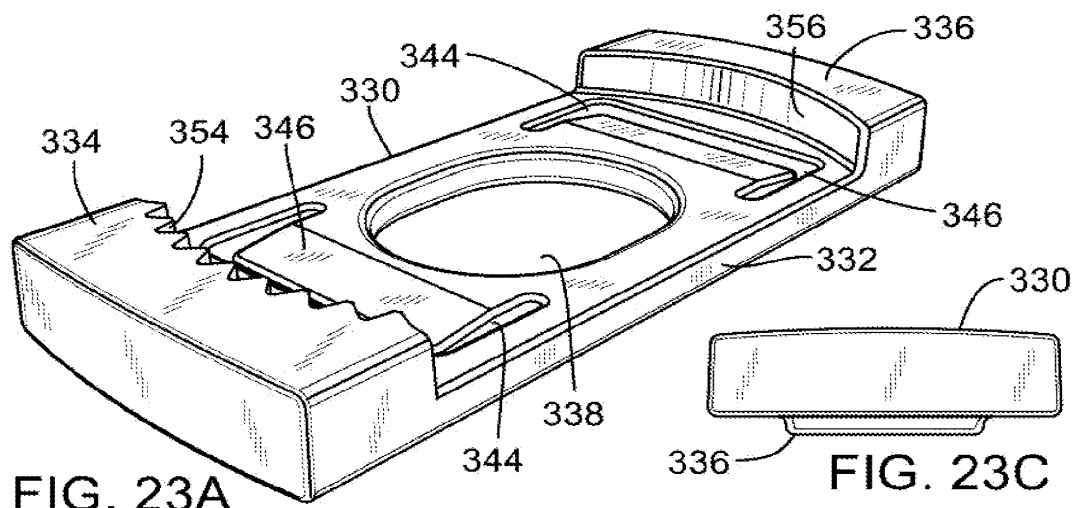


FIG. 23B

FIG. 23E

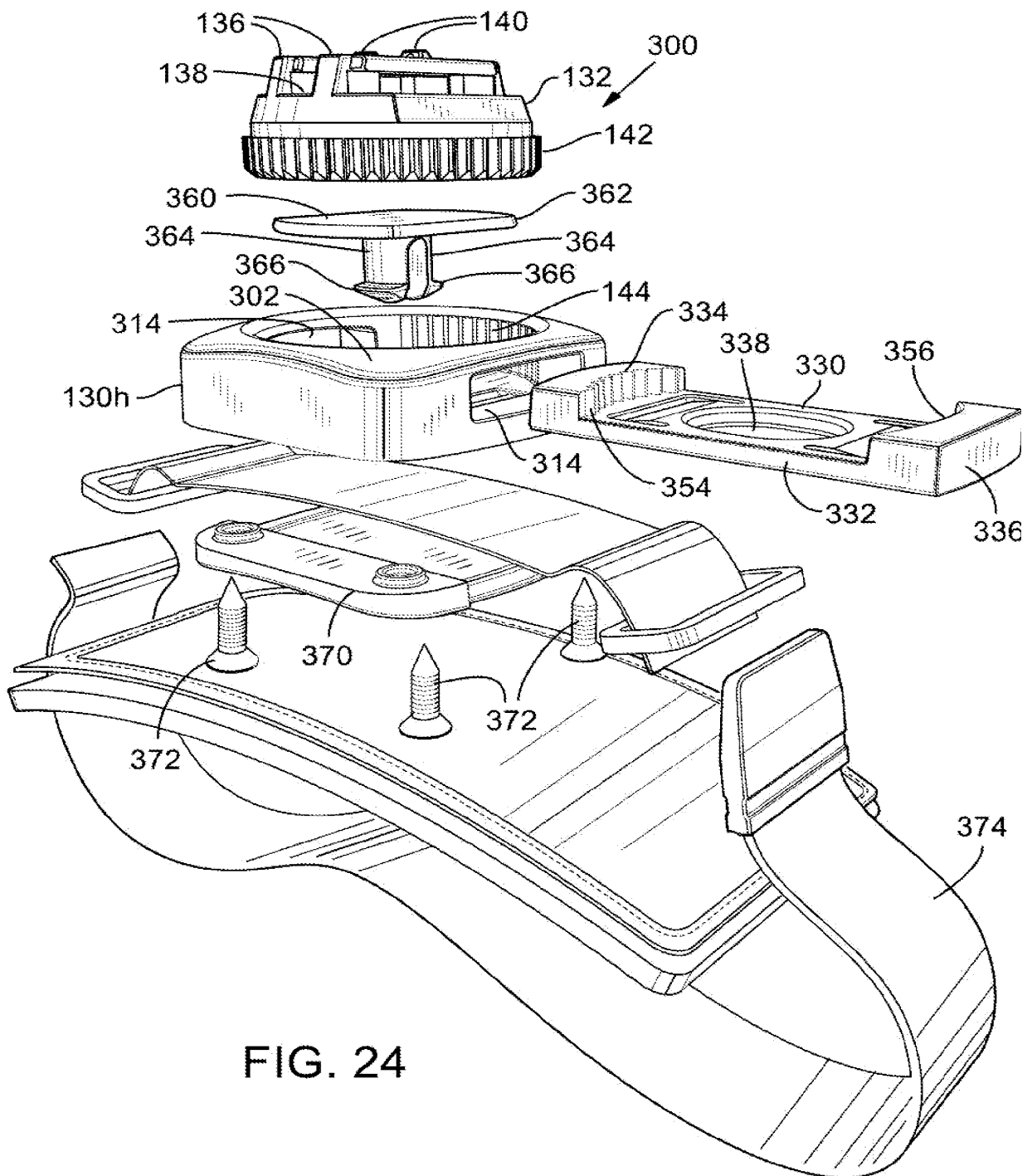
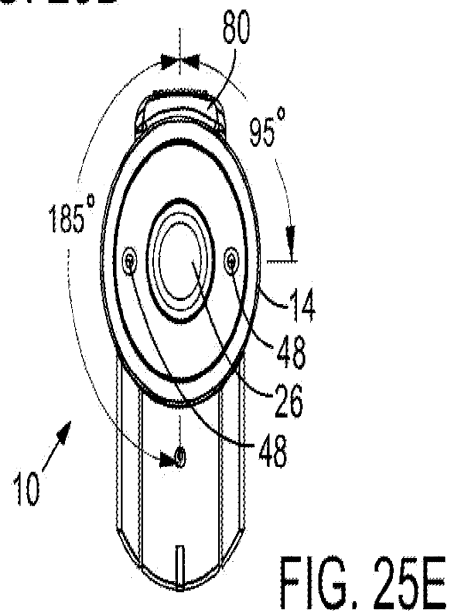
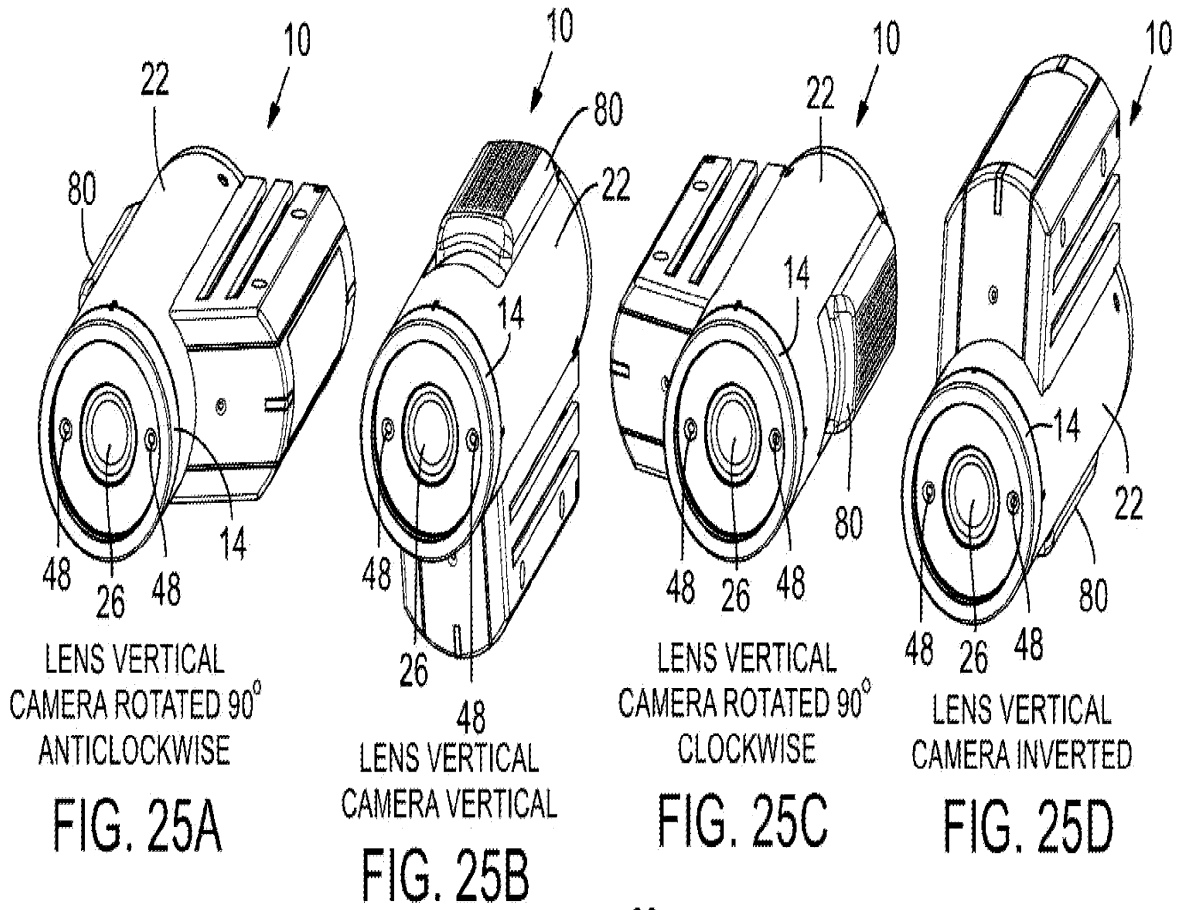


FIG. 24



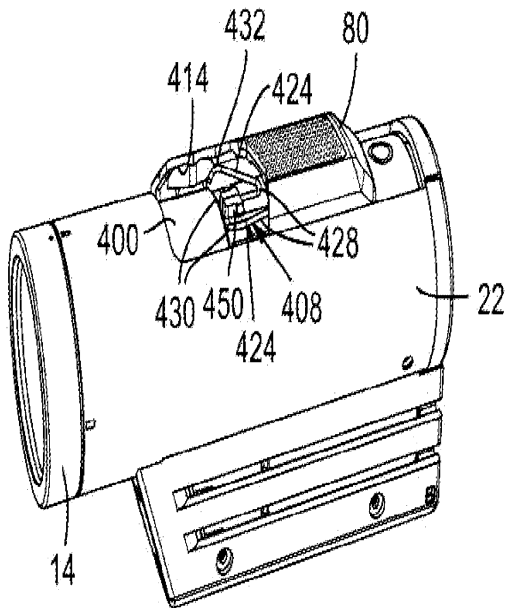


FIG. 26A

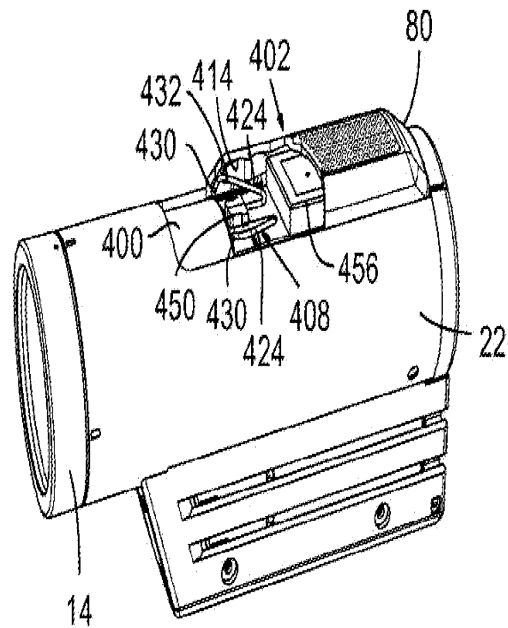


FIG. 27A

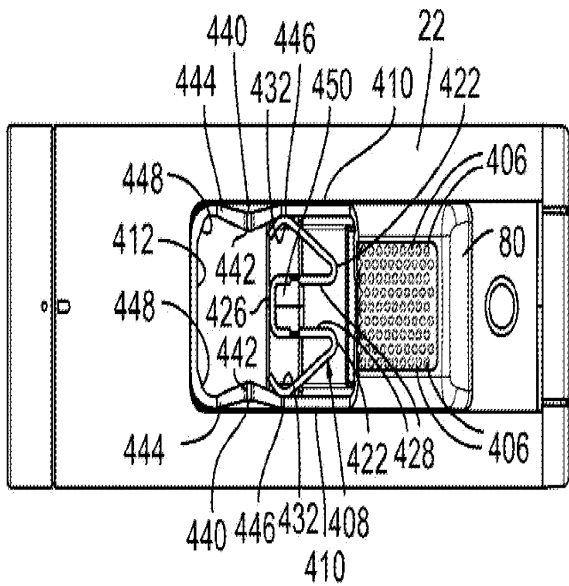


FIG. 26B

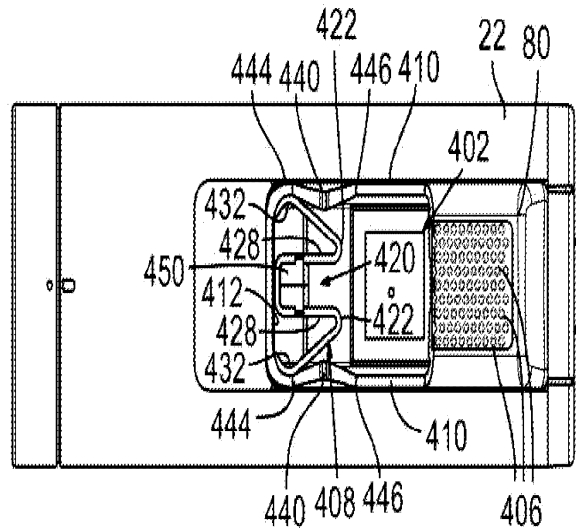


FIG. 27B

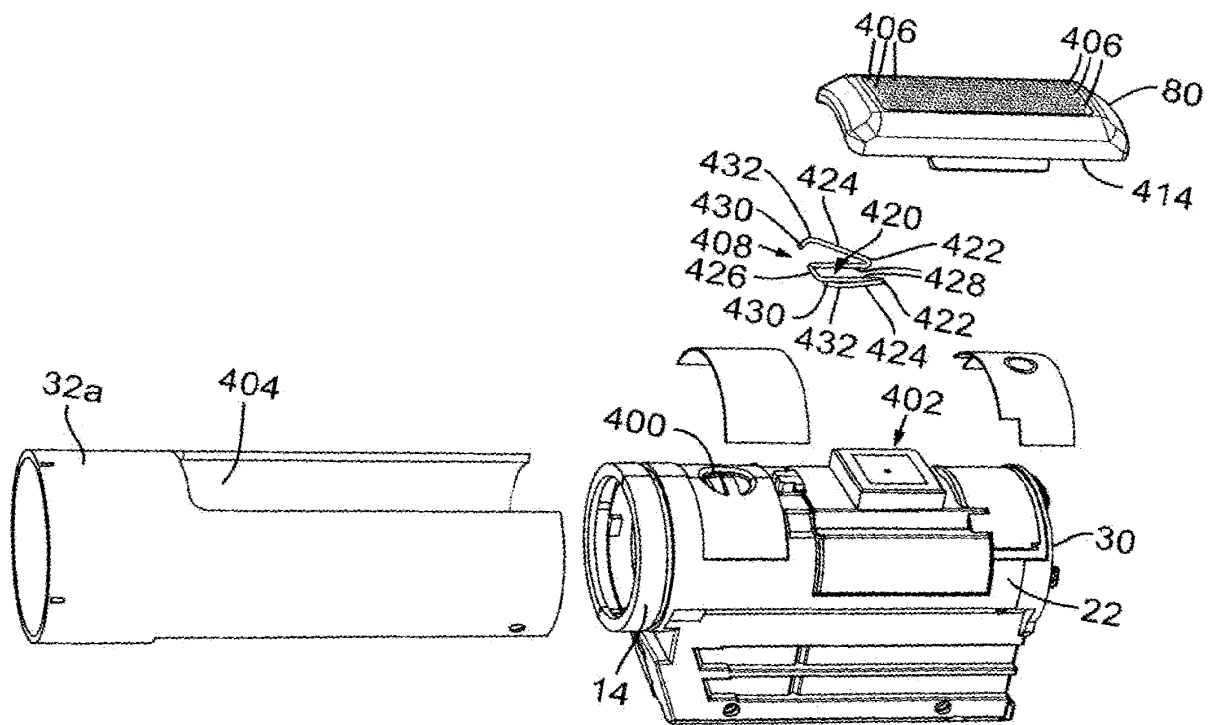
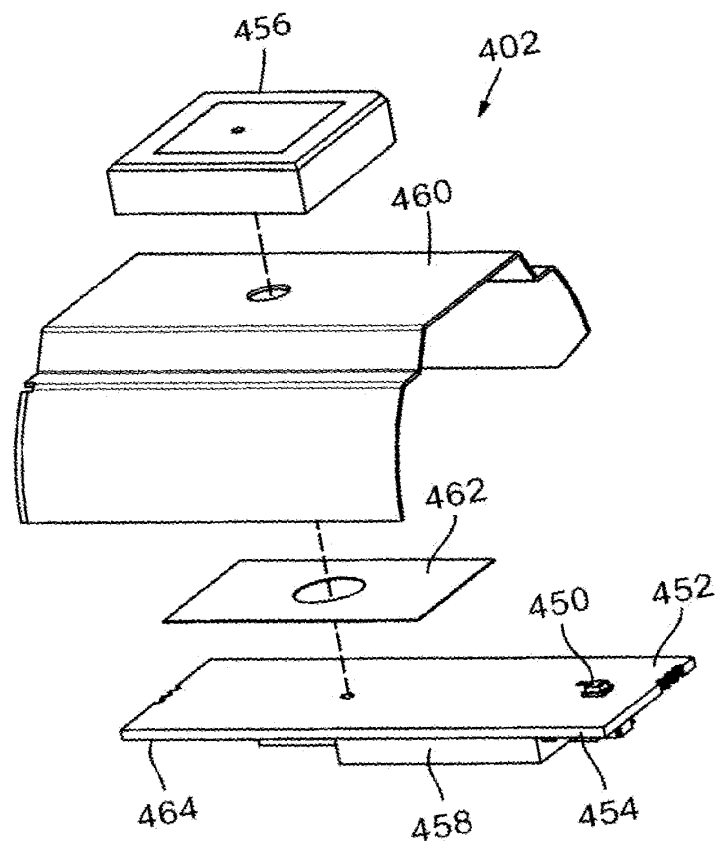
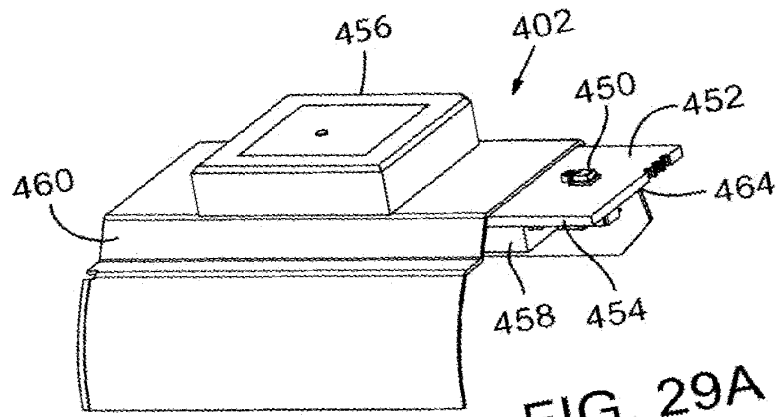


FIG. 28

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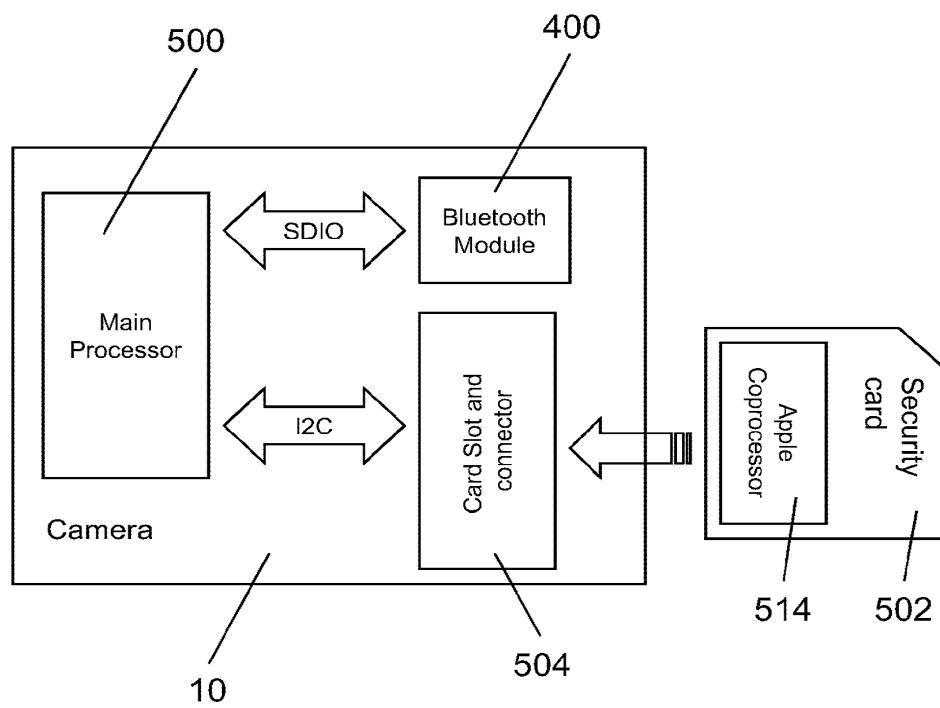
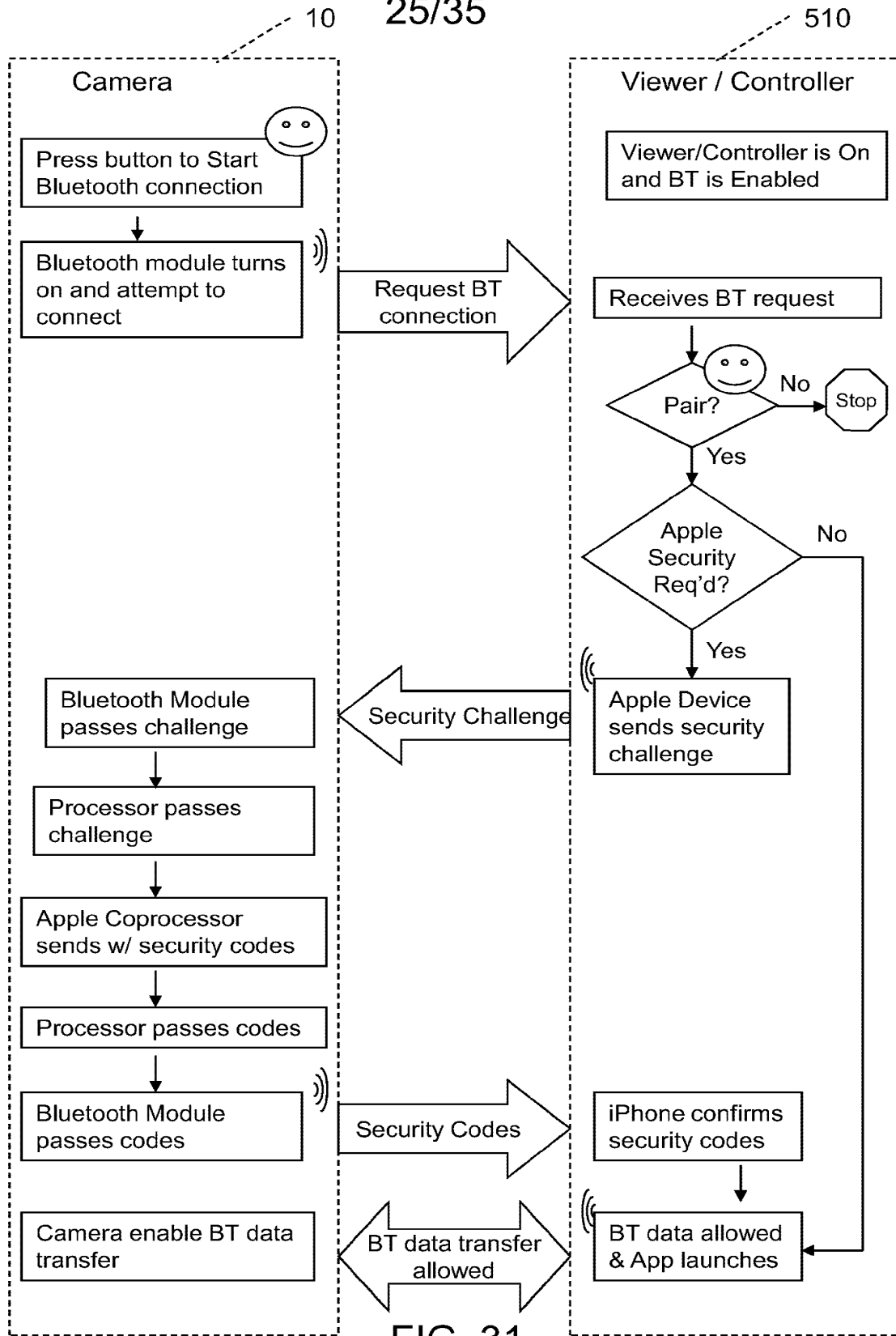


FIG. 30



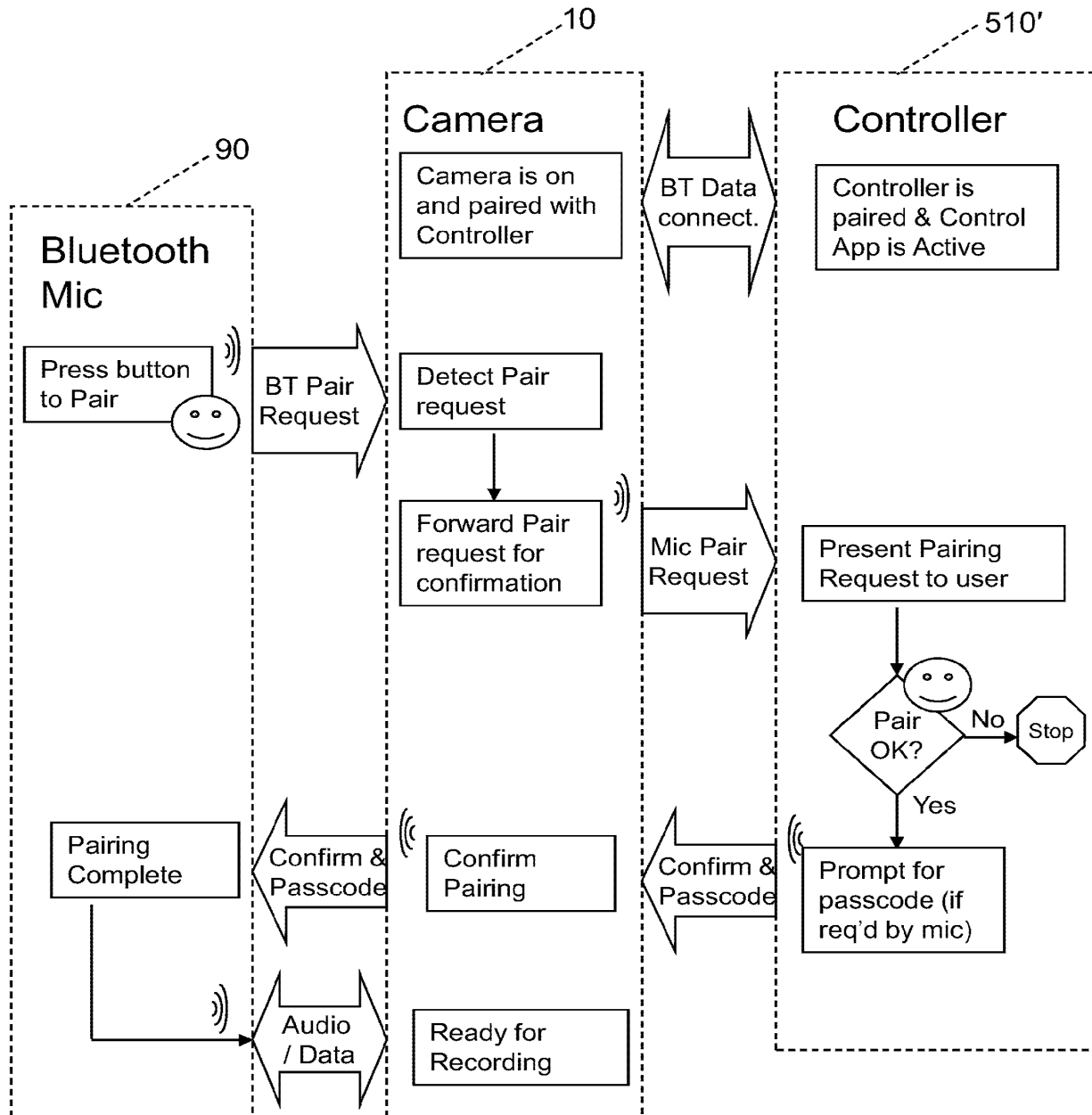


FIG. 32

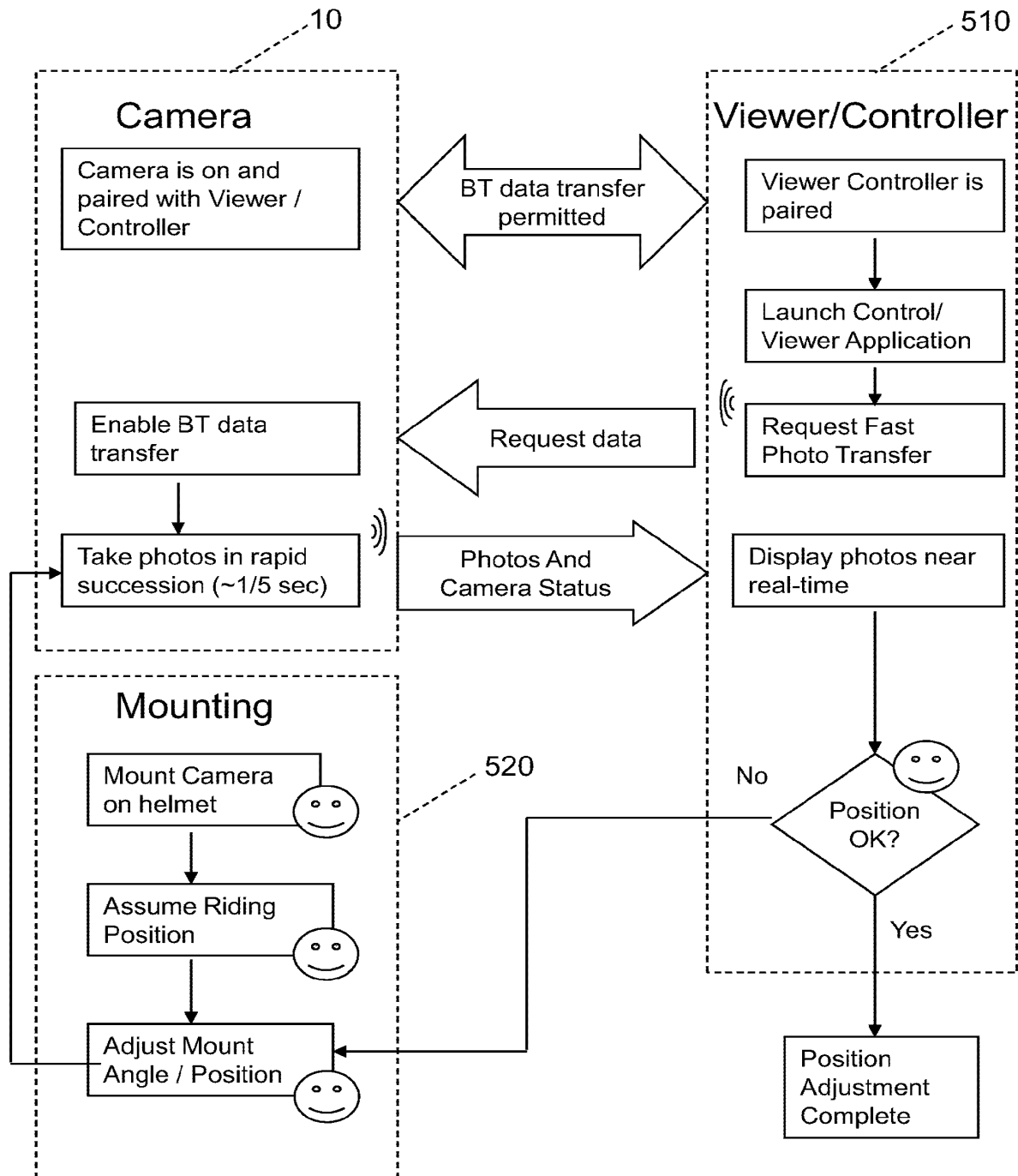


FIG. 33

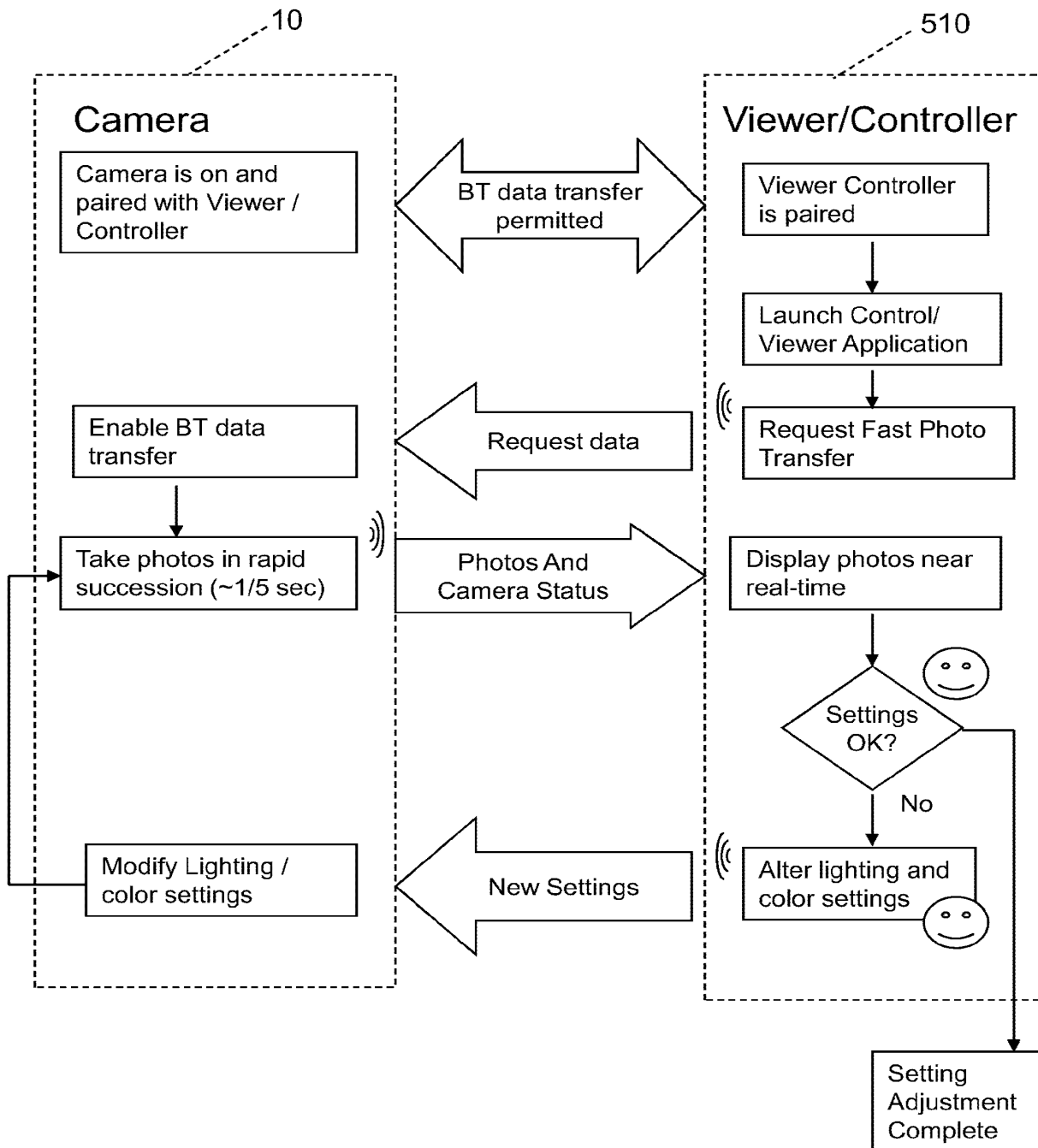
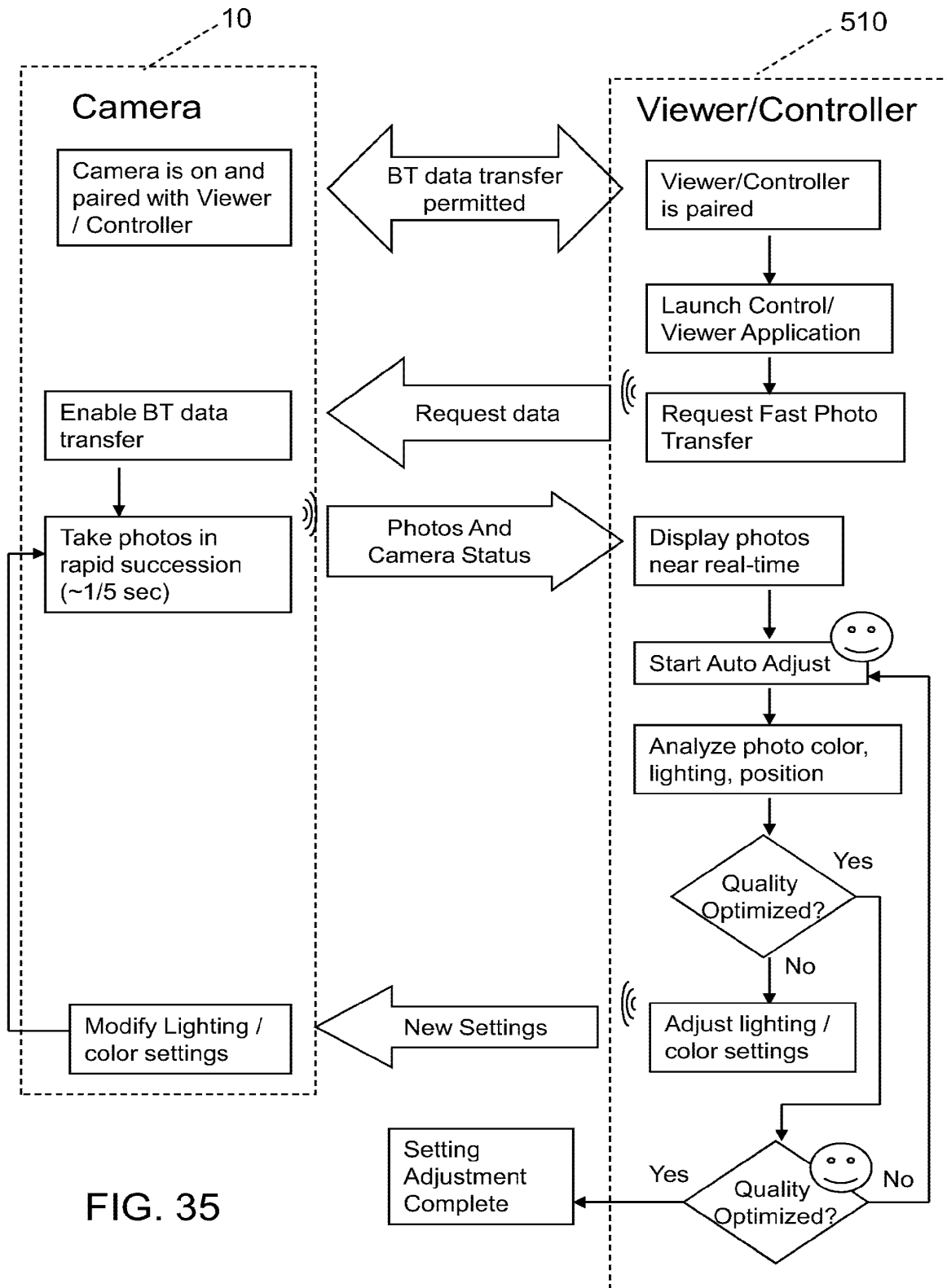


FIG. 34



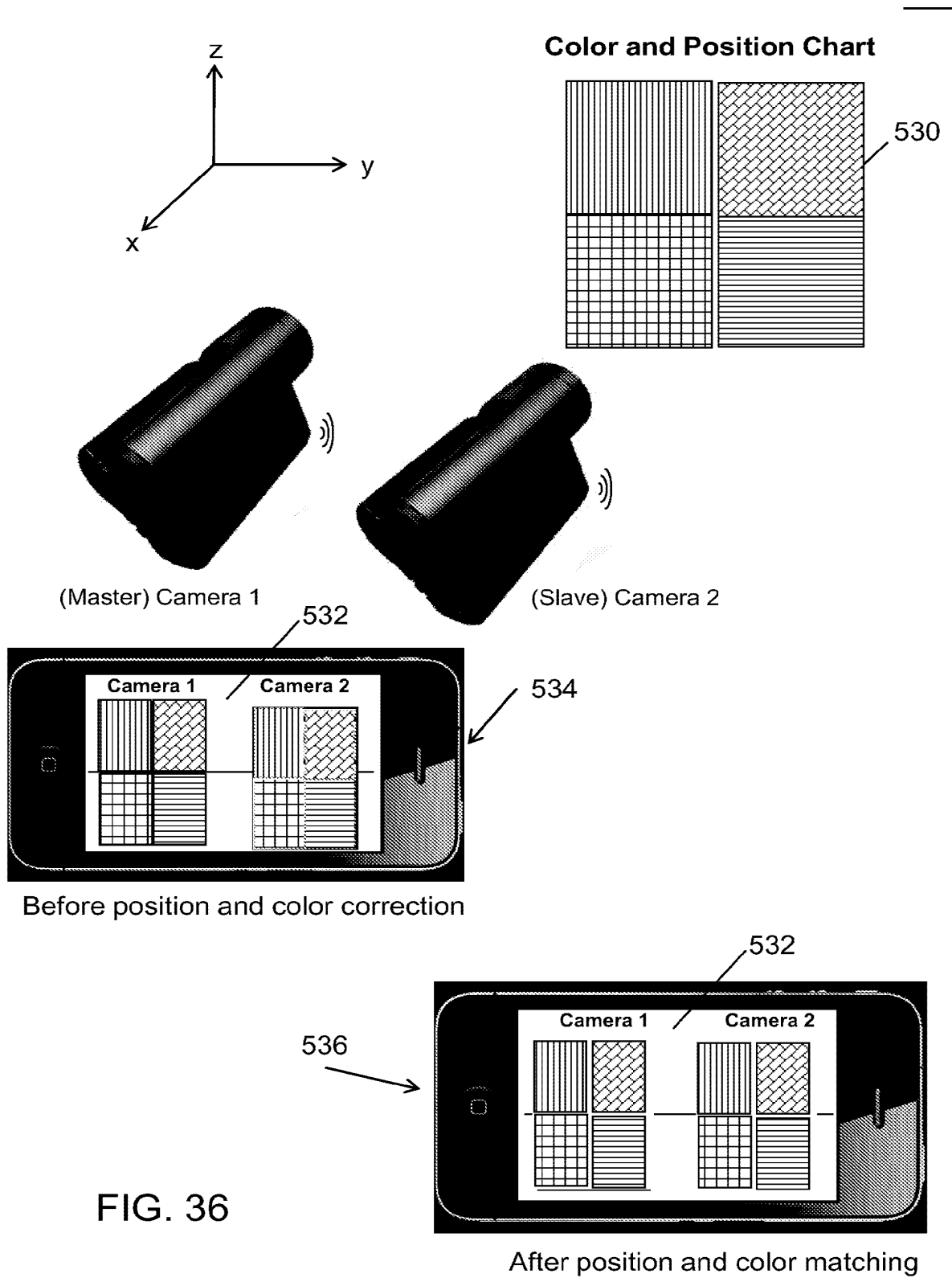


FIG. 36

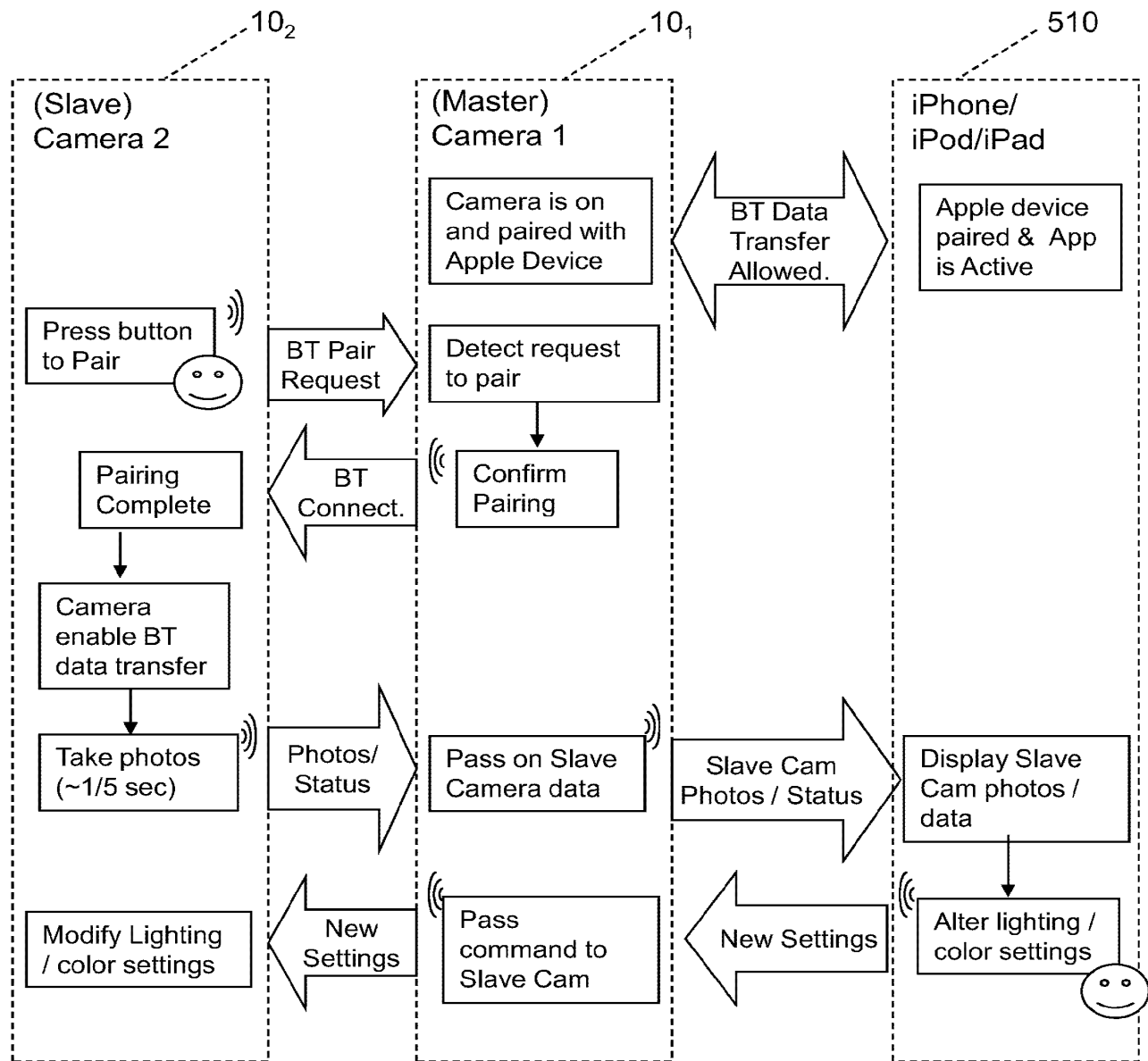


FIG. 37

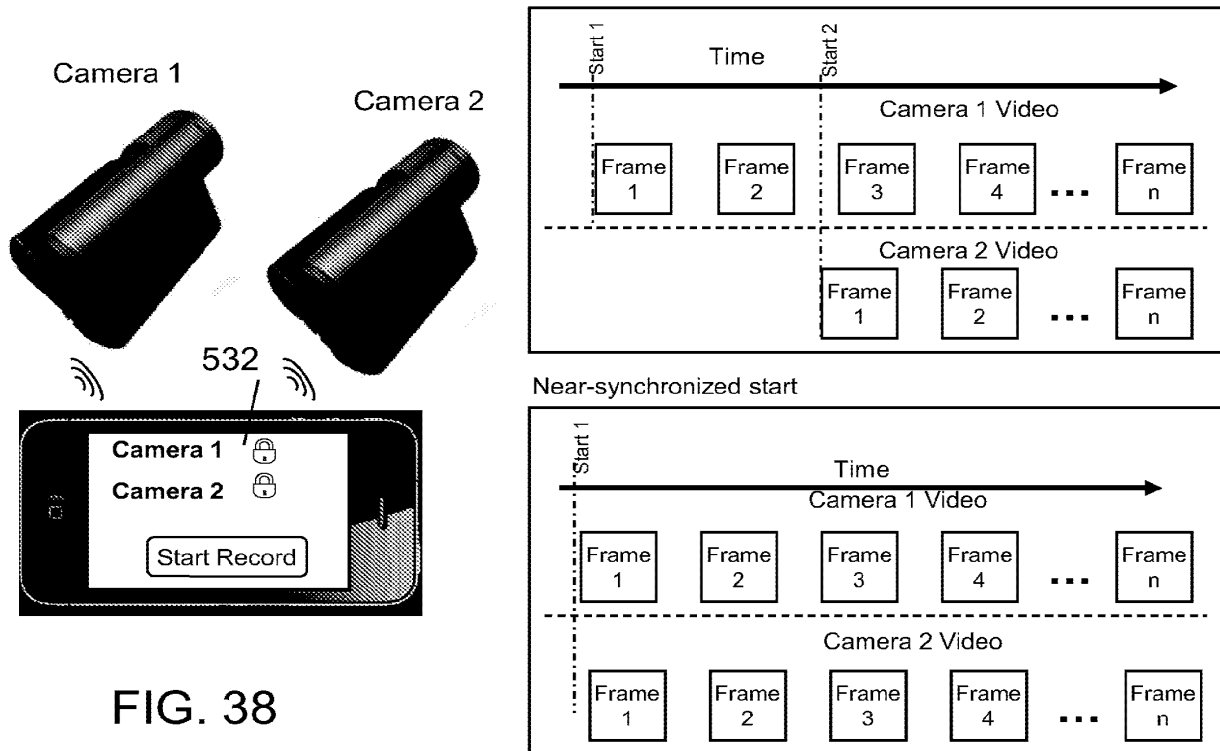
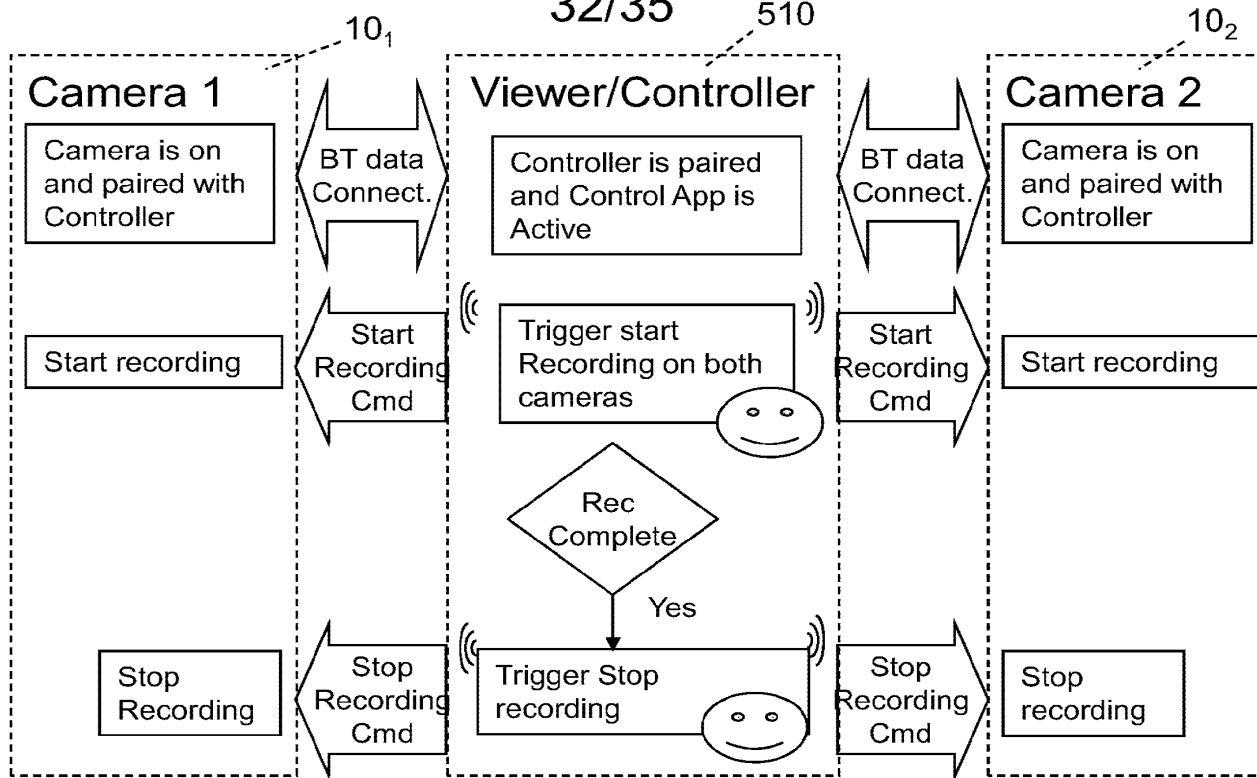


FIG. 38

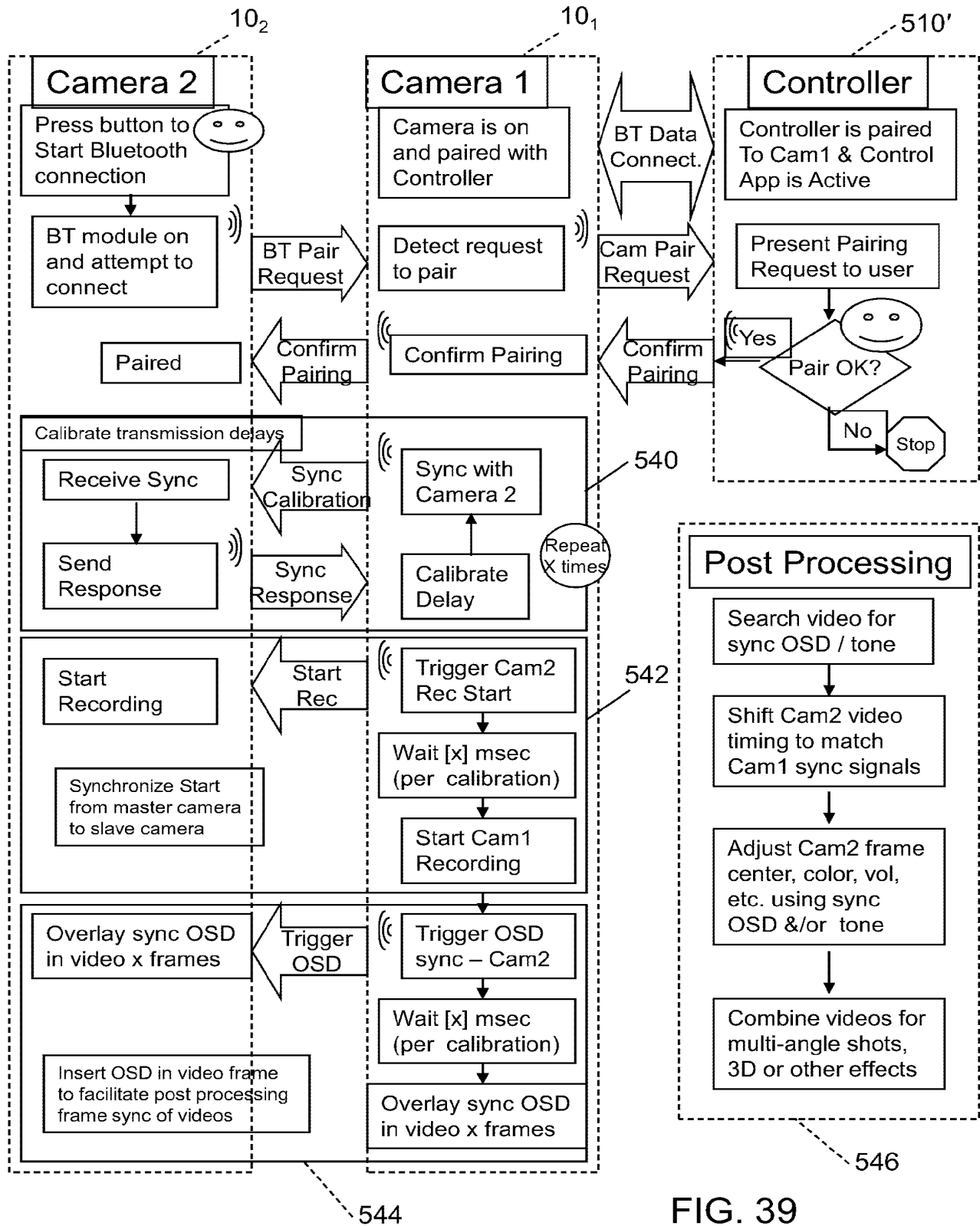


FIG. 39

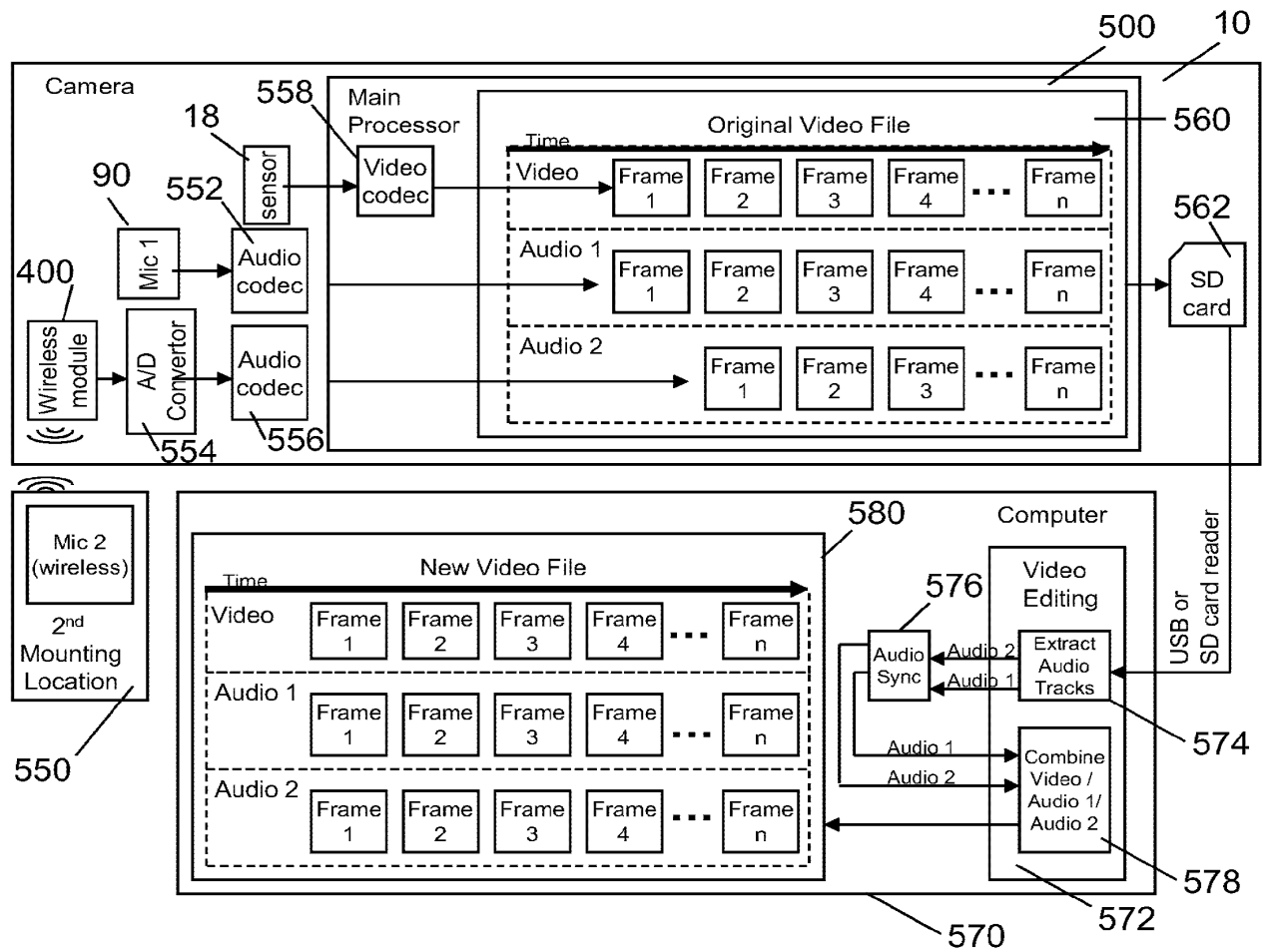


FIG. 40

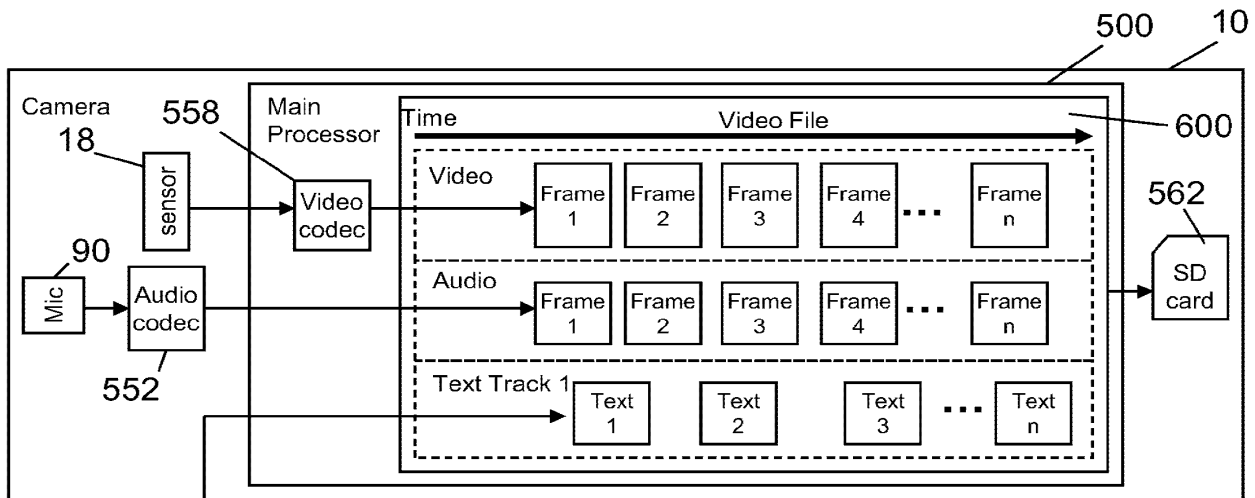


FIG. 41

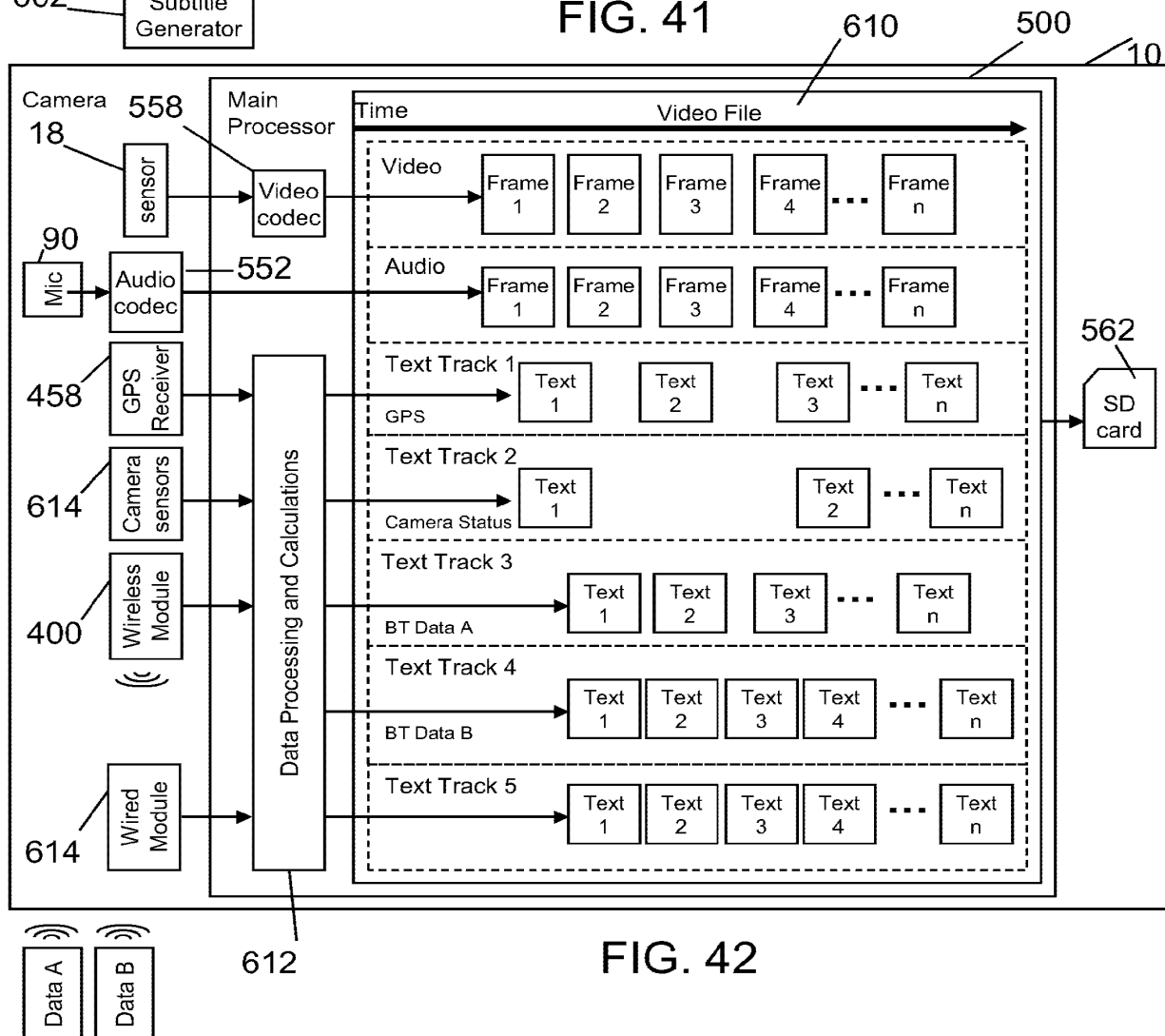


FIG. 42

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(51) INT CL⁷
B60R 1/00

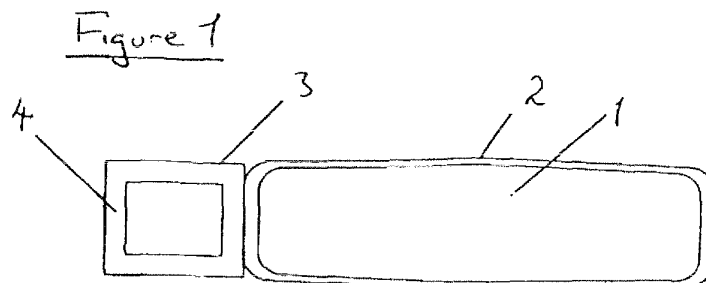
(52) UK CL (Edition R)
B7J J69

(56) Documents Cited
US 5642238 A **US 5289321 A**

(58) Field of Search
UK CL (Edition Q) **B7J J69**
INT CL⁶ **B60R 1/00 1/02 1/08**
Online: EPODOC, WPI, JAPIO

(54) Abstract Title
Vehicle reversing aid

(57) A vehicle reversing aid which provides the vehicle driver with an enhanced view of the region adjacent to the rear of the vehicle is provided by a video camera and a rear view assembly, characterised in that the assembly includes a first module, typically a rear view mirror (1), and a second module including a display screen (3) to show the image captured by the video camera. The driver simultaneously sees a general view to the rear of the vehicle and a close-up view of the region at the rear of the vehicle as displayed on the screen (3). The display screen 3 may be located within the area of the mirror 1.



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Figure 1

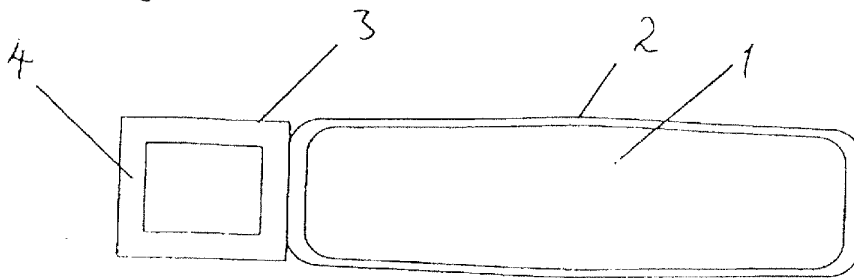
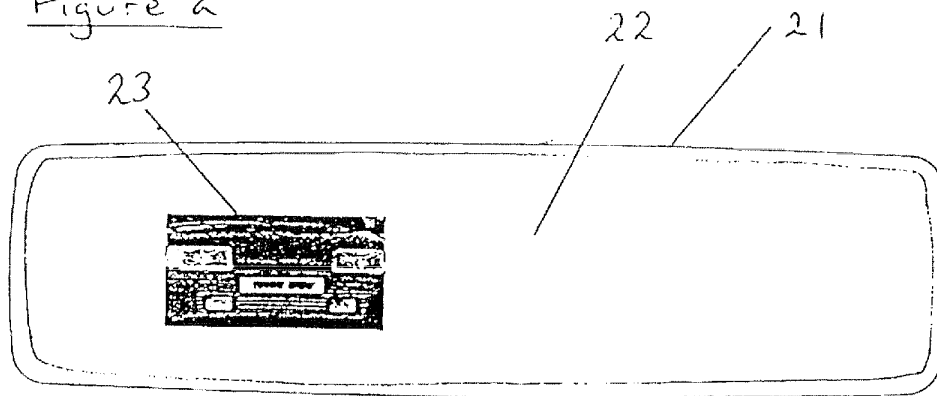


Figure 2



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Figure 3a

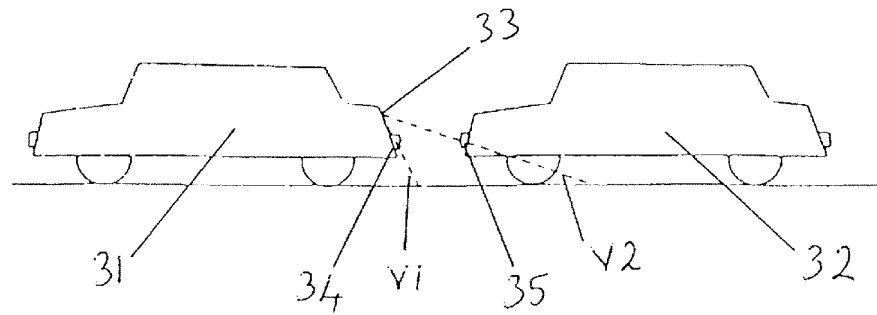
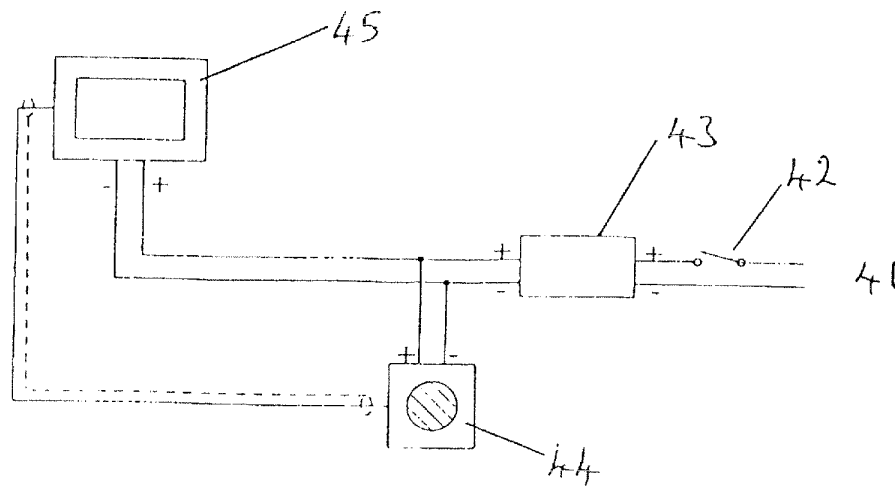


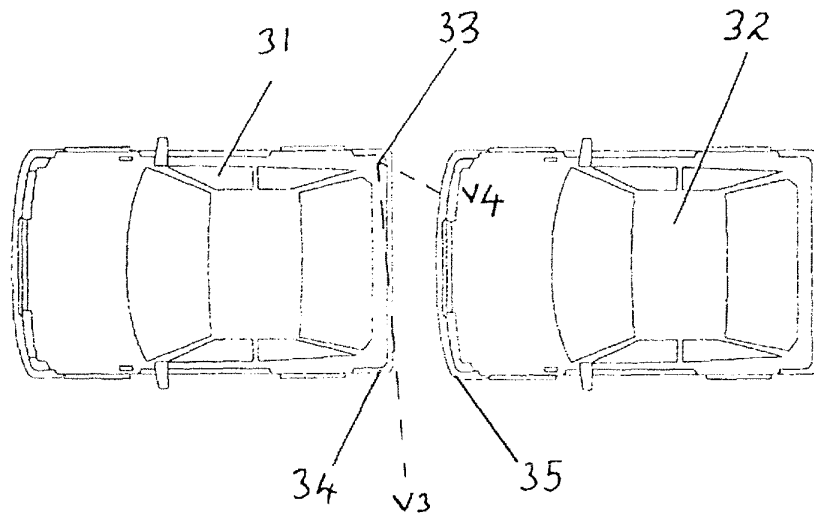
Figure 4



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Figure 3b



GB 1486

Vehicle reversing aid

This invention relates to a vehicle reversing aid which provides the vehicle driver with an enhanced view of the region adjacent to the rear of the vehicle.

5 Good awareness of what is behind a moving vehicle is of assistance to the driver at all times but especially when reversing and most particularly when reversing in a confined space. The awareness is important for reasons of safety and for
10 disputes between their respective owners and insurers. Neither interior nor exterior mirrors give a clear view of the region adjacent to the rear of the vehicle. A particular difficulty arises in estimating the distance from an adjacent object such as a vehicle or an obstruction. In reversing into a parking
15 space between vehicles at a kerbside many car drivers find it hard to judge the distance from the vehicle behind them.

It has hitherto been proposed, particularly for large vehicles, to mount a video camera at the rear of the vehicle to monitor
20 the presence of any object close to the vehicle and to display the video image on a screen on the dashboard so as to indicate the position of the object relative to the vehicle.

The present invention has the objective of providing a clear
25 view for a vehicle driver of all aspects of the situation behind the vehicle.

According to the present invention there is provided a reversing aid for a driver-operated vehicle which has a rear view assembly
30 and is fitted at the rear with a video camera directed to an area immediately to the rear of the vehicle, characterised in that the assembly includes two display modules, the first module providing a general view to the rear of the vehicle and the

second module comprises a display screen to show the image captured by the video camera.

The reversing aid according to the invention offers the
5 advantage of simultaneously presenting to the driver both a
general view, usually a wide angle view, to the rear of the
vehicle and a close-up view of the area to the rear of the
vehicle as displayed on the video screen. This combination has
important safety implications in that a single glance takes in
10 the situation distant from the vehicle and immediately adjacent
to it. It is also beneficial in that the driver instinctively
looks to a rear view unit to assess the position behind the
vehicle and thus conveniently takes in whichever view is most
relevant. In the case of reversing into a parking space the
15 driver can pay more attention to the video image.

A further advantage of the reversing aid according to the
invention is that the video screen does not occupy any space on
the vehicle dashboard or console, leaving these free for the
20 customary instrument gauges and controls. Indeed in many modern
cars there is no spare space in the region of the dashboard or
console.

The first module of the assembly can simply be a conventional
25 rear view mirror but can alternatively be a second display
screen linked to a second video camera which is aligned to give
a general view to the rear of the vehicle.

The video camera which provides a close-up view (referred to
30 herein as the "close-up" camera) is preferably located in a
position at which it gives an angled view to the rear. This can
be achieved by mounting the camera at an angle or by facing the
camera directly backwards with a small interposed mirror to give
the required view. The positioning of the camera and any
35 interposed mirror is desirably such as to give an image which

shows both the rear of the vehicle and the leading portion of an adjacent object. Such an image assists in simultaneously showing the vehicle driver both the distance between the vehicle and the object, such that the driver can manoeuvre the vehicle
5 with great precision.

The close-up camera or any interposed mirror is thus suitably located above or below the vehicle's rear bumper (fender) - or the position this would occupy if present - or to one side of
10 the rear of the vehicle. One convenient location is within the vehicle's rear light cluster.

The positioning of the camera(s) is preferably chosen to provide protection against damage and to avoid obstructions to the
15 required view.

Within the assembly the respective locations of the first and second modules are preferably chosen to complement each other. It is preferred that the image from the or each video camera be
20 laterally inverted for display on the screen so as to correspond to the reversal provided by a conventional mirror. Complementary images in the assembly, whether both from video cameras or from a mirror for the general view and video camera for the close-up view, assist in allowing the driver to make a
25 rapid simultaneous assessment of the situation behind the vehicle.

While the close-up view can be located within the area of the general view, it is preferably located outside but immediately
30 adjacent to the general view.

The video camera(s) can be monochrome or colour but monochrome is generally preferred as giving higher sensitivity than a colour camera. For both the general and close-up views the
35 preferred depth of focus is from about 10 mm to infinity. A wide

viewing angle is desirable, from about 70° up to almost 180° and can be provided by a suitable lens, e.g. a fish-eye lens.

In general just one video camera is sufficient for the
5 respective view, but the invention also offers the possibility
of using more than one camera. Similarly the assembly can
employ several video screens, each screen giving a different
view to the rear of the vehicle. Multiple screens showing views
from multiple cameras can be shared between different
10 assemblies, for example a screen on a left-hand rear view
assembly showing an image to the left of the vehicle, a screen
on a right-hand rear view assembly showing an image to the right
of the vehicle and a screen on a central interior assembly
showing an image viewed from the centre of the vehicle.

15 The assembly may form an interior rear view unit or an exterior
rear view unit. In certain instances it may be desirable for
more than one of the rear view units on the vehicle to be an
assembly according to the invention, e.g. an interior mirror
20 plus screen and/or left and right side mirrors plus screens.
This ensures that the driver is presented with the close-up rear
view from whichever unit is observed.

Examples of suitable display screens include a liquid crystal
25 display (LCD), which may be backlit or reflective, a light
emitting polymer (LEP), or a thin film device deposited directly
on the rear view mirror.

The camera can typically include a lens module comprising an
30 optical lens that focuses an incoming light signal on to an
electronic detector. Examples of suitable detectors include a
charge-coupled device (CCD) and a complementary metal oxide
semiconductor (CMOS).

Electrical power for the screen(s) and camera(s) can conveniently be supplied by the battery of the vehicle, but an independent power supply for one or more of these can be employed if desired. The screen display can be provided at all
5 times the vehicle power is on, but alternatively can be arranged to be shown only when the vehicle is in its reversing mode. The latter option can be provided by a switch associated with the vehicle gear selection lever.

10 By way of illustration, the invention is further described with reference to the accompanying figures, in which:

Figure 1 is a view of a first type of rear view assembly in a reversing aid according to the invention.

15

Figure 2 is a view of a second type of rear view assembly according to the invention.

Figure 3a is a side view of a vehicle fitted with a reversing
20 aid according to the invention and of a second vehicle adjacent thereto.

Figure 3b is a plan view of a vehicle fitted with a reversing
25 aid according to the invention and of a second vehicle adjacent thereto.

Figure 4 is a circuit diagram of a reversing aid according to the invention.

30 The rear view assembly illustrated in Figure 1 includes a mirror 1 enclosed in a frame 2 to which is clamped a second frame 3 surrounding an LCD screen 4. The assembly is attached to the vehicle windscreen by a support post (not shown) connected to the back of the frame 2.

35

In the alternative version of assembly illustrated in Figure 2 includes a frame 21 encloses a mirror 22 but in this version an LCD screen 23 is located within the area of the mirror surface. The assembly is again attached to the vehicle windscreen by a support post (not shown) connected to the vehicle roof.

Figures 3a and 3b show a first car 31 fitted with a video camera 33 at the upper part of its boot lid and having an interior rear view assembly (not shown) according to the invention. The car 31 is shown reversing towards a second car 32. The video camera 33 is aligned to have a field of vision indicated by the dotted lines V1 and V2 (figure 3a) and V3 and V4 (figure 3b). In a fore and aft direction the field of vision takes in the rear bumper 34 of the car 31 and the front bumper 35 of the car 32. In a sideways direction the field of vision takes in almost the whole width of the rear bumper 34 of the car 31 and the front bumper 35 of the car 32 and of the kerb. The image on the on the display screen of the rear view assembly of car 31 thus gives a clear indication of the distance between the cars and their distance from the kerb.

The Figure 4 circuit diagram shows the wiring input 41 from a car battery (not shown) and a control switch 42 attached to the vehicle's gear selection lever (not shown). The circuit includes a DC converter 43, a video camera 44 and an LCD display unit 45. The DC converter 43, which is located in the boot of the car, provides a stable 12 V DC output from the input from the car battery. The camera 44 is a monochrome CCD camera with a standard $f = 3.6 \text{ mm}$ lens.

CLAIMS

1. A reversing aid for a driver-operated vehicle which has a rear view assembly and is fitted at the rear with a video camera (33) directed to an area immediately to the rear of the vehicle, characterised in that that the assembly includes two display modules (1,3), the first module (1) providing a general view to the rear of the vehicle and the second module comprises a display screen (3) to show the image captured by the video camera (33).
2. A reversing aid as claimed in claim 1, in which the first module is a rear-view mirror (1).
3. A reversing aid as claimed in claim 1 or claim 2, in which the display screen (3) shows the image from a camera (33) which gives an angled view to the rear.
4. A reversing aid as claimed in claim 1 or claim 2, in which the angled view is provided via an interposed mirror.
5. A reversing aid as claimed in any preceding claim, in which the display screen (3) shows the image from a camera (33) located above or below the vehicle's rear bumper or to one side of the rear of the vehicle.
6. A reversing aid as claimed in claim 4, in which the camera is located within the vehicle's rear light cluster.
7. A reversing aid as claimed in any preceding claim, in which the respective locations of the first and second modules complement each other.

8. A reversing aid as claimed in claim 6, in which the image from the video camera (33) is laterally inverted for display on the display screen (3).

5 9. A reversing aid as claimed in any preceding claim, in which the display screen (3) is located within the area of the first module (1).

10 10. A reversing aid as claimed in any of claims 1 to 8, in which the display screen (3) is located immediately adjacent to first module (1).

15 11. A reversing aid as claimed in any preceding claim, which has more than one screen, each screen giving a different view to the rear of the vehicle.

12. A reversing aid as claimed in any preceding claim, which forms an interior rear view unit.

20 13. A reversing aid as claimed in any of claims 1 to 11, which forms an exterior rear view unit.

25 14. A reversing aid as claimed in any preceding claim, in which the display screen (3) is selected from a liquid crystal display (LCD), either backlit or reflective, a light emitting polymer (LEP), or a thin film device deposited directly on the rear view mirror.

30 15. A reversing aid as claimed in any preceding claim, in which the screen display is shown only when the vehicle is in its reversing mode.



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UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.Q): B7J (J69)

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Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	US 5642238 (SALA) see Figure 3, column 2 lines 51-60 and column 3 lines 58-60	1-3,5-7, 9,11,13-15
X	US 5289321 (SECOR) see Figures 3,4 & 6, column 4 lines 11-22 and column 5 lines 27-30	1-3,5-8,10-12,14

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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(54) Title: PORTABLE VIDEO AND IMAGING SYSTEM

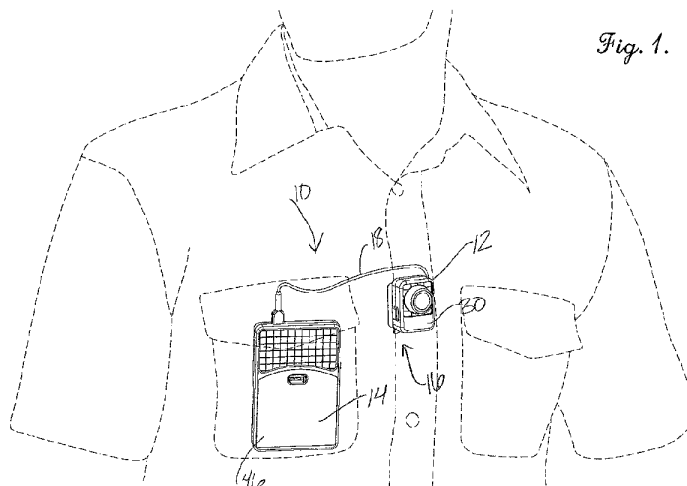


Fig. 1.

(57) Abstract: A portable video and imaging system includes a camera for capturing video of an event, and a video recording device for recording the captured video of the event. The camera is housed in a first housing, the recording device is housed in a second housing, and the first and second housings are physically separate. Various embodiments provide for the system to be mounted to a user's body, an article of clothing, such as a shirt or a hat, to a vehicle, or to an ancillary component carried by the user, such as a firearm.

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PORTABLE VIDEO AND IMAGING SYSTEM

RELATED APPLICATIONS

[0001] This non-provisional patent application claims priority benefit, with regard to all common subject matter, of earlier-filed U.S. Provisional Patent Application No. 61/707,348, filed September 28, 2012, and entitled "PORTABLE VIDEO AND IMAGING SYSTEM," and U.S. Provisional Patent Application No. 61/707,326, filed September 28, 2012, and entitled "MOBILE VIDEO AND IMAGING SYSTEM." The identified earlier-filed provisional patent applications are hereby incorporated by reference in their entirety into the present application.

BACKGROUND

1. FIELD

[0002] Embodiments of the invention relate to a portable system for recording videos and still images. More particularly, embodiments of the invention relate to a portable digital video recording system sized to be worn on a user's body and configured to be mounted in a plurality of locations on the user's body, including a clothing article worn by the user, on a device carried by the user, such as a firearm, or in a vehicle. In other embodiments, the portable video and imaging system may be mounted in or on a vehicle.

2. RELATED ART

[0003] Although recording devices for recording video and still images are generally known, the recording device is commonly housed in a single housing that stores a camera, a memory element, and a processing element. The single housing is

not mountable to a user's body. Moreover, when the recording device is used for law enforcement where captured video is frequently used as evidence, the loss of captured video due to damage or removal of the single housing of the recording device is problematic.

SUMMARY

[0004] Embodiments of the invention solve the above-mentioned problems by providing a computer program, method, apparatus, and system for mounting a small, portable digital video recording system to a user's body, an article of clothing, a device carried by the user, or in a vehicle.

[0005] An embodiment of the video recording system broadly comprises a camera component for capturing video of an event and a recording component comprising a processor and a memory associated with the camera component for storing the captured video. The camera component includes a camera housed within a housing having a size configured to mount on a user's body. The housing includes at least one input to instruct recording by the camera. The video recording system further includes a mounting assembly for mounting the camera to the user's body. In embodiments, the mounting assembly is a button-mount assembly including a slotted plate presenting a slot for receipt of a button through the slot.

[0006] Another embodiment of the video recording system broadly comprises the camera component and recording component described above. The mounting assembly, however, is a clip, such as an alligator clip, configured for grasping a clothing article of the user. In yet another embodiment, the mounting assembly is a hook-and-

loop fastener. An even further embodiment comprises a mounting assembly for mounting the camera and recording components to a vehicle and broadly comprising a cradle for holding the recording component and a mounting arm for holding the camera component, wherein the mounting arm is secured to the cradle. Other embodiments comprise mounting assemblies for securing at least one or both of the camera and recording components to a belt worn by the user, around a head of a user or hat worn by the user, and on a firearm carried by the user.

[0007] In embodiments of the invention, the camera component is in a first housing, and the recording component is in a second housing. The camera and recording components are communicatively coupled together, and the housings for the two components are physically separate housings.

[0008] This summary is provided to introduce a selection of concepts in a simplified form that are further described below in the detailed description. This summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter. Other aspects and advantages of the current invention will be apparent from the following detailed description of the embodiments and the accompanying drawing figures.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

[0009] Embodiments of the current invention are described in detail below with reference to the attached drawing figures, wherein:

[0010] Fig. 1 is an environmental view of a portable video and imaging system of embodiments of the invention and mounted on a user's body;

[0011] Fig. 2 is a front exploded view of the camera component mounted to a first mounting assembly that is a button-mount assembly;

[0012] Fig. 3 is a rear exploded view of the button-mount assembly of Fig. 2;

[0013] Fig. 4 is a rear perspective view of the button-mount assembly of Fig. 2;

[0014] Fig. 5 is an exploded view of the button-mount assembly and particularly illustrating mounting of the assembly on the user's body;

[0015] Fig. 6 is a fragment, right side elevation view of the camera component and button-mount assembly and particularly illustrating the assembly mounted to the button of the user's shirt;

[0016] Fig. 7 is a horizontal cross-sectional view taken through line 7-7 of Fig. 7 and illustrating a retention clip of the button-mount assembly;

[0017] Fig. 8 is an environmental view of a second mounting assembly of embodiments of the invention secured to the user's body;

[0018] Fig. 9 is a rear perspective view of the second mounting assembly and particularly illustrating a clip;

[0019] Fig. 10 is an exploded view of a third mounting assembly that is a hook-and-loop fastener;

[0020] Fig. 11 is a front exploded view of a fourth mounting assembly for securing the camera component and the recording component together in a vehicle and particularly illustrating the camera component mounted to the clip of the second mounting assembly;

- [0021]** Fig. 12 is a rear exploded view of the fourth mounting assembly of Fig. 11;
- [0022]** Fig. 13 is an exploded view of the clip and a mounting bracket of the fourth mounting assembly and particularly illustrating mounting of the camera component;
- [0023]** Fig. 14 is a fragment front perspective view of the clip mounted in the mounting bracket and particularly illustrating structure that frictionally secures the clip in place;
- [0024]** Fig. 15 is a front perspective view of the camera component mounted to the clip, and the clip mounted on a mounting arm of the fourth mounting assembly;
- [0025]** Fig. 16 is a rear perspective view of the fourth mounted assembly of Fig. 15;
- [0026]** Fig. 17 is a left side elevation view of the assembly of Fig. 15;
- [0027]** Fig. 18 is a front exploded view of a fifth mounting assembly similar to the fourth mounting assembly of Fig. 13 but particularly illustrating the camera component mounted to the button-mount assembly of Fig. 2;
- [0028]** Fig. 19 is a rear perspective view of the camera component mounted by the fifth mounting assembly;
- [0029]** Fig. 20 is a horizontal cross sectional view taken through line 20-20 of Fig. 19 and illustrating a boss secured within the button-mount assembly of Fig. 2;
- [0030]** Fig. 21 is an environmental view of a sixth mounting assembly for mounting the system to a user's head or hat;
- [0031]** Fig. 22 is a rear perspective view of a portion of the sixth mounting assembly and particularly illustrating mounting of the camera component;

[0032] Fig. 23 is a front exploded view of the camera component mounted via the sixth assembly and particularly illustrating a first angle of rotation of the camera component;

[0033] Fig. 24 is a rear exploded view of the camera component mounted via the sixth assembly of Fig. 23;

[0034] Fig. 25 is a rear perspective view of the camera component mounted by the sixth mounting assembly;

[0035] Fig. 26 is a front perspective view of a seventh mounting assembly for mounting the camera component;

[0036] Fig. 27 is a rear perspective view of the seventh mounting assembly of Fig. 26;

[0037] Fig. 28 is a front perspective view of an eighth mounting assembly for mounting the camera component;

[0038] Fig. 29 is a rear perspective view of the eighth mounting assembly of Fig. 28; and

[0039] Fig. 30 is a schematic of the camera component and recording component of embodiments of the invention.

[0040] The drawing figures do not limit the current invention to the specific embodiments disclosed and described herein. The drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the invention.

DETAILED DESCRIPTION

[0041] The following detailed description references the accompanying drawings that illustrate specific embodiments in which the invention can be practiced. The embodiments are intended to describe aspects of the invention in sufficient detail to enable those skilled in the art to practice the invention. Other embodiments can be utilized and changes can be made without departing from the scope of the current invention. The following detailed description is, therefore, not to be taken in a limiting sense. The scope of the current invention is defined only by the appended claims, along with the full scope of equivalents to which such claims are entitled.

[0042] In this description, references to “one embodiment,” “an embodiment,” or “embodiments” mean that the feature or features being referred to are included in at least one embodiment of the technology. Separate references to “one embodiment,” “an embodiment,” or “embodiments” in this description do not necessarily refer to the same embodiment and are also not mutually exclusive unless so stated and/or except as will be readily apparent to those skilled in the art from the description. For example, a feature, structure, act, etc. described in one embodiment may also be included in other embodiments, but is not necessarily included. Thus, the current technology can include a variety of combinations and/or integrations of the embodiments described herein.

[0043] Features and components of embodiments of the invention may be, in some respects, similar to features and components described in U.S. Application Serial No. 14/040,006, filed September 27, 2013, claiming priority to U.S. Provisional Patent Application No. 61/707,326, filed September 28, 2012, and entitled “MOBILE VIDEO AND IMAGING SYSTEM” (identified above in the Related Applications section), and

owned by the assignee of the present application. The referenced non-provisional application filed concurrently herewith and claiming priority to the '326 Provisional Application is incorporated by reference herein in its entirety. Additionally, the following patent and patent application, both of which are owned by the assignee of the present application, are incorporated by reference herein in their entirety: U.S. Patent No. 8,520,069, issued August 27, 2013, and entitled "VEHICLE-MOUNTED VIDEO SYSTEM WITH DISTRIBUTED PROCESSING; and U.S. Patent Application No. 13/967,151, filed August 14, 2013, entitled "COMPUTER PROGRAM, METHOD, AND SYSTEM FOR MANAGING MULTIPLE DATA RECORDING DEVICES."

[0044] Turning to the figures, and particularly Fig. 1, an embodiment of the present invention is a digital video recording system 10 broadly comprising a camera component 12, a recording component 14, and a mounting assembly 16. The digital video recording system 10 is portable and relatively small, such that the system can be easily carried by a user on the user's body, a clothing article of the user, a device carried by the user, such as a firearm, or in a vehicle. The system 10 is unobtrusive and lightweight so as to not interfere with routine activity by the user. Moreover, the mounting assembly 16 of the system 10 for mounting on the user's body or clothing article of the user provides a secure mount that will not become dislodged, even under active movement by the user.

[0045] In embodiments of the invention, the digital video recording system 10 is advantageous for use by law enforcement personnel during an event, such as approaching a suspect or performing an arrest. Law enforcement personnel routinely encounter physically demanding activities and other rigors. The mounting assembly 16

of embodiments of the invention provides secure mounting configurations that can be used by the law enforcement personnel during these demanding activities and based on their preference of location on the personnel's body or clothing. Although embodiments of the invention are adapted for law enforcement personnel, it should be appreciated that the digital video recording system 10 can be used by any user desiring to record events occurring in front of and around the user or a vehicle (in embodiments where the recorder is mounted in the vehicle).

[0046] In embodiments of the invention, the camera component 12 is physically separated from the recording component 14, such that each component 12,14 is housed in its own distinct housing, as described in more detail below. The camera and recording components 12,14 are, in embodiments, communicatively coupled via cabling 18, such as a pigtail cable having a mini-USB for interconnecting the two components. In alternative embodiments, the camera and recording components 12,14 are wirelessly communicatively coupled, and wireless signals comprising instructions or data may be transmitted via communications networks such as the Internet, Wi-Fi links, radio-frequency ("RF") links, Bluetooth technology, infrared (IR), Near Field Communication (NFC) technology, or long and short wave radio.

[0047] The camera component 12 is configured to capture video or still images (individually or collectively, "video") and to transmit the captured video to the recording component 14 for storage on a memory of the recording component, as further discussed below. By separating the housing for the camera component 12 from the housing for the recording component 14, the housing for the camera component can be very small, light, and easily mounted in multiple locations. Additionally, should the

camera component 12 be dislodged or removed during physical activity, such as an altercation between law enforcement personnel and a suspect, the recording component 14 that stores the captured video is not removed or damaged. For example, should the suspect remove the camera component 12 from the law enforcement personnel's body, the recording component 14 is not also removed (or at least not easily removed). In situations where the captured video is legally important to law enforcement personnel (such as evidence to establish a particular event occurred), insuring that the captured video is not stolen or destroyed is advantageous.

[0048] The camera component 12 generally includes image and audio capture components and circuitry, such as a camera 20, a microphone 22, and user interface elements 24 for providing input or instructions to the camera. The camera 20 comprises an image sensor 26 and a lens 28 and is configured to operate with relatively little ambient light. The image sensor 26 is a high-sensitivity image sensor operable to capture video in HD and in low light at a minimum lux of at least 0.0687 lux. Suitable image sensors of embodiments of the invention are sold by Omnivision™, Product No. OV10630-CBGA. In embodiments of the invention, a suitable lens 28 of the camera 20 is sold by Sunex Digital Imaging Optics™, Product No. DSL235, and a suitable lens holder is also sold by Sunex, Part No. CMT233. The lens 28 has the following field of view: horizontal, 97 degrees; vertical, 70 degrees; and diagonal, 136 degrees. In embodiments of the invention, the camera 20 is operable to record in 720p video with an H.264 codec, a 1280 X 720 resolution, and at 30 frames per second. Moreover, encoded, captured video may be viewed on standardized video-viewing software. It

should be appreciated that other image sensors and lenses could be employed in embodiments of the invention.

[0049] In alternative embodiments of the invention, the camera component 12 may also include a memory element (not shown) for temporarily storing captured video prior to transmission to the recording component 14. In such an embodiment, storage of the captured video on the memory element of the camera component 12 is cached for short-term storage, such as if the captured video cannot be transmitted to the recording component 14.

[0050] As noted above, the camera component 12 includes a first housing 30. A width of the housing 30 is approximately 0.25 inch to approximately 5 inches, approximately 0.5 inch to approximately 4 inches, approximately 0.75 inch to approximately 3 inches, or approximately 1.125 inch. A height of the housing 30 is approximately 0.5 inch to approximately 5 inches, approximately 0.75 inch to approximately 4 inches, approximately 1.25 inches to approximately 3 inches, or approximately 1.5 inches. A depth of the housing (excluding the lens and lens holder that extend from a main body of the housing 30) is approximately 0.15 inch to approximately 1 inch, approximately 0.25 inch to approximately 0.9 inch, approximately 0.35 inch to approximately 0.75 inch, or approximately 0.5 inch. Additionally, the camera component 12 weighs less than or equal to 5 ounces, less than or equal to 3 ounces, less than or equal to 1 ounce, or approximately 0.8 ounce.

[0051] The housing 30 is made of ABS or other lightweight, durable material and is covered with neoprene to be soft to the touch and water resistant. The housing 30 includes the user interface elements 24 positioned thereon, which in embodiments of

the invention comprise at least a first input 32 and a second input 34. The first input 32 is a power on/off switch that can be actuated to a power on position where the system 10 is, in various embodiments of the invention, either (1) in a standby mode, such that the system is ready to begin capturing video upon instruction by the user; (2) in a capture mode, such that the system begins continuously capturing video upon actuation of the power on/off switch; or (3) in a trigger event mode, such that the system begins capturing video upon a triggering event, as described in more detail below. The first input 32 is a slide switch that can be moved from an actuated position to a non-actuated position. When in an actuated position, the first input 32 slides to reveal a green-colored portion of the housing to indicate the actuated position to the user. The first input 32 is located on a side of the housing 30.

[0052] The second input 34 controls active record and marking of an event. In particular, in embodiments of the invention where the first input 32 places the camera component 12 in a standby mode, the user can quickly instruct recording by depressing or otherwise actuating the second input 34. During recording of an event, the user can also mark the captured video. "Marking" of the captured video provides an indication of a point in time, i.e., the time when the user depresses the second input 34. The user can then quickly move to marked locations in the captured video upon viewing of the video using standardized video viewing software. Marking of the captured video allows the user to identify the point in time at which a particular event in the captured video occurs. Actuation of the second input 34 thus serves as both an instruction to begin recording and to mark the captured video to identify a time or location in the captured video corresponding to actuation of the second input 34.

[0053] The microphone 22 is mounted in the housing 30 and is operable to capture audio of an event. The microphone 22 comprises at least one opening 36 on a front of the housing 30. In embodiments of the invention, the housing 30 includes a third input (not shown) for stopping or otherwise muting the recording of audio (while still recording video). This third input may be desired by some law enforcement personnel located in a jurisdiction that does not allow audio recordings of an event.

[0054] In embodiments of the invention, the housing 30 does not include any LEDs or other indication that the camera component 12 is recording so that persons encountered by the user of the system 10 do not realize they are being recorded. However, in alternative embodiments, the housing 30 may include one or more LEDs or other indicators to identify recording by the system 10, and such indicators may or may not be viewable by persons other than the user of the system 10.

[0055] As shown in Figs. 1 and 2, the cabling 18 for communicatively connecting the housing 30 to the recording component 14 extends from a rear of the housing 30. Various lengths of cabling 18 may be provided depending on how and where the user mounts the camera component 12 and the recording component 14.

[0056] Referring to Fig. 30, the recording component 14 generally includes a processing element 38, a memory element 40, a power element 42, and at least one communication port 44. As noted above, the recording component is housed in a second housing 46 that is physically separate from the first housing 30 of the camera component.

[0057] The processing element 38 may include processors, microprocessors, microcontrollers, digital signal processors (DSPs), field-programmable gate arrays

(FPGAs), analog and/or digital application-specific integrated circuits (ASICs), and the like, or combinations thereof. The processing element 38 may generally execute, process, or run instructions, code, software, firmware, programs, applications, apps, processes, services, daemons, or the like, or may step through states of a finite-state machine.

[0058] The memory element 40 may include data storage components such as read-only memory (ROM), programmable ROM, erasable programmable ROM, random-access memory (RAM), hard disks, floppy disks, optical disks, flash memory, thumb drives, universal serial bus (USB) drives, and the like, or combinations thereof. In embodiments, the memory element 40 is a solid state element with no moving parts. The memory element 40 may include, or may constitute, a non-transitory “computer-readable storage medium.” The memory element 40 may store the instructions, code, software, firmware, programs, applications, apps, services, daemons, or the like that are executed by the processing element 40. In particular embodiments, the memory element 40 stores the video captured by the camera component 12 and transmitted to the recording component 14. The memory element 40 may also store settings, data, documents, sound files, photographs, movies, images, databases, and the like. The processing element 38 may be in communication with the memory element 40 through address busses, data busses, control lines, and the like.

[0059] The power element 42 is a battery or other component for providing power to the system 10. The power element 42 is housed in the second housing 46 and is, in embodiment, rechargeable. In embodiments, the batter can be easily removed and replaced in the field, which extends the operating time and use for the system 10.

[0060] The at least one communication port 44 generally allows the recording component 14 to communicate with the camera component 12 or a server or other computing device (not shown) through a communications network (not shown). Thus, The communication port 44 may be in communication with the processing element 38 and the memory element 40.

[0061] The communication port 44 may be wired and may include connectors or couplers to receive metal conductor cables or connectors or optical fiber cables. In embodiments, a first communication port 44a is a mini-USB port (also known as a micro-USB port) for receipt of the mini-USB adaptor from the cabling 18 for transmission of captured data from the camera component 12 and to the recording component 14. In embodiments, the port 44a is recessed within the second housing 46 to allow for quick break-away of the cabling 18 from the recording component 14. Such may be desirable if the user is in a situation where the camera component 12 is being removed or dislodged from the user's body or clothing, as the recording component having the stored video is not also removed with the camera component 12. The at least one communication port 44 may also comprise a second communication port 44b for receipt of a mini-USB for transmission of recorded video to a computing device.

[0062] In embodiments, the at least one communication port 44 may also or alternatively be wireless and may include antennas, signal or data receiving circuits, and signal or data transmitting circuits. The communication port 44 may transmit and receive radio frequency (RF) signals and/or data and may operate utilizing communication standards such as cellular 2G, 3G, or 4G, IEEE 802.11 or 802.16 standards, Bluetooth™, or combinations thereof.

[0063] The second housing 46 for the recording component 14 is generally rectangularly-shaped, although it could be other shapes. In embodiments, the second housing is sized and configured to be positioned in the user's front breast pocket or front pants pocket, as illustrated in Fig. 1, when the camera component 12 is mounted to a front of the user's shirt. A width of the second housing 46 is approximately 1 inch to approximately 5 inches, approximately 1.5 inches to approximately 4 inches, approximately 2 inches to approximately 3 inches, or approximately 2.625 inches. A height or length of the housing 46 is approximately 1 inch to approximately 8 inches, approximately 2 inches to approximately 7 inches, approximately 3 inches to approximately 6 inches, or approximately 4 inches. A depth of the housing 46 is approximately 0.15 inch to approximately 1 inch, approximately 0.25 inch to approximately 0.9 inch, approximately 0.35 inch to approximately 0.75 inch, or approximately 0.625 inch. Additionally, the recording component 14 weighs less than or equal to 7 ounces, less than or equal to 5 ounces, less than or equal to 4 ounces, or approximately 3.1 ounces. Similar to the first housing 30, the second housing 46 is made of ABS or other lightweight, durable material and is covered with neoprene to be soft to the touch and water resistant. The communication ports 44a, 44b are positioned on the housing 46.

[0064] In embodiments of the invention, the digital video recording system 10 may be provided with "pre-event" recording program and method in which the system 10 records constantly in a loop of a selected duration of time, such as thirty seconds or sixty seconds. Upon a triggering event occurring, as described below, the camera component 12 transmits to the recording component 14 the captured video for the

selected duration of time, e.g., the thirty-second segment of captured video occurring prior to the triggering event. Examples of a triggering event may include, for example, the user actuating the second input 34 to instruct recording by the camera component 12, turning on a vehicle's siren and/or signal lights, an accelerometer measurement outside a pre-established norm, a position of the vehicle and/or officer as measured by a GPS, a vehicle crash event or the police vehicle attaining a threshold speed (e.g., 80 m.p.h.), etc. In embodiments, the recording component 14 may receive a signal from, for example, the vehicle indicative of a triggering event. In response to receipt of the signal, or based on a type of triggering event as evidenced by the signal, the recording component 14 may begin recording.

[0065] The digital video recording system 10 may also generate time stamps for the captured video. In such an embodiment, the system 10 includes a clock (not shown) for noting a time when a particular item of video is captured. The recording component 14 then identifies each frame based on the time generated by the clock. Each frame of the captured video has a unique time stamp. An officer or other user reviewing the captured video will then know when a particular image or item of video obtained from the recording component 14. In even further embodiments, the time stamp may include a date (if not already included in the time stamp), any triggering event (as described herein), etc.

[0066] Various embodiments of the digital video recording system 10 may include any one or more of the following features: required entry of a password or code prior to accessing and changing operational settings; required use of a key to unlock a lockable housing for removal of any removable memory components; incorporation of electronic

watermarks into the recorded video images to prevent tampering or alteration; wireless downloading of the contents of the memory element 40 to a laptop or other computer; streaming the live video from the camera component 12 and possibly other inputs and/or outputs via a high-speed wireless data network; encoding of multiple video streams from multiple cameras simultaneously; a remote control device for allowing a user to remotely control the operation of the system 10; and a temperature sensor and temperature indicator operable to detect and warn the user if the system 10 is at risk of malfunction or damage due to an ambient temperature that is too high or too low for proper operation, such as may easily occur in a vehicle on a very hot or very cold day. The housings 30,46 may be vented to dissipate heat and may include other passive or active features to moderate temperature, especially in relatively extreme environments. Embodiments of the invention may also include a computer program for viewing the captured video on a mobile communications device, such as via an app, at a website, or using viewing software.

[0067] In yet further alternative embodiments, the system 10 may also include an integrated GPS receiver (not shown) connected to a GPS antenna (not shown). Utilizing the information provided by these components, the system 10 may mark recorded video with real-time position data of where the captured video was taken. The system 10 may include a "dead reckoning" function that works with GPS to allow for operation in shielded locations, such as underground garages. Some embodiments may communicate directly with the GPS receiver so that GPS coordinates stored in video event metadata may be automatically updated upon the automatic or manual marking or flagging of a video event.

[0068] In addition or as an alternative to the GPS, embodiments of the invention may include an RFID or another type of location or identification feature or sensor (not shown) that informs the system 10 of the location of the camera component 12 and/or the recording component 14. In embodiments, the RFID is mounted within the first housing 30 of the camera component to identify the user using the system 10 and potentially a location of the camera component 12.

[0069] Turning now to Figs. 2-29, various mounting assemblies 16 are illustrated. As discussed above, the camera component 12 and/or both the camera and recording components 12,14 are configured to be mounted to the user's body or clothing, a device carried by the user, or a vehicle. In embodiments of the invention, the mounting assemblies 16 are interchangeable, so that the user may mount the camera component 12 and/or the recording component 14 in various positions and locations based on the desired preferences of the user. As illustrated in Fig. 1, to facilitate ease of manufacture, mounting, purchase, and use of the camera and recording components 12,14, the camera component 12 includes a generally square-shaped recessed seat 48 located on a rear of the first housing 30 for securing or otherwise coupling the user-preferred mounting assembly to the camera component 12. The recessed seat is sized and configured to couple to each of the mounting assemblies 16, as described below, so as to present a system 10 with the interchangeable mounting assemblies.

[0070] In a first mounting assembly 16a illustrated in Figs. 2-7, the mounting assembly is a button-mount assembly for mounting the camera component 12 to a button 50 located on the user's shirt. The mounting assembly 16a broadly comprises a slotted plate 52, a mounting bracket 54 forwardly extending from the slotted plate 52, a

longitudinal track 56 formed between the slotted plate 52 and the mounting bracket 54, a retention clip 58 held in the longitudinal track 56 and for preventing the mounting assembly 16a from becoming dislodged from the user's clothing, and a coupler 60 for securing the mounting assembly 16a to the camera component 12.

[0071] The slotted plate 52 comprises a generally rectangular-shaped, flat body 62 having a slot 64 formed therethrough. The slot 64 is formed in the body 62 of the plate 52 along a general longitudinal axis of the plate 52. The longitudinal axis generally coincides with the height of the camera component 12 once the mounting assembly 16a is coupled with the camera component 12. Alternatively, the slot 64 could be formed along a transverse, diagonal, or other axis of the plate 52. The slot 64 is open at a first, lower end 66 of the slotted plate 52 and closed at a second, general upper end 68 of the slotted plate 52. In use, the slot 64 is placed behind the button 50 on the user's shirt and guided downwards over yarn or other material that secures the button 50 to the user's clothing. Once the slot 64 is positioned over the yarn retaining the button 50, the button extends from a general front 70 of the slotted plate 52 and the yarn or other material securing the button to the user's clothing is held within the slot 64 of the slotted plate 52. A rear 72 of the slotted plate 52 is then adjacent the user's shirt.

[0072] The mounting bracket 54 is integrally formed on or coupled to the front 70 of the slotted plate 52, such that the mounting bracket 54 at least partially overlays and forwardly extends from the front 70 of the plate 52. The bracket 54 thus presents a raised area comprising the longitudinal track 56 between the front 70 of the plate 52 and a front 74 of the bracket 54. The track 56 extends along at least a portion of the slot 64. When the button-mount assembly 16a is mounted to the button 50 of the user's

clothing, the button 50 is held in the longitudinal track 56 between the front 70 of the slotted plate 52 and the mounting bracket 54.

[0073] To insure that the button-mount assembly 16a does not become dislodged from the user's clothing, the assembly 16a further includes the retention clip 58, as illustrated in Figs. 5-7. The retention clip 58 is mechanically secured within the longitudinal track 56, as further described below. The clip 58 comprises a generally flat body 76 having a transverse shoulder 78 and two longitudinally-extending legs 80. A top 82 of the shoulder 78 is provided with an inverted saddle 84 that is arcuate in shape to interfit and mate with an arcuate shape of the button 50. The legs 80 extend downwards from a bottom 86 of the shoulder 78, and a lower end 88 of each leg 80 is toothed 90 to facilitate grasping of the legs by the user.

[0074] To position the retention clip 58 within the longitudinal track 56, the user slides the clip upwards, shoulder first, so that the inverted saddle 84 seats with the button. Each leg 80 is provided with an outwardly extending, chamfered tab 92. The longitudinal track 56 has receiving openings 94 formed at a general lower end of the track 56. To secure the clip 58 within the track 56, the legs 80 are transversely resilient so that they can be flexed inwards towards each other. The user places a finger at the toothed portion 90 of each leg 80 and slightly pushes inwards while sliding the retention clip 58 upwards into the track 56. Once seated within the track 56, the user releases the inwards pressure on the legs 80, which returns the legs 80 to a neutral state and locates the outwardly extending tabs 92 on the legs within the receiving openings 94 on the track 56. To remove the camera component 12 from the user's clothing, the user reverses the above process by pressing inwardly on the toothed portion 90 of the legs

to remove the tabs 92 from the openings 94 in the track 56 and allow the retention clip 58 to be slid out of the track 56. The user can then remove the slotted plate 52 from the button 50.

[0075] The coupler 60 of the button-mount assembly 16 comprises a ledge 96 integral or coupled with the mounting bracket 54 and sized and configured to interfit with the recessed seat 48 on the rear of the housing 30, and a screw 98 for securing the combined mounting bracket 54 and slotted plate 52 to the camera component 12. As illustrated in Fig. 2, the ledge 96 is positioned on the front 74 of the mounting bracket 54. The ledge 96 is generally square-shaped to match the generally square-shaped recessed seat 48 on the camera component housing 30. As can be appreciated, the perimeter of the ledge 96 may be slightly less than an inner perimeter of the recessed seat 48 to insure the ledge 96 fits or seats within the recessed seat 48.

[0076] As illustrated in Fig. 2, a small opening or hole 100 is formed in the front 74 of the mounting bracket 54 to receive the screw 98 therethrough. The screw 98 is received within a similarly-sized threaded opening 102 on the rear of the camera component housing 30. The user screws the combined slotted plate 52 and mounting bracket 54 to the rear of the camera component housing 30 by placing the screw 98 through the hole 100 in the bracket 54 and threading in the opening 102.

[0077] Referring now to Figs. 8-9, a second mounting assembly 16b is illustrated and comprises a clip 104 configured for grasping a clothing article of the user. In embodiments, the clip 104 is an alligator clip and comprises a first, bottom plate 106, a second, top plate 108, a spring 110 interposed between the plates 106,108 to provide resilient grasping tension, and a coupler 112. Referring to Fig. 9, each plate 106,108

has an inner face 114, an outer face 116, a grasping end 118 that is grasped by the user when positioning the clip 104, and an open end 120 that opens up to receive the user's clothing or other structure to which the clip 104 is being attached.

[0078] The plates 106,108 are pivotably secured together at their respective grasping ends 118. The spring 110 is interposed between the plates 106,108 to provide a pivot point about which the plates are pivoted. The spring 110 is a flat, U-shaped spring, and opposing ends 122 of the spring 110 are secured to the inner face 114 of each plate 106,108. In the spring's rest state, the opposing ends 122 of the spring 110 extend outwardly. Upon the user grasping each of the grasping ends 118 of the plates 106,108, the opposing ends 122 of the spring 110 are pushed together to pivot the grasping ends 118 of each plate 106,108 towards each other and, in response, pivot the open ends 120 of each plate 106,108 away from each other.

[0079] In a plan view, each plate 106,108 has the same general shape. However, when viewing the clip 104 from the sides, it can be seen that the first, bottom plate 106 is generally flat, except that the grasping end 118 angles slightly downwards. The second, top plate 108 is also generally flat, except that the grasping end 118 angles slightly upwards. The angle for the top plate 108 is greater than the angle for the lower plate 106. This provides better positioning for the user to apply force at the grasping end 118 when the user is applying pressure to the top plate 108 to open the plates 106,108. As is illustrated, the outer face 1106 of each plate 106,108 at the grasping end 118 includes a plurality of depressions 124 to assist in tactile gripping of the plates during positioning of the clip 104.

[0080] Referring to Fig. 11 (which illustrates both a second mounting assembly 16b and the second mounting assembly 16b working in conjunction with a fourth mounting assembly 16d), the coupler 112 comprises a raised seat 126 and a screw 128. The raised seat 126 is integral with or secured to the outer face 116 of the bottom plate 106. Similar to the first mounting assembly 16a and the ledge 96 of the mounting bracket 54, a perimeter and a shape of the raised seat 126 is approximately the same as the perimeter and shape of the recessed seat 48 on the rear of the camera component housing 30. The raised seat 126 of the clip 104 then interfits with the recessed seat 48 of the housing 30. As can be appreciated, the perimeter of the raised seat 126 may be slightly less than an inner perimeter of the recessed seat 48 to insure the raised seat 126 fits or seats within the recessed seat 48.

[0081] The screw 128 is threaded through an opening 130 in the bottom plate 106 to secure the clip 104 to the camera component 12. The clip 104 can be mounted to the camera component 12 in a plurality of directions by rotating the orientation of the clip 104 relative to the housing 30.

[0082] A third mounting assembly 16c is illustrated in Fig. 10 and is a hook-and-loop mount (also known as Velcro™). The hook-and-loop mounting assembly 16c broadly comprises a plate 132, a mounting bracket (not shown) substantially similar to the mounting bracket 54, a coupler 136 for coupling the plate 132 and mounting bracket to the camera component housing 30, and adhesively-securable hook-and-loop material 138. The plate 132 and mounting bracket are, in embodiments, integral, although the mounting bracket may be, in alternative embodiments, a separate component coupled with the plate 132. The plate 132 is generally rectangular-shaped. The mounting bracket

is integrally formed on or coupled to a front 140 of the plate 132, such that the mounting bracket at least partially overlays and forwardly extends from the front 140 of the plate 132.

[0083] The coupler 136 comprises a ledge (not shown but substantially similar to the ledge 96 of mounting bracket 54) integral or coupled with the mounting bracket and sized and configured to interfit with the recessed seat 48 on the rear of the camera component housing 30, and a screw 144 for securing the combined mounting bracket and plate 132 to the camera component 12. Similar to ledge 96, the ledge of mounting assembly 16c is positioned on a front of the mounting bracket. The ledge is generally square-shaped to match the generally square-shaped recessed seat 48 on the camera component housing 30. As can be appreciated, the perimeter of the ledge may be slightly less than an inner perimeter of the recessed seat 48 to insure the ledge fits or seats within the recessed seat 48. To secure the mounting assembly 16c to the camera component housing 30, the screw 144 is threaded through an opening 146 in the mounting bracket.

[0084] The hook-and-loop material 138 comprises a first substrate 148 having a hooked material 150 on one face and adhesive (not shown) on another face, and a second substrate 152 having a loop material 154 on one face and adhesive (not shown) on another face. One of the first and second substrates 148,152 is adhesively secured to a rear of the plate 132, and the other of the substrates 148,152 is adhesively secured to a structure to which the system 10 is desired to be mounted. The user can then mate the hook-and-loop materials 150,154 to secure the system 10 to the desired structure.

[0085] A small opening or hole is formed through the plate 132 and mounting bracket to receive the screw 144 therethrough. The user then screws the combined plate and mounting bracket to the rear of the camera component housing 30 by threading the screw 144 through the opening.

[0086] A fourth mounting assembly 16d is illustrated in Figs. 11-17 and is a cradle mount for mounting both the camera component 12 and the recording component 14. The mounting assembly 16d broadly comprises a cradle 158, a mounting arm 160, a first clip mounting bracket 162, and the clip 104 of the mounting assembly 16b. The cradle 158 is sized and configured to releasably and easily mount the recording component 14. The cradle 158 includes a main body 164 with a plurality of flexible arms 166 extending therefrom to secure the recording component 14 in the cradle. The plurality of arms 166 extend from the body 164 at generally right angles to the body. An outermost end 168 of each arm 166 curves slightly inwardly to hold the recording component 14 within the cradle 158. In particular, the recording component 14 is snap-fit within the cradle 158, such that the flexible arms 166 can be moved slightly outwardly to place the recording component 14 against the cradle's body 164. The outermost end 168 of each arm 166 then wraps around the recording component 14 to snap or frictionally secure the recording component 14 within the cradle 158.

[0087] A portion 170 of the body 164 of the cradle 158 extends rearwardly, as illustrated in Fig. 11, to receive the mounting arm 160, and is provided with a plurality of openings 172. The mounting arm 160 can then be secured to the body 164 of the cradle 158 through any one of the openings 172, as discussed in more detail below, depending on a desired positioning of the mounting assembly 16d. It should be appreciated that

the mounting arm 160 may also be secured to the body 164 of the cradle 158 in a plurality of angles or orientations. For example, as illustrated in Fig. 11, a longitudinal axis of the mounting arm 160 (i.e., the axis extending from the narrow to the wide ends of the arm) is generally perpendicular to a transverse axis of the cradle 158. However, the mounting arm 160 could be positioned so that its longitudinal axis is generally parallel to the transverse axis of the cradle 164 by rotating the arm approximately 90 degrees to the left or to the right from the orientation shown in Fig. 11. Thus, the mounting arm 160 can be positioned at any desired angle relative to the cradle 158 and further can be positioned at different locations on the cradle 158 by securing a screw through one of the plurality of openings 172 in the cradle 158, as further described below.

[0088] The mounting arm 160 comprises a tapered body 174 having a wide end 176 and a narrow end 178. The wide end 176 is provided with a first hole or opening 180 through the body 174 to receive a first screw (not shown) for securing the mounting arm 160 to the body 164 of the cradle 158. In particular, the first screw (not shown) is located through the first opening 180 in the wide end 176 of the mounting arm 160 and through one of the plurality of openings 172 in the body 164 of the cradle 158 to secure the mounting arm 160 to the cradle 158. The narrow end 178 is provided with the second hole or opening 182 through the body 174 to receive a second screw 186 for securing the first clip mounting bracket 162 to the body 174 of the mounting arm 160. The narrow end 178 of the mounting arm 160 is provided with a raised, generally circular positioning mount 188 for positioning the attached camera component 12 in a plurality of orientations. The circular positioning mount 188 extends generally rearwardly

from the body 174 of the mounting arm 160 (i.e., the direction opposite the front of the recording component 14 when mounted in the cradle 158) and includes a plurality of depressions 190. In particular, four depressions 190 are provided, one at each of the general north, south, east, and west locations on the circular positioning mount 188. However, it should be appreciated that more or less depressions may be provided and may also be positioned at different locations on the circular positioning mount 188. The location of each depression 190 corresponds to a preferred angle or orientation of a position of the camera component 12 as described below.

[0089] The first clip mounting bracket 162 is sized and configured to removably retain the camera component 12 and includes a front face 192 (facing towards the mounting arm 160 when the first clip mounting bracket 162 is secured to the mounting arm 160) and a rear face 194 (facing towards the rear of the camera component 12 when the camera component 12 is retained in the first clip mounting bracket 162). The front face 192 of the first clip mounting bracket 162 is provided with a plurality of detents 196 configured to be received in the plurality of depressions 190 on the circular positioning mount 188 of the mounting arm 160. In embodiments, the mounting bracket 162 includes four detents 196, one of each provided at the general north, south, east, and west locations to coincide with the location of the depressions 190 on the circular positioning mount 188. However, it should be appreciated that more or less detents 196 may be provided and may also be positioned at different locations on the first clip mounting bracket 162.

[0090] The first clip mounting bracket 162 is pivotably secured to the narrow end 178 of the mounting arm 160, as illustrated in Figs. 11 and 12. The second screw 186 is

located through the second hole or opening 182 in the narrow end 178 of the mounting arm 160 and secured to the mounting bracket 162 to couple the components together. To enable pivoting of the clip mounting bracket 162 relative to the mounting arm 160, a spring 198 surrounds the second screw 186. The spring 198 enables the clip mounting bracket 162 to be pulled by the user away from the mounting arm 160, such that the detents 196 on the bracket 162 clear the circular positioning mount 188. That is, in a secure position, the detents 196 are held in or otherwise interfit with the depressions 190, as illustrated in Figs. 11 and 12. During pivoting of the mounting bracket 162, the bracket is pulled laterally from the mounting arm 160 so that the detents 196 slide above the circular positioning mount 188 during rotation of the bracket 162 relative to the mounting arm 160. Upon rotating the mounting bracket 162 to the desired location, the spring 198 locates the mounting bracket 162 back towards the mounting arm 160, such that the detents 196 again interfit with the depressions 190 and secure the mounting bracket 162 in position.

[0091] The rear face 192 of the first clip mounting bracket 162 is provided with a pair of walls 200 that create a track or slot 202 within which the clip 104 of the second mounting assembly 16b can be frictionally secured. As illustrated in Fig. 13, the walls 200 are positioned on the edge of the rear face 192 of the clip mounting bracket 162. A width of the track 202 created between the walls 200 is approximately the same size as (or slightly larger) than a width of the first and second plates 106,108 of the clip 104. The width of the plates 106,108 increases from the open end 120 to the grasping end 118 of the clip 104, and similarly, the width of the track 202 in the mounting bracket 162 widens from a lower to an upper end of the track. The camera component 12 can then

be secured to the clip 104, as described above, and the clip 104 can be secured within the track 202 on the clip mounting bracket 162. To assist with securing the clip 104 in the clip mounting bracket 162, the walls 200 of the track are each provided with a locking tab 184 at the lower end and as best illustrated in Figs. 13 and 14. The locking tab interfits with ridges 185 on the plates 106, 108 of the clip 104.

[0092] The fourth mounting assembly 16d is configured to be mounted to a vehicle, such as the inside of a vehicle near a dashboard, an upper middle console, a windshield, or any other location desired by the user. To mount the mounting assembly 16d to the vehicle, the mounting assembly further includes a coupler 204, such as a RAM mount sold by RAM Mounts®. The coupler 204 includes a ball joint 206 operable to be secured to the mounting arm 160 and cradle 158 via a screw (not shown) threaded through the first hole 180 of the mounting arm 160. Extending from the ball joint 206 is a ball 208 operable to be received in a socket 210 of a separate mounting installation 212, such as the RAM mount. The separate mounting installation 212 may be a suction-cup unit that includes the socket 210 for receipt of the ball 208 of the ball joint 206. The suction-cup unit can then be mounted to the windshield or dashboard of the vehicle. Other methods and configurations of mounting the fourth mounting assembly 16d within the vehicle may be employed.

[0093] A fifth mounting assembly 16e illustrated in Figs. 18-20 is substantially similar to the fourth mounting assembly 16d, except that instead of the first clip mounting bracket 162, the mounting assembly 16e includes a button mounting bracket 212 sized and configured to operate with the button-mount assembly 16a. It should be noted that in reference to the figures, like structure is identified with the same reference

numeral. The button mounting bracket 212 is operable to be secured to the mounting arm 160 of the fourth mounting assembly 16d and removably retains the camera component 12. The button mounting bracket 212 includes a front face 214 (facing towards the mounting arm 160 when the button mounting bracket 212 is secured to the mounting arm 160) and a rear face 216 (facing towards the rear of the camera component 12 when the camera component 12 is retained on the button mounting bracket 212). The front face 214 of the button mounting bracket 212 is provided with the plurality of detents 196, substantially similar to the first clip mounting bracket 162, that are configured to be received in the plurality of depressions 190 on the circular positioning mount 188 of the mounting arm 160. The button mounting bracket is pivotably secured to the narrow end 178 of the mounting arm 160, as illustrated in Fig. 18 and as described above for the fourth mounting assembly 16d.

[0094] The rear face 216 of the button mounting bracket 212 is provided with a large boss 218 that simulates the button to which the button-mount assembly 16a is attached. Thus, it should be understood that the button mounting bracket 212 does not mount to an actual button but rather uses the button-mount assembly 16a to removably couple the camera component housing 30 to the mounting arm 160 via the button mounting bracket 212. That is, when the camera component 12 has the button-mount assembly 16a secured to it, the mounting bracket 54 of mounting assembly 16a is slid over the boss 218, such that the boss 218 fits within the longitudinal track 56 of the mounting bracket 54. The retention clip 58 can then be used to secure the mounting bracket 54 on the boss, as described above for mounting assembly 16a.

[0095] Similar to the fourth mounting assembly 16d, the button mounting bracket 212 of the fifth mounting assembly 16e is sized and configured to be pivotably secured to the mounting arm 160, and the mounting arm is in turn secured to the cradle 158. The fifth mounting assembly 16e thus provides for indirectly mounting the camera component 12 to the cradle 158 via the mounting arm 160 without having to remove the button-mount assembly 16a secured to the camera component housing 30. In embodiments, the user is provided with two mounting arms 160, each having either the first clip mounting bracket 162 or the button mounting bracket 212 secured thereto so that the user does not have to remove the respective mounting bracket 162,212.

[0096] A sixth mounting assembly 16f is illustrated in Figs. 21 and 22 and is a hat mount for mounting the video recording system 10 to the user's helmet, cap, or other type of hat 220, directly to the user's head, or to an animal, such as a canine. The sixth mounting assembly 16f works in conjunction with a strap 222 that surrounds the hat 220, such as a strap that is buckled or stretchable to fit securely on the hat. The mounting assembly 16f is sized and configured to mount the button-mount assembly 16a described above. That is, when the camera component 12 is secured to the button-mount assembly 16a, the button-mount assembly 16a can be secured to the user's hat 220 via the mounting assembly 16f, such that the camera component 12 is secured to the user's hat. The recording component 14 can also be secured to the user's hat 220 via the mounting assembly 16f. In particular, when the recording component 14 is mounted in the cradle 158 of mounting assembly 16d or 16e, the cradle can be mounted to the hat via the mounting assembly 16f, as further described below.

[0097] The mounting assembly 16f broadly comprises a first mounting plate 224 for mounting the camera component 12 and a second mounting plate 226 for mounting the recording component 14. The first mounting plate 224 is slightly concave about a lateral axis to fit snugly against an arcuate crown of the hat 220. The first mounting plate 224 comprises two vertical slots 228 formed in the plate 224 for threading of the strap 222 on the hat 220 therethrough. A third lateral slot 230 is provided along a top end of the plate 224 for a further securement point, if desired. An outward face of the plate 224 includes a hinged backplate 232 for receipt of the button-mount assembly 16a. As illustrated in Fig. 21, the hinged backplate 232 is attached, at its general bottom end, to a general bottom center of the first mounting plate 224 via a hinge 234. The backplate 232 is rotatable along a vertical axis relative to the first mounting plate 224, and in embodiments, pressure actuated by the user is needed to rotate the backplate 232 (that is, the backplate 232 does not rotate easily, such that the attached camera component 12 stays in the desired position). A boss, substantially similar to the boss 218, is located on the hinged backplate 232. Similar to the mounting assembly 16e, the button-mount assembly 16a is secured to the hinged backplate 232 by locating the boss 218 in the longitudinal track of the button-mount assembly 16a.

[0098] Referring to Fig. 21, the second mounting plate 226 is similar to the first mounting plate 224, except that the second mounting plate 226 does not include the hinged backplate 232 and instead includes two screw holes 236 for securing the second mounting plate 226 to the cradle 158. In use, the second mounting plate 226 is positioned to a rear or side of the user's head.

[0099] A seventh mounting assembly 16g is substantially similar to the sixth mounting assembly 16f that is a hat mount, except that mounting assembly 16g is sized and configured to mount the camera component 12 when it is attached to the clip 104 of the second mounting assembly 16b. Referring to Figs. 23-25, the mounting assembly 16g comprises the first and second mounting plates 224,226 that are substantially similar to the first and second mounting plates 224,226 of mounting assembly 16f. The only difference is that instead of the large boss 218, the hinged backplate 232 secured to the first mounting plate 224 includes a recessed seat 238 and a post 240. The seventh mounting assembly 16g further includes a second clip mounting bracket 242 that is substantially similar to the first clip mounting bracket 162, except that a front face 246 of the second clip mounting bracket 242 is provided with an octagonal-shaped seat 248 for interfitting with the recessed seat 238 on the hinged backplate 232. In embodiments, the user can rotate the clip 104 at 45 degree angles relative to the hinged backplate 232. The octagonal-shaped seat 248 assists with locating the clip 104 at the desired angle. In use, the user secures the clip 104 at the desired angle by inserting a screw 244 through a receiving post 250 on the front face 246 of the second clip mounting bracket 242. In alternative embodiments, the clip 104 may be rotatable relative to the hinged backplate 232 without having to screw in position. It should be appreciated that the octagonal-shaped seat 248 could be provided on the hinged backplate 232, and the recessed seat 238 could be provided on the front face 246 of the second clip mounting bracket 242.

[00100] In an eighth mounting assembly 16h shown in Figs. 26 and 27, either of the button-mount assembly 16a or the clip mounting assembly 16b (not shown) is

secured to the eighth mounting assembly 16h to provide for angling of the camera component 12 along a vertical axis (i.e., relative to a horizontal plane). The eighth mounting assembly 16h comprises first and second plates 252,254 secured together via a hinge 256. The first plate 252 is secured to the rear of the camera component 12 via a screw 258, and the second plate 254 is secured to either the mounting bracket 54 of the button-mount assembly 16a or the clip 104 of the clip mounting assembly (not shown). An outer face of the first plate 252 (the face closest to the camera component 12) includes a raised seat 260 sized and configured to interfit with the recessed seat 48 on the camera component housing 30. The two plates 252,254 are secured together at their respective bottom ends via the hinge 256. The hinge 256 allows for rotation of one plate with respect to the other plate. In embodiments, the hinge 256 is generally tight, such that it does not easily rotate but instead will only rotate upon pressure being applied by the user against the first plate 252, which is secured to the camera component 12, or the camera component itself.

[00101] The user can couple the button-mount assembly 16a to the second plate 254, as shown in Fig. 26. The user can then mount the button-mount assembly 16a to the user's shirt or article of clothing, as described above. The hinged plates 252,254 allow the camera component 12 to be rotated to different angles relative to the horizon. As noted above, the hinged plates 252,254 of the eighth mounting assembly 16h could also be secured to the clip 104 of the second mounting assembly 16b, such that the second plate 254 is secured to the clip 104 via a screw.

[00102] Referring now to Figs. 28 and 29, a ninth mounting assembly 16i comprises a saddle bracket 262 for securing the camera component 12 to a barrel of a

firearm (not shown). The saddle bracket 262 includes a body 264 having a top end 266 and a bottom end 268. A general upper half of the body 264 includes two arms 270 that are sized and configured to extend around the barrel of a firearm. The saddle bracket 262 can then be secured to the firearm by inserting two screws (not shown) through openings 272 in two tabs 274 extending from the top end 266 of the bracket 262. The bottom end 268 of the saddle bracket 262 is provided with an octagonal-shaped raised seat 276, similar to the seat 248. The raised seat 276 is configured to receive the second clip mounting bracket 244 of the seventh mounting assembly 16g, similar to how the second clip mounting bracket 244 is secured to the hinged backplate 232 of the first mounting plate 224 of mounting assembly 16g.

[00103] Although the invention has been described with reference to the embodiments illustrated in the attached drawing figures, it is noted that equivalents may be employed and substitutions made herein without departing from the scope of the invention as recited in the claims.

[00104] Having thus described various embodiments of the invention, what is claimed as new and desired to be protected by Letters Patent includes the following:

CLAIMS:

1. A portable video system comprising:
a camera component for capturing video of an event, said camera component comprising a camera housed within a housing having a size configured to mount on a user's body,
said housing of the camera component including an input to instruct recording by the camera;
a recording component comprising a processor and a memory associated with the camera for storing the captured video; and
a mounting assembly for mounting the camera to the user's body, the mounting assembly being a button-mount assembly including a slotted plate presenting a slot for receipt of a button through the slot, wherein the button is located on a clothing article of the user.
2. The portable video system of claim 1, wherein said camera comprises an image sensor and a lens.
3. The portable video system of claim 2, wherein said camera component is operable to capture the event for a predetermined period of time prior to the user actuating the input to instruct recording by the portable video system.
4. The portable video system of claim 1,

wherein said slot of the slotted plate of the button-mount assembly is formed in the plate along a general longitudinal axis of said slotted plate, and

wherein the slot is open at a lower end of the slotted plate and closed at a general upper end of the slotted plate, such that the slot is placed behind the user's button and guided downwards over yarn or other material that secures the button to the user's clothing article so that the button extends from a general front of the slotted plate and the yarn or other material securing the button to the user's clothing article is held within the slot of the slotted plate.

5. The portable video system of claim 4,

wherein said button-mount assembly further includes a mounting bracket that at least partially overlays and forwardly extends from the front of the slotted plate to present a longitudinal track between said front of the slotted plate and the mounting bracket, and

wherein the button is held in the longitudinal track between the front of the slotted plate and the mounting bracket.

6. The portable video system of claim 5, wherein the button-mount assembly further includes a retention clip held in the longitudinal track between the front of the slotted plate and the mounting bracket and for securing in the track after placement of the slotted plate about the button, wherein the retention clip prevents the button-mount assembly from becoming dislodged from the user's clothing article.

7. The portable video system of claim 5, wherein the camera is configured to be coupled with the mounting bracket of the button-mount assembly.

8. The portable video system of claim 7,
wherein the camera includes a front side and a rear side, and wherein said rear side of the camera has a recessed seat, and
wherein the mounting bracket includes a ledge configured to interfit in said recessed seat of the camera to secure the camera to the button-mount assembly.

9. The portable video system of claim 1,
wherein said housing for the camera is a first housing,
wherein said processor and memory are stored in a second housing, and
wherein the second housing is physically separated from the first housing.

10. The portable video system of claim 9, wherein said first and second housings are coupled via a wired cable for transmission of captured video from the camera stored in the first housing and to the memory stored in the second housing.

11. A portable video system comprising:

a camera for capturing video of an event, said camera housed within a housing having a size configured to mount on a user's body;

a processor and a memory associated with the camera for storing the captured video; and

a mounting assembly for mounting the camera to the user's body, the mounting assembly being a clip configured for grasping a clothing article of the user.

12. The portable video system of claim 11,

wherein the clip includes at least two plates pivotably secured together at a general end of each plate, such that each plate pivots with respect to the other plate to position the plates in either of a closed position or an open position,

wherein when the plates are pivoted towards each other, the plates are in the closed position,

wherein when the plates are pivoted away from each other, the plates are in the open position, and

wherein when in the open position, the user can secure the plates around the clothing article of the user.

13. The portable video system of claim 12, wherein a spring is interposed between the plates at the end where the plates are pivotably secured together to provide a resilient tension that pivots the plates to a closed position unless the plates are otherwise actuated by the user.

14. The portable video system of claim 11,
wherein the camera includes a front side and a rear side, and wherein said rear side of the camera has a recessed seat, and

wherein at least one of the plates of the clip has a raised seat formed on an outward face of the plate and that is configured to interfit with the recessed seat of the camera to secure the camera to the clip.

15. The portable video system of claim 11,
wherein said housing for the camera is a first housing,
wherein said processor and memory are stored in a second housing, and
wherein the second housing is physically separated from the first housing.

16. The portable video system of claim 15, wherein said first and second housings are coupled via a wired cable for transmission of captured video from the camera stored in the first housing and to the memory stored in the second housing.

17. The portable video system of claim 11,
wherein said camera comprises an image sensor and a lens, and
wherein said camera is operable to capture the event for a predetermined period of time prior to the user actuating a power on input for the portable video system.

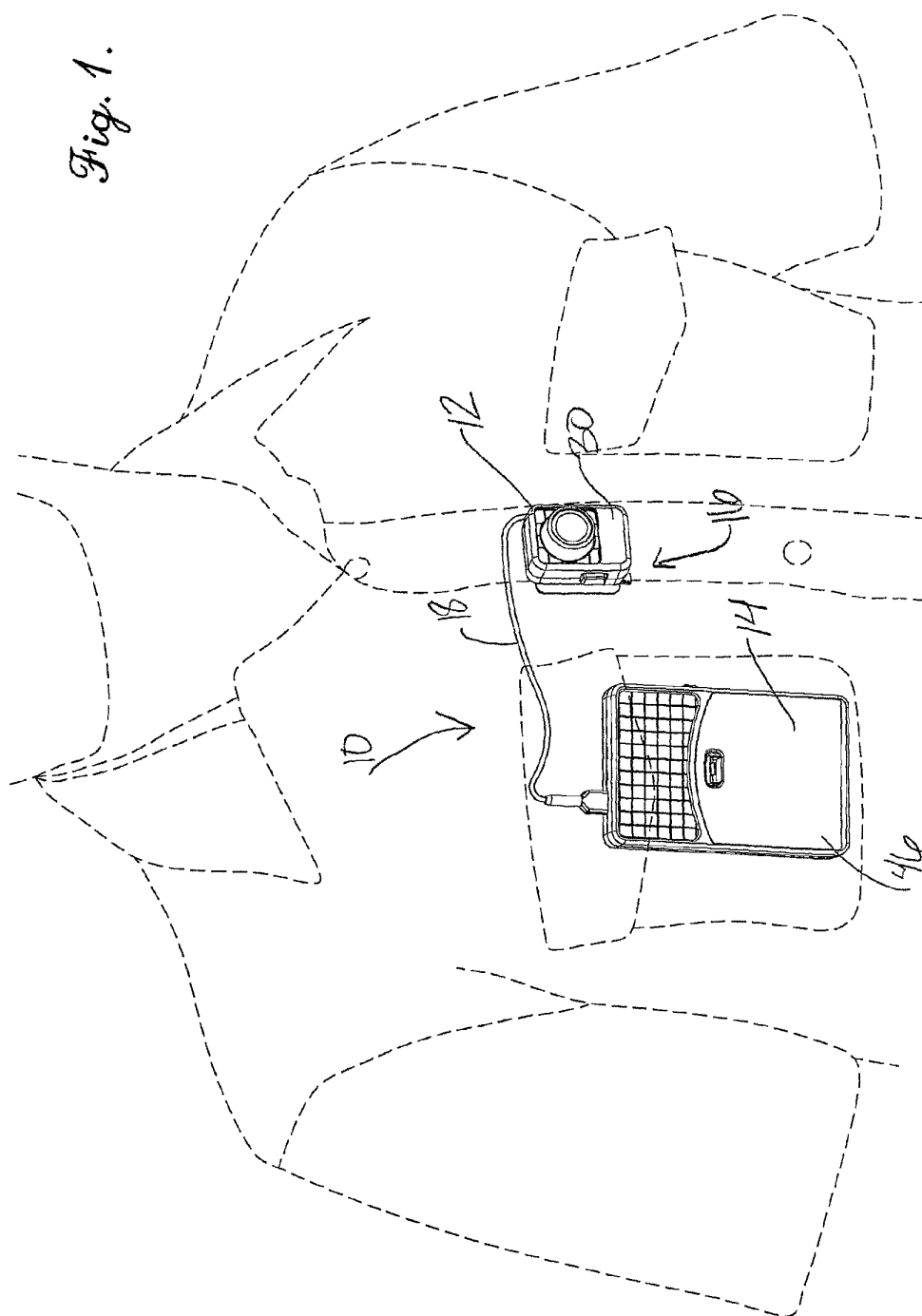
18. A portable video system comprising:
a camera for capturing video of an event, said camera housed within a first housing having a size configured to mount on a user's body;
a video recording device housed within a second housing and operable to record the captured video of the event,
said video recording device being communicatively coupled with the camera housed within the first housing,
said video recording device including a processor and a memory for storing said captured video of the event,
said second housing being physically separated from said first housing; and
a mounting assembly for mounting at least the camera to a user's body or a clothing article.

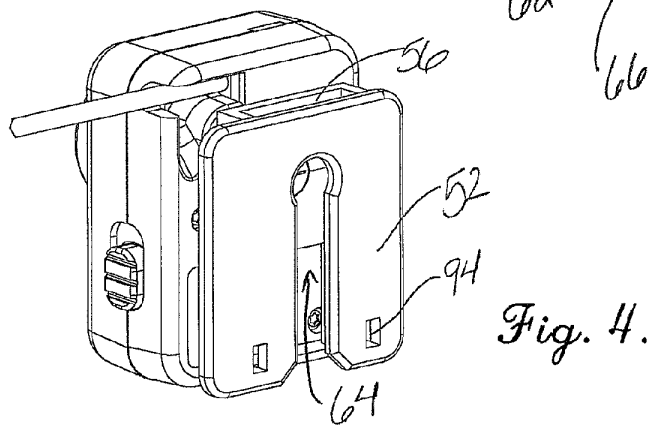
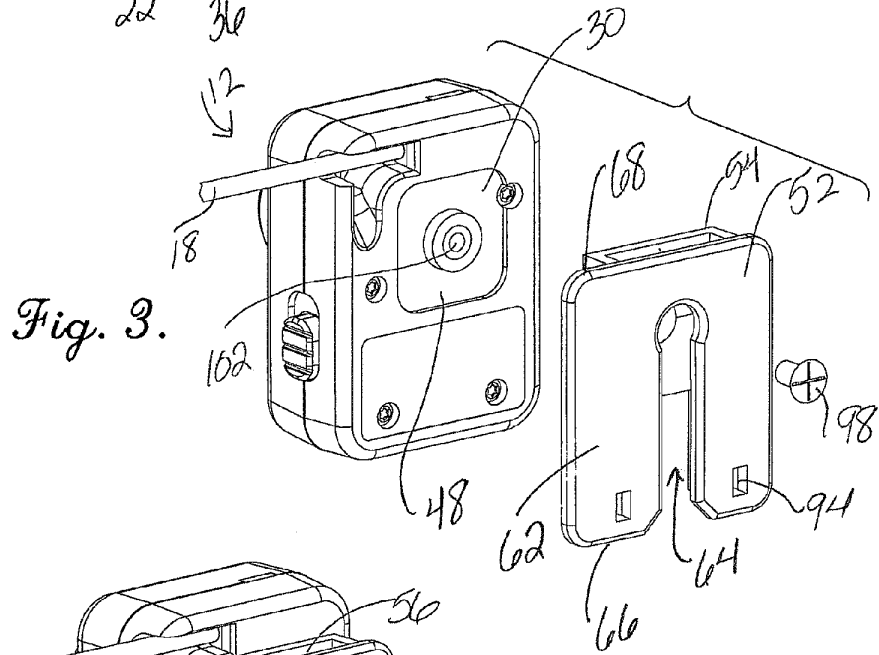
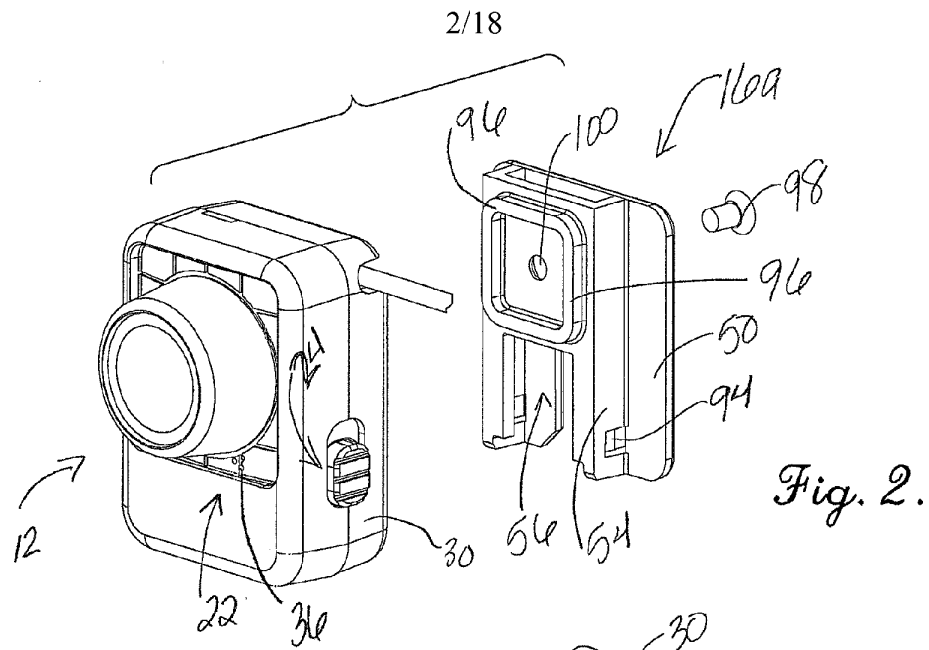
19. The portable video system of claim 18, wherein said mounting assembly is a button-mount assembly including a slotted plate presenting a slot for receipt of a button through the slot, wherein the button is located on a clothing article of the user.

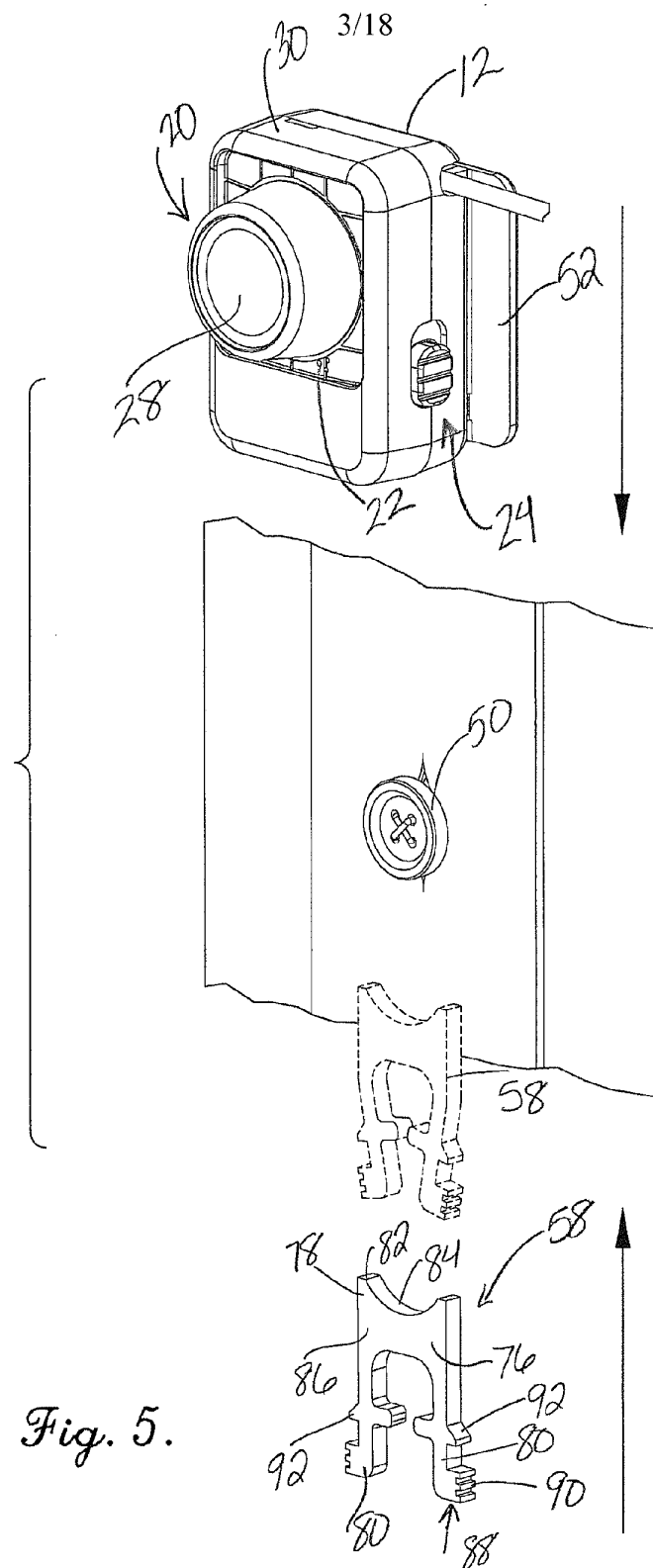
20. The portable video system of claim 18,
wherein said mounting assembly is a clip,
wherein the clip includes at least two plates pivotably secured together at a
general end of each plate, such that each plate pivots with respect to the other plate to
position the plates in either of a closed position or an open position,
wherein when the plates are pivoted towards each other, the plates are in the
closed position,
wherein when the plates are pivoted away from each other, the plates are in the
open position, and
wherein when in the open position, the user can secure the plates around the
clothing article of the user.

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Fig. 1.







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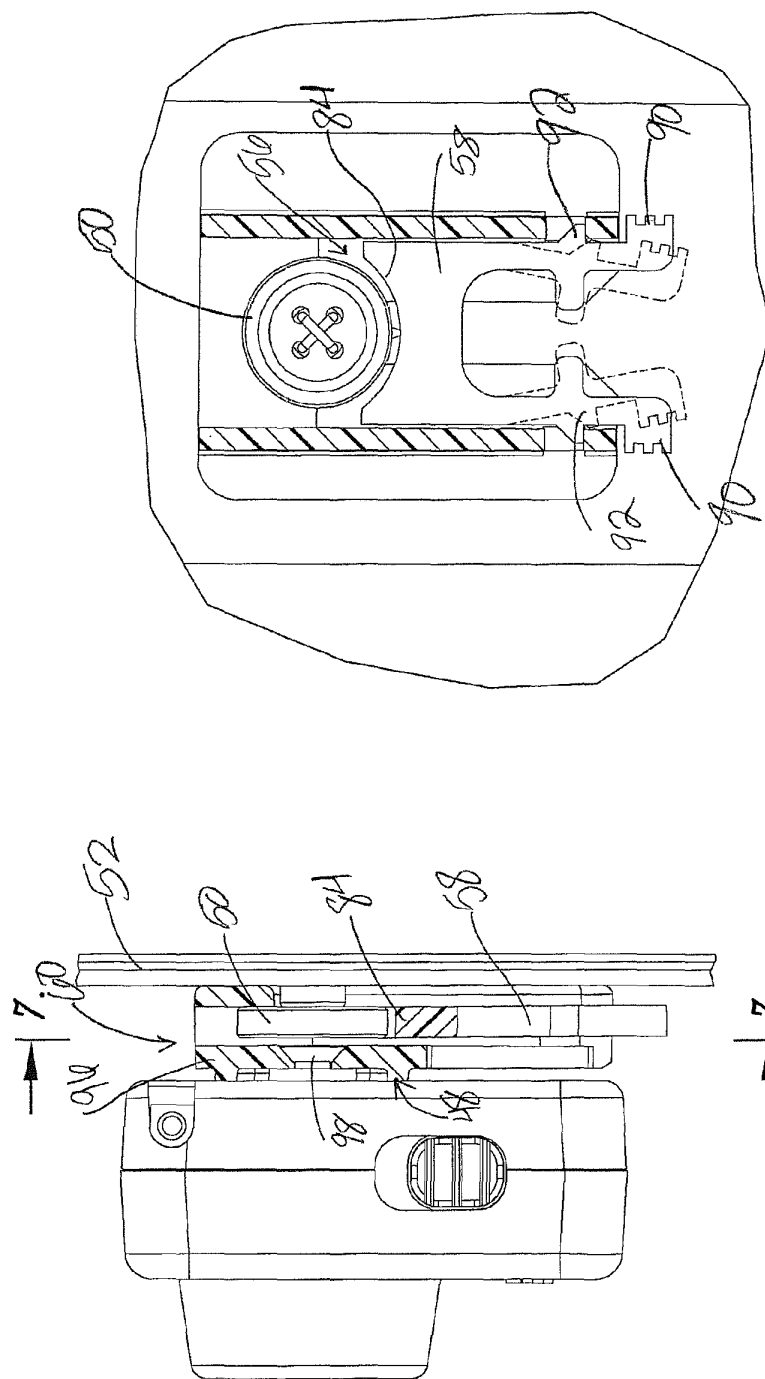
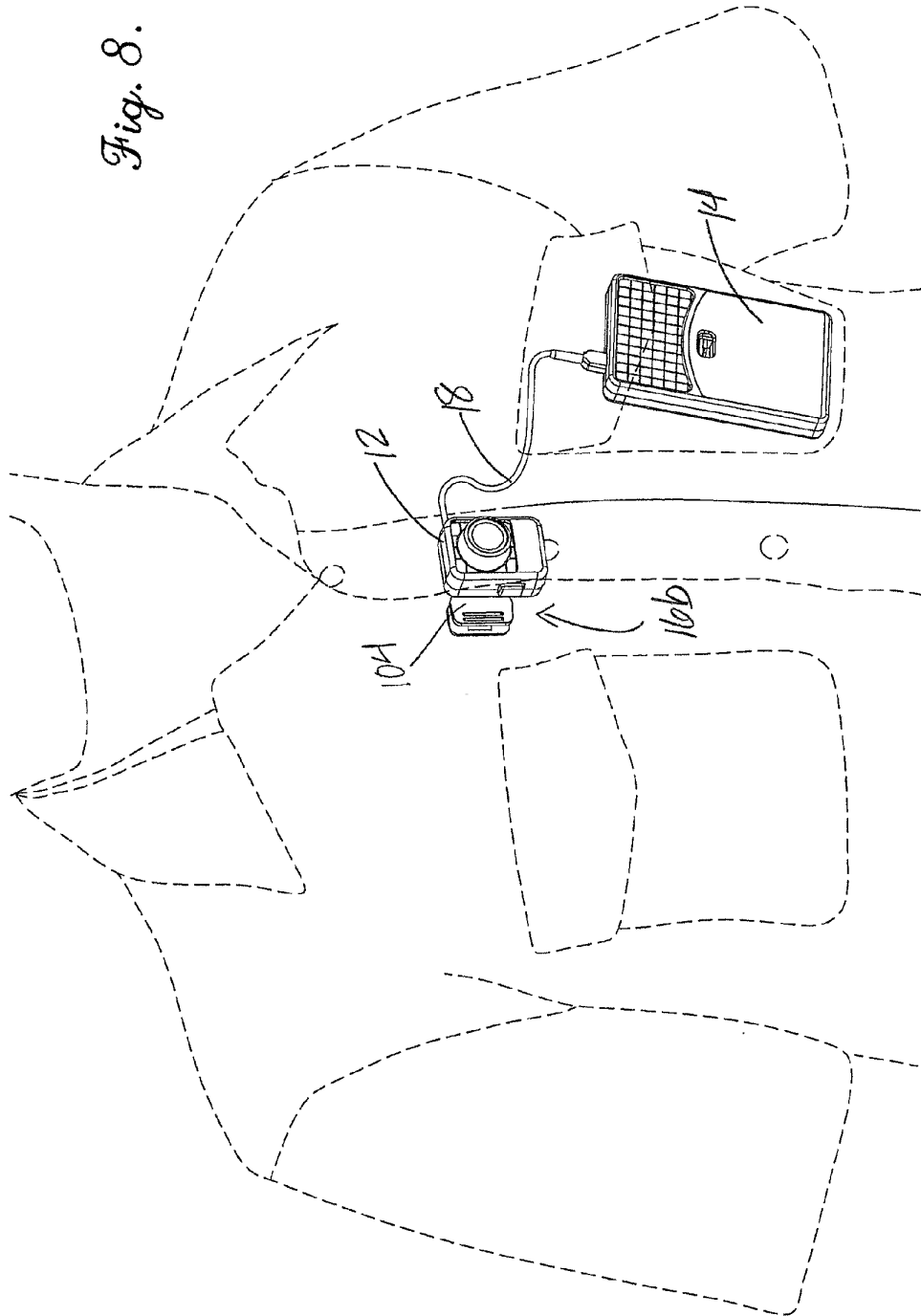


Fig. 7.

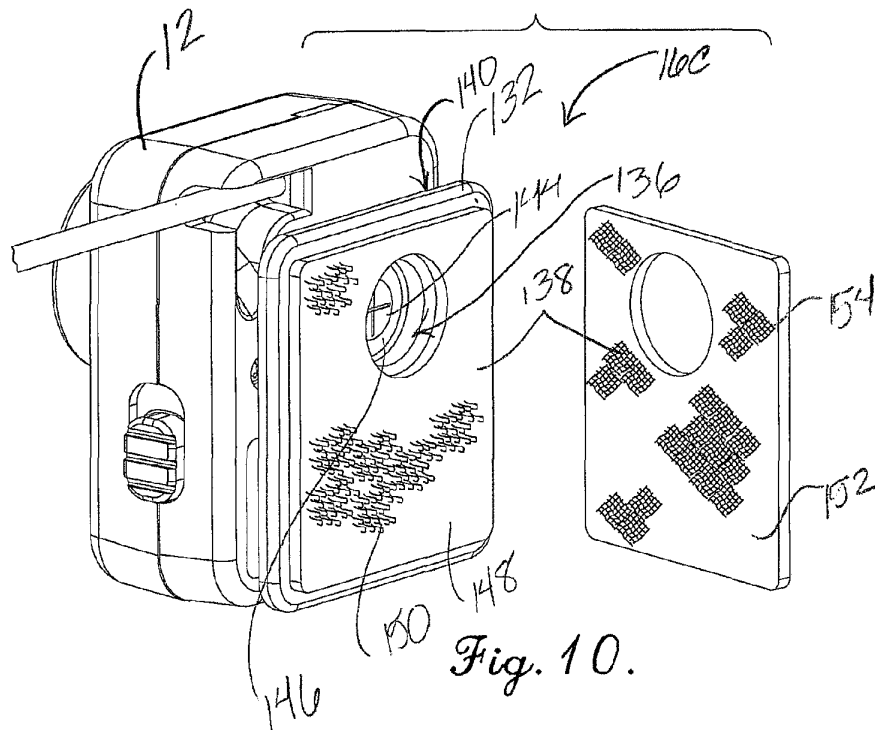
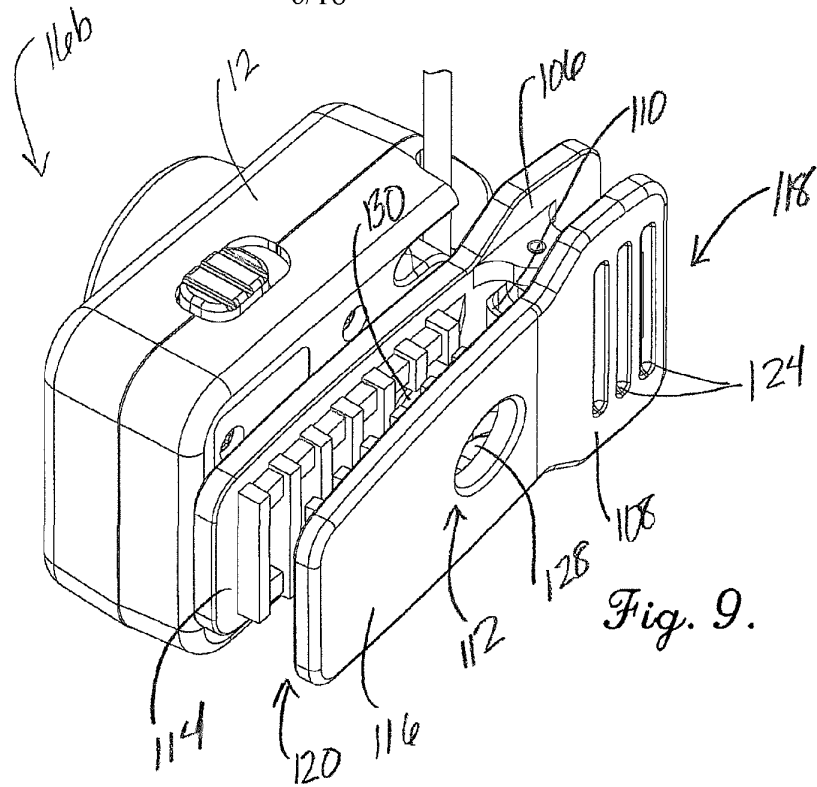
Fig. 6.

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Fig. 8.



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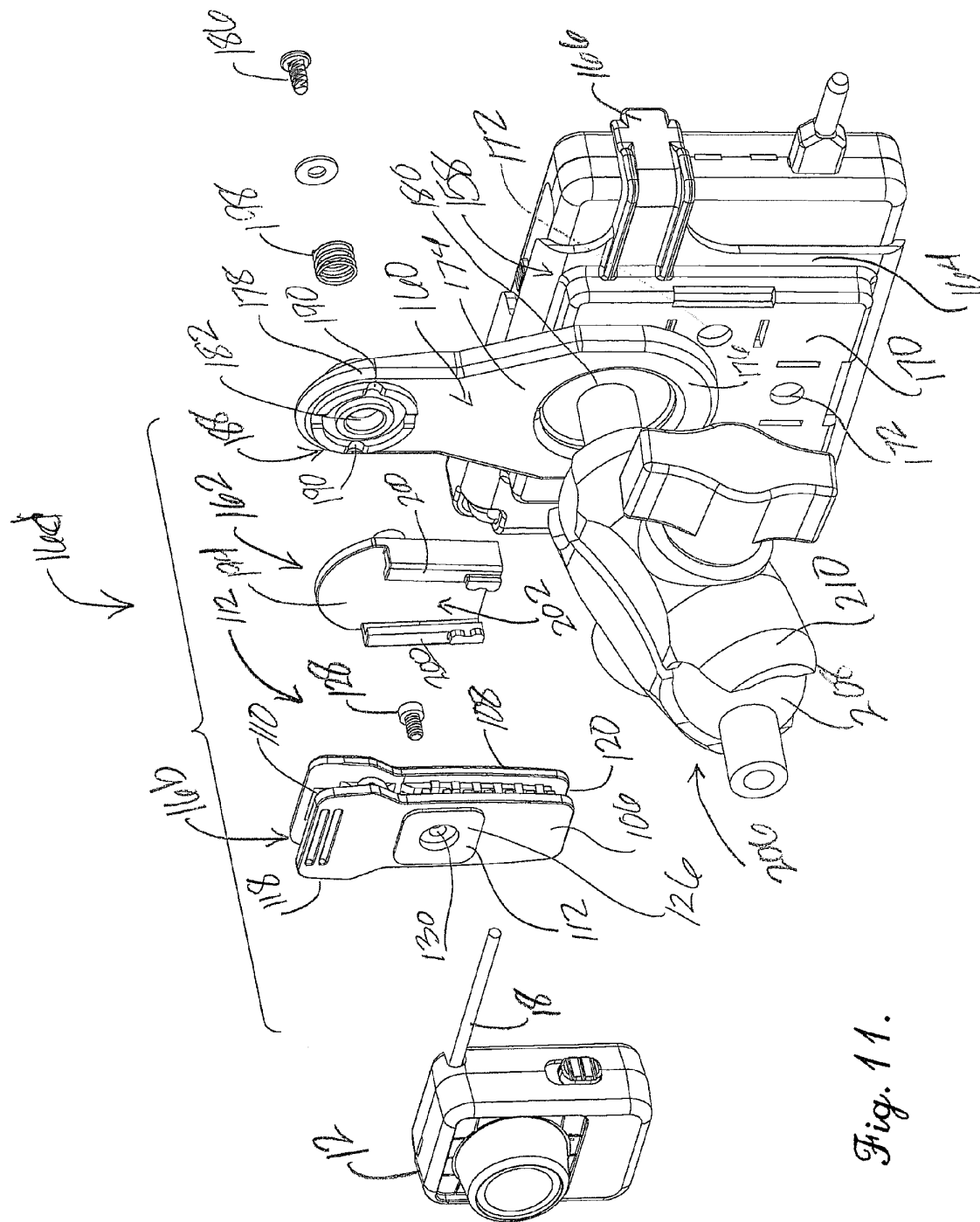


Fig. 11.

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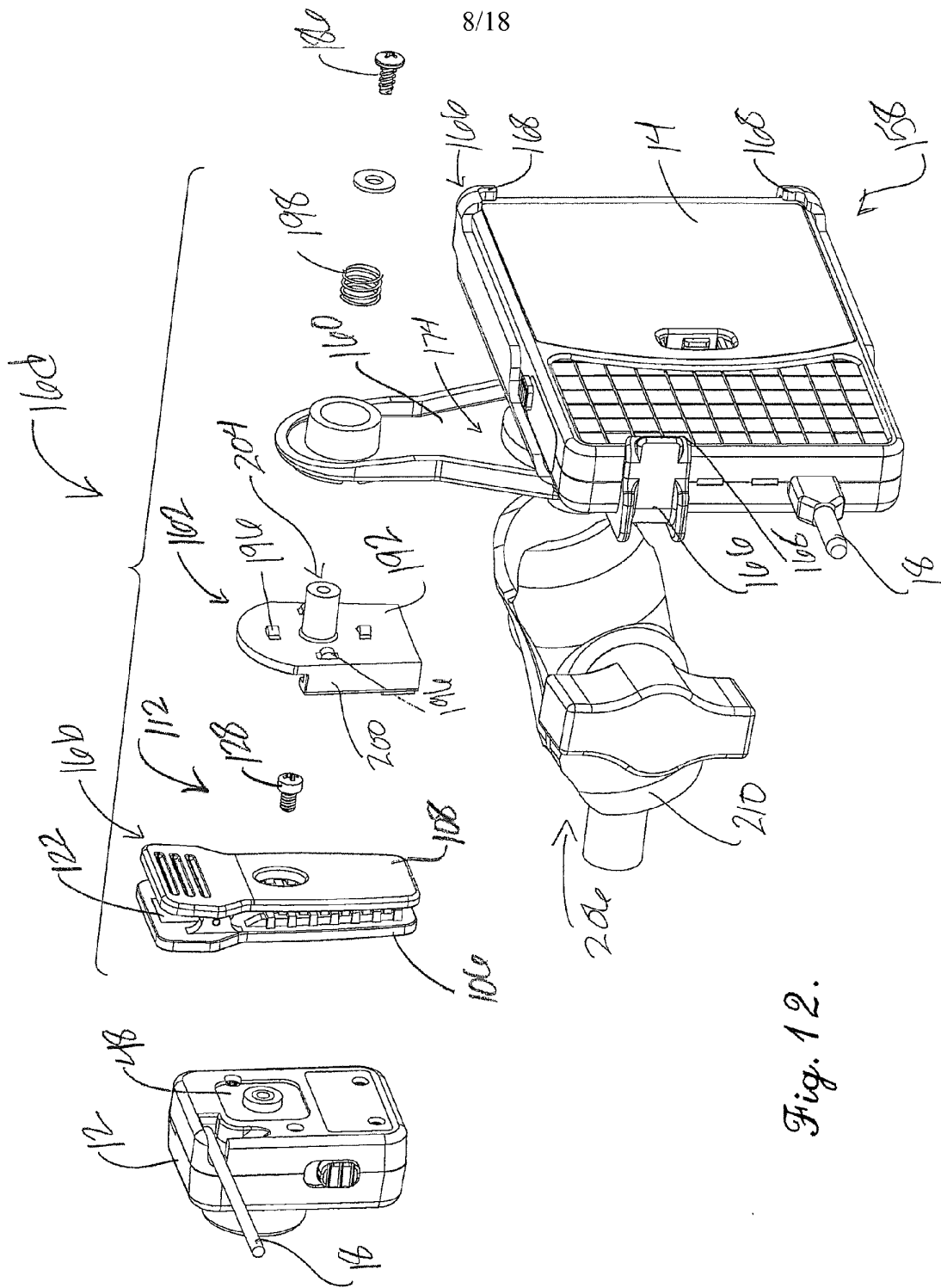


Fig. 12.

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Fig. 13.

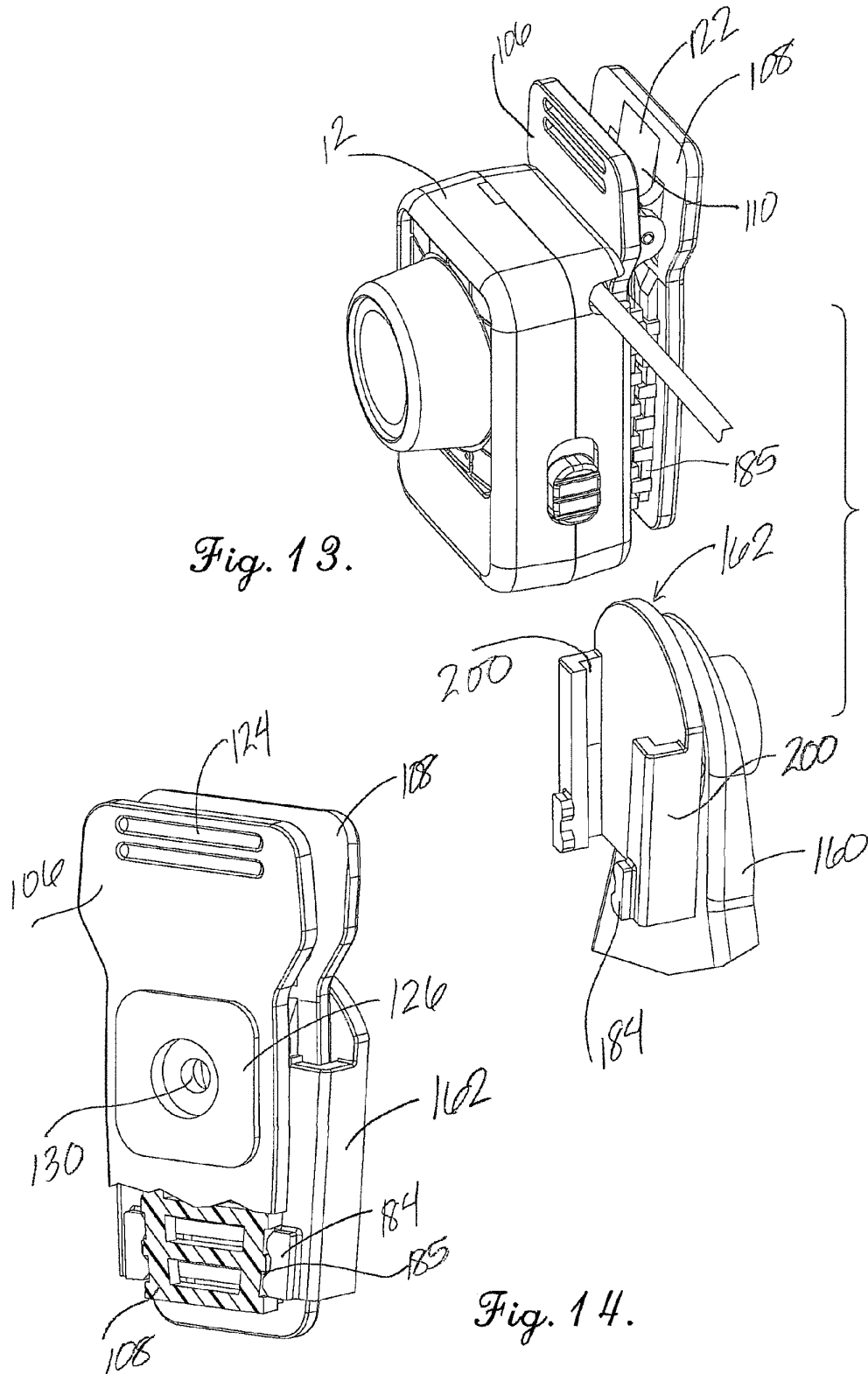


Fig. 14.

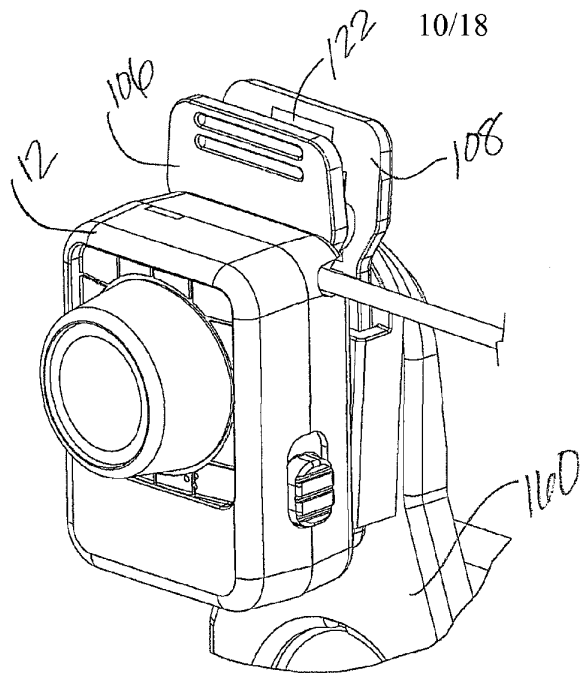


Fig. 15.

Fig. 16.

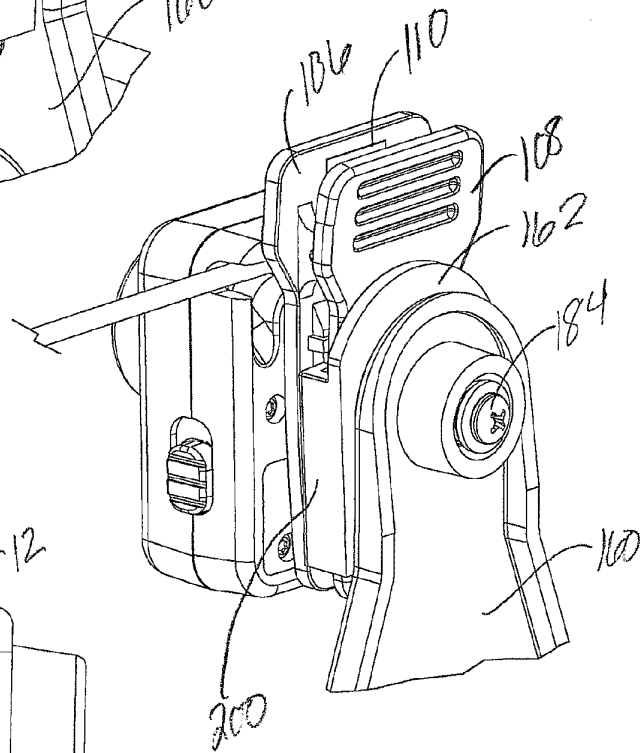
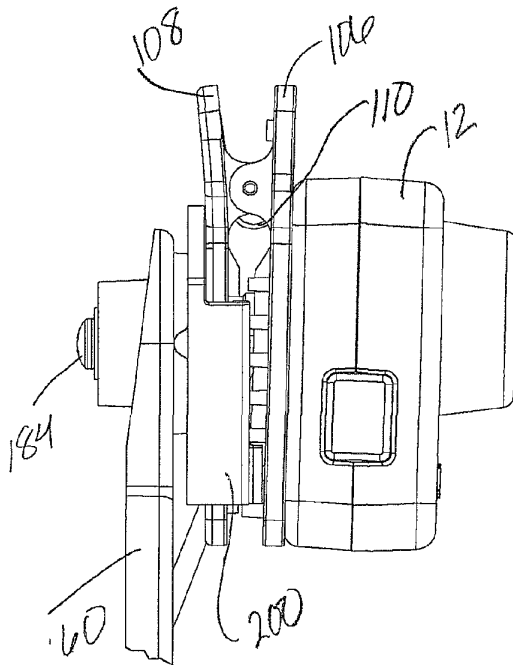


Fig. 17.

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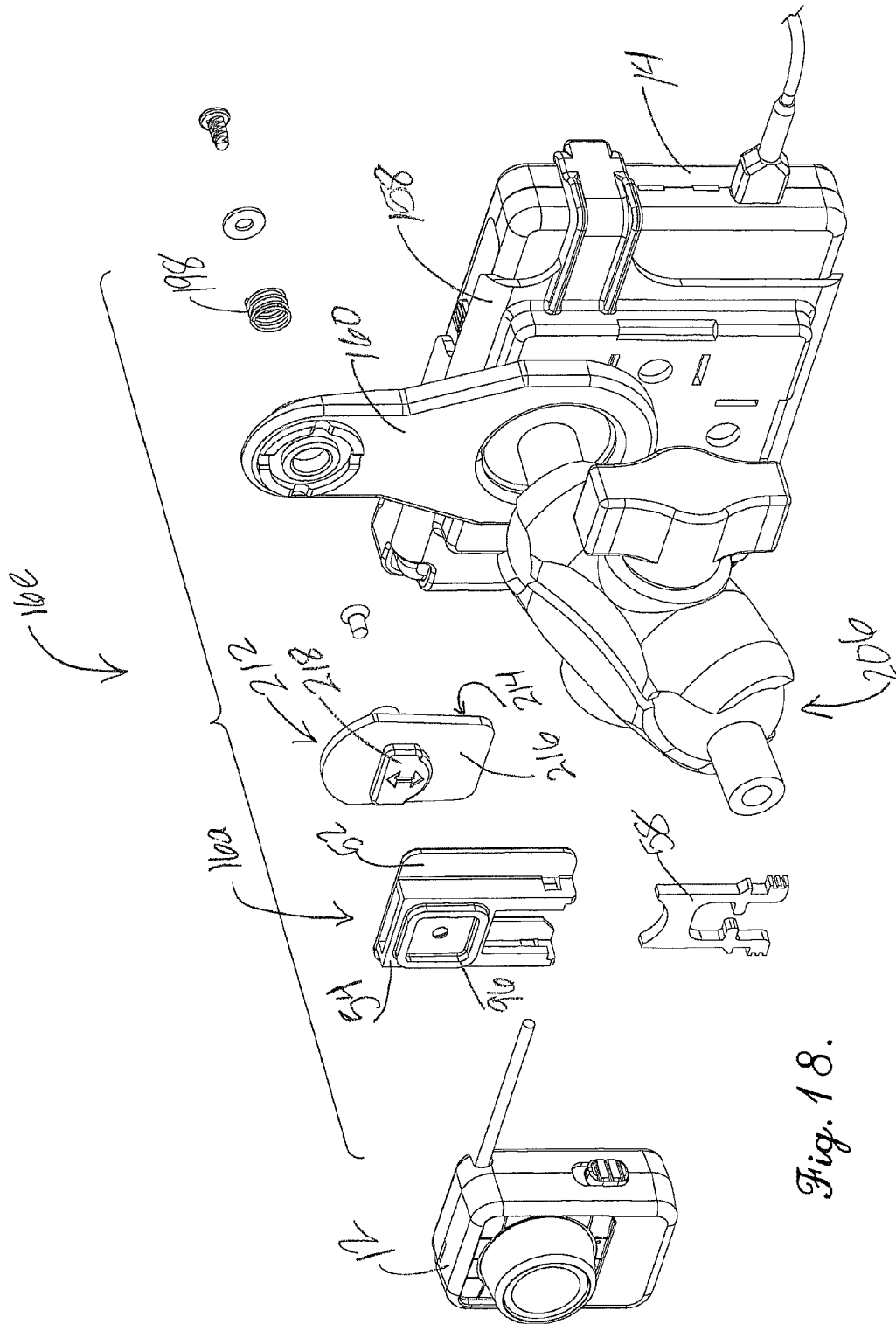


Fig. 18.

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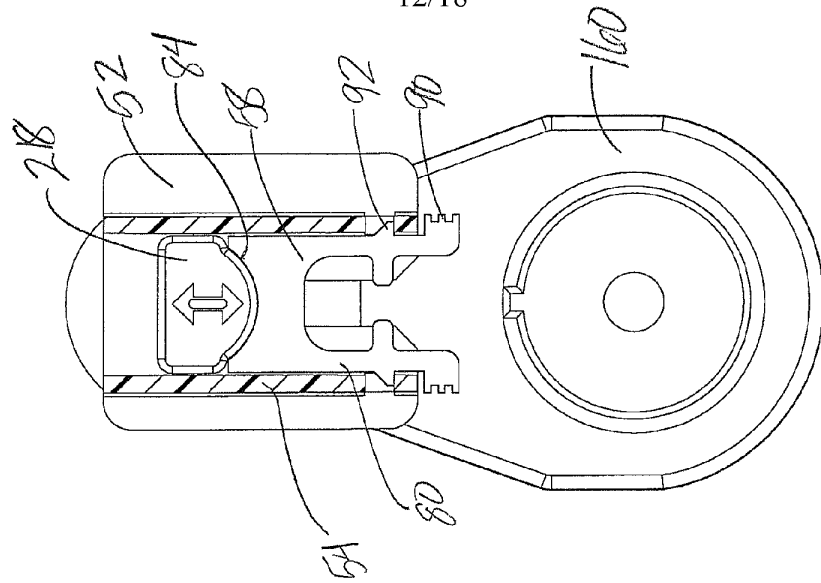


Fig. 20.

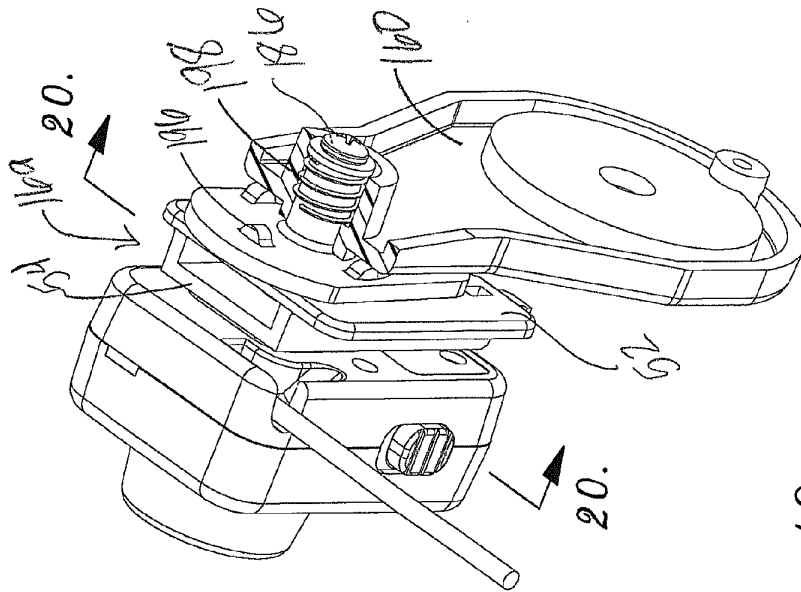


Fig. 19.

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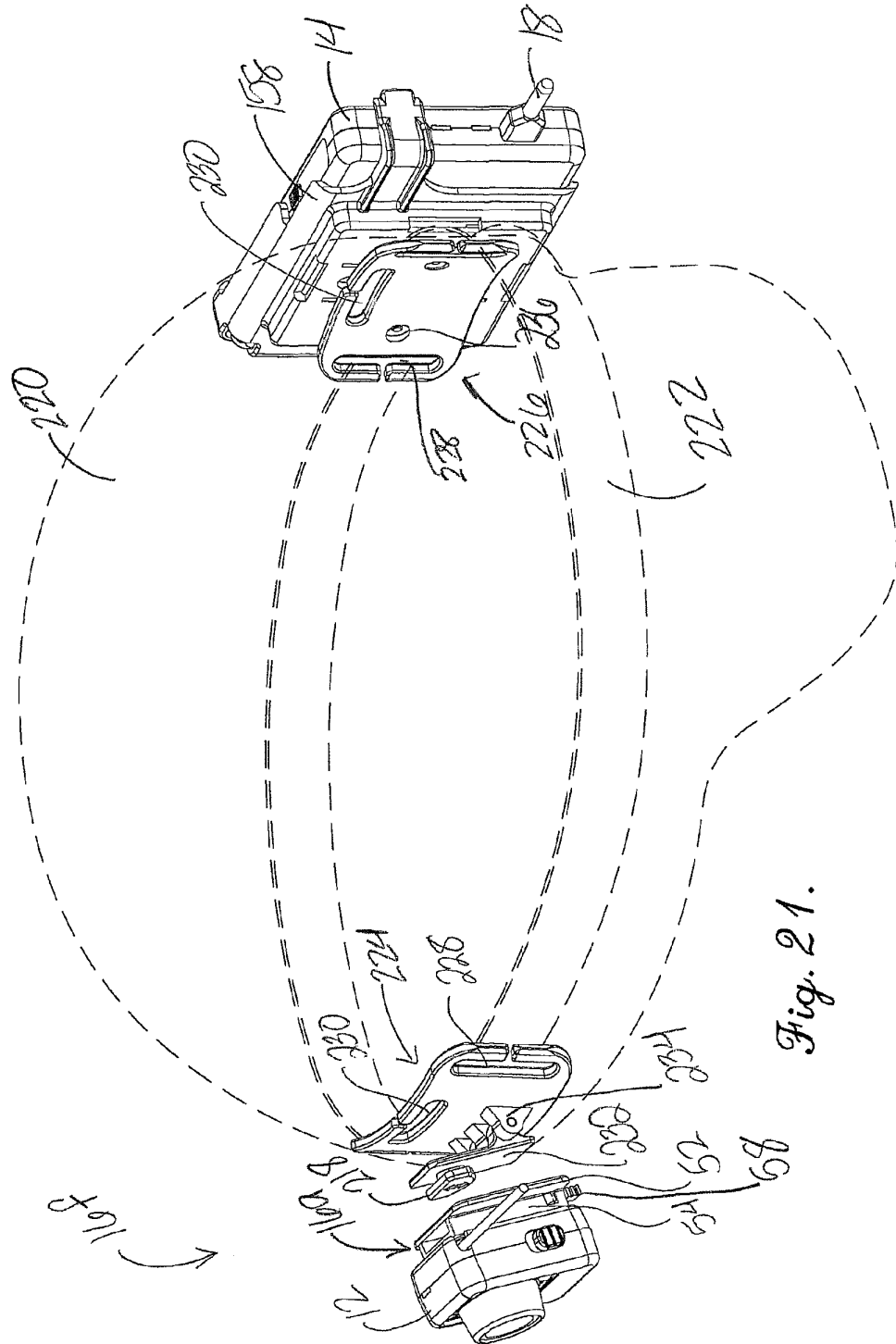


Fig. 21.

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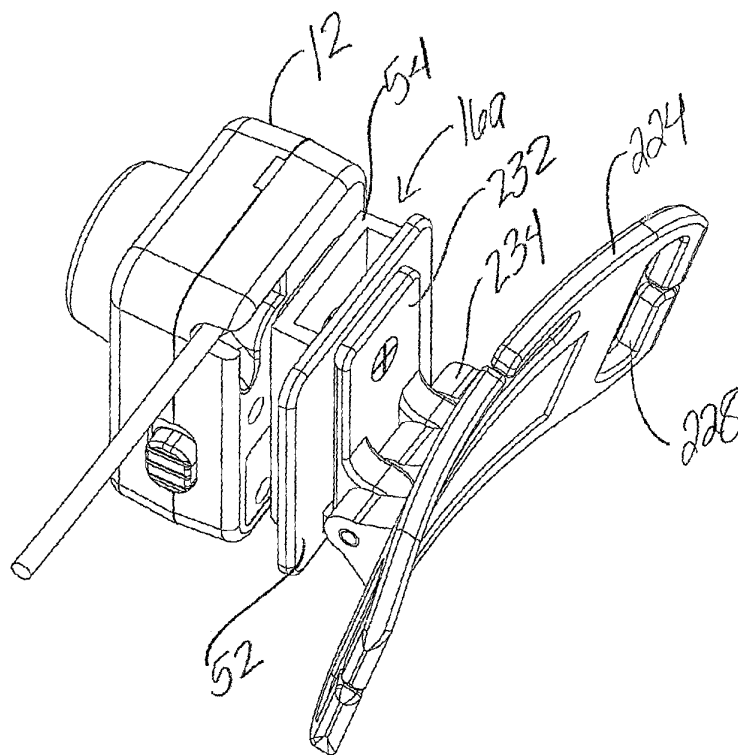


Fig. 22.

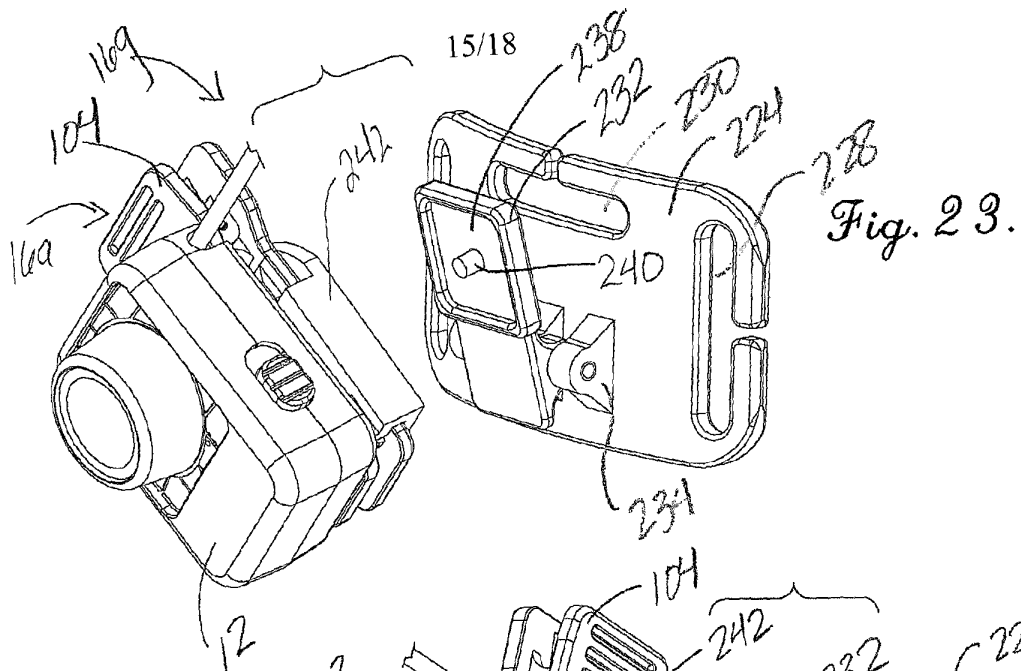


Fig. 24.

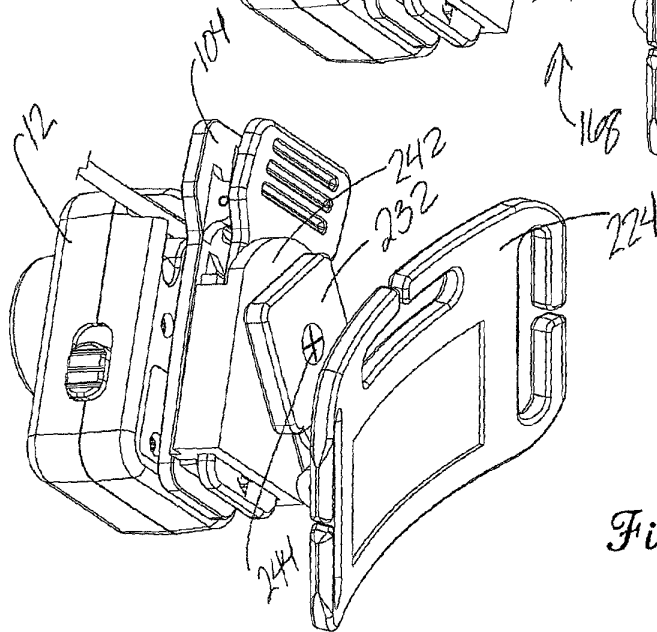
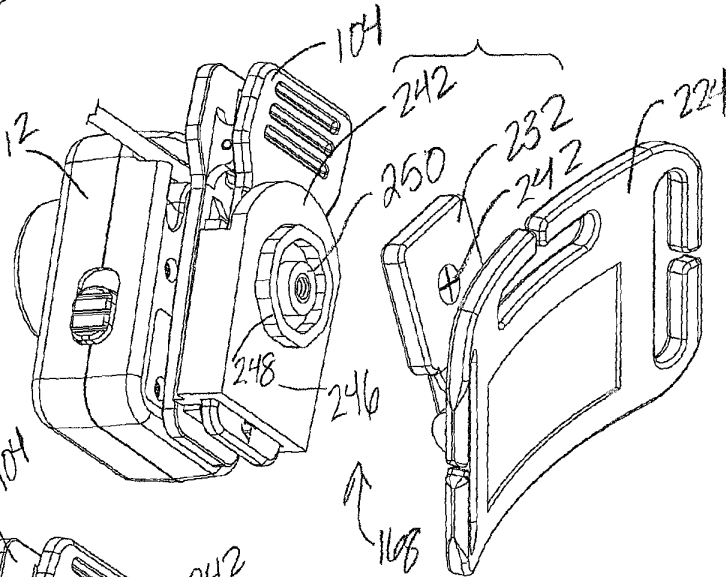
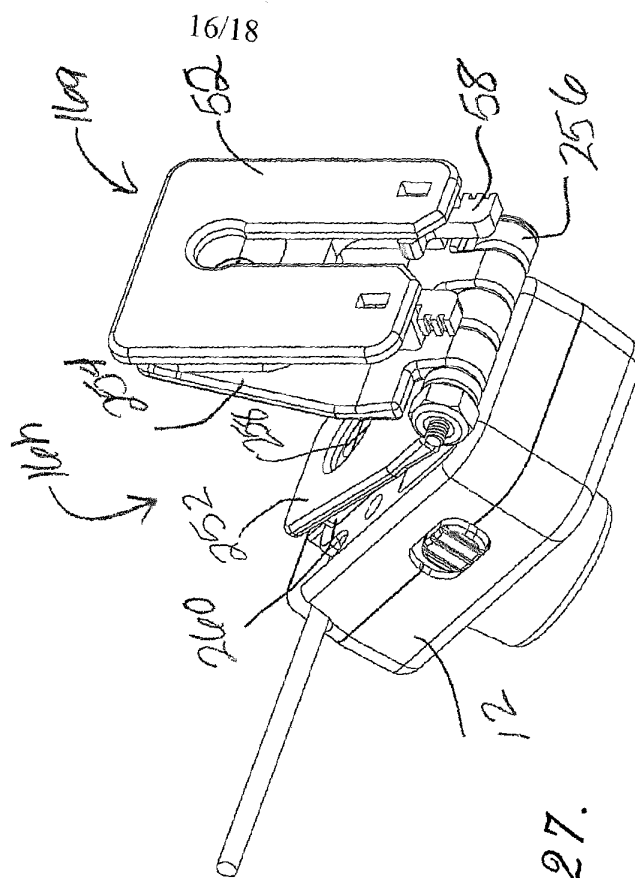
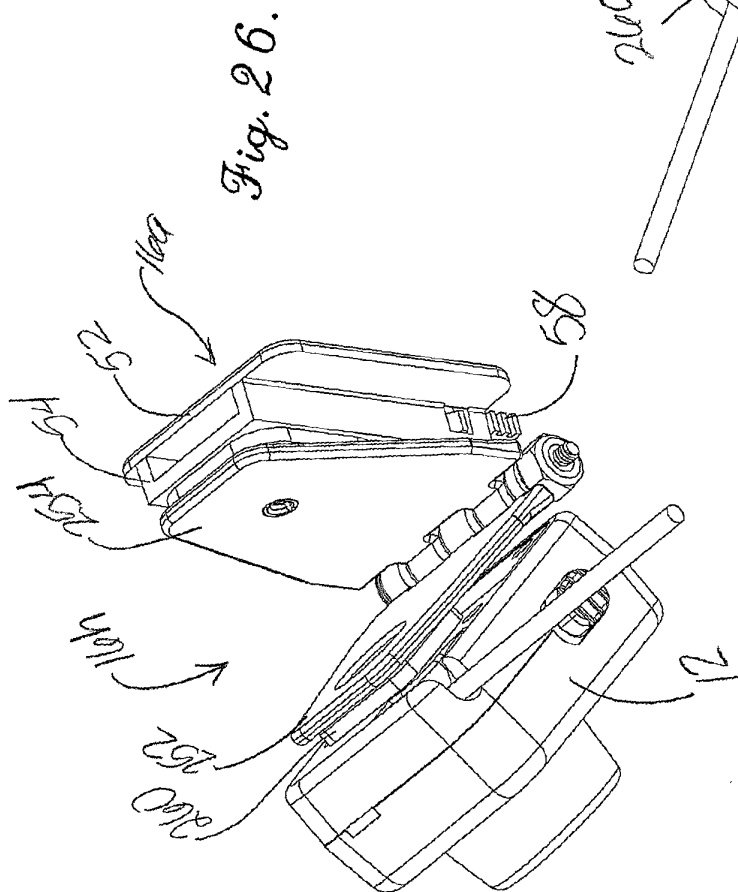


Fig. 25.



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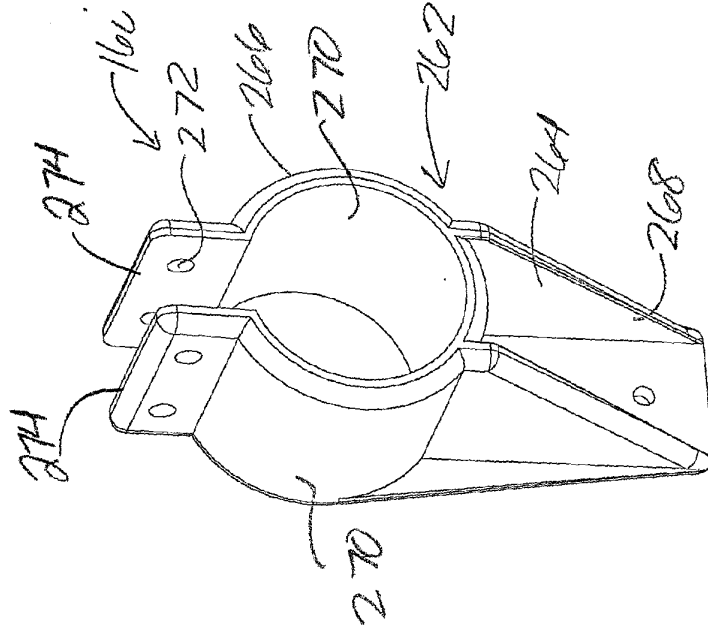


Fig. 29.

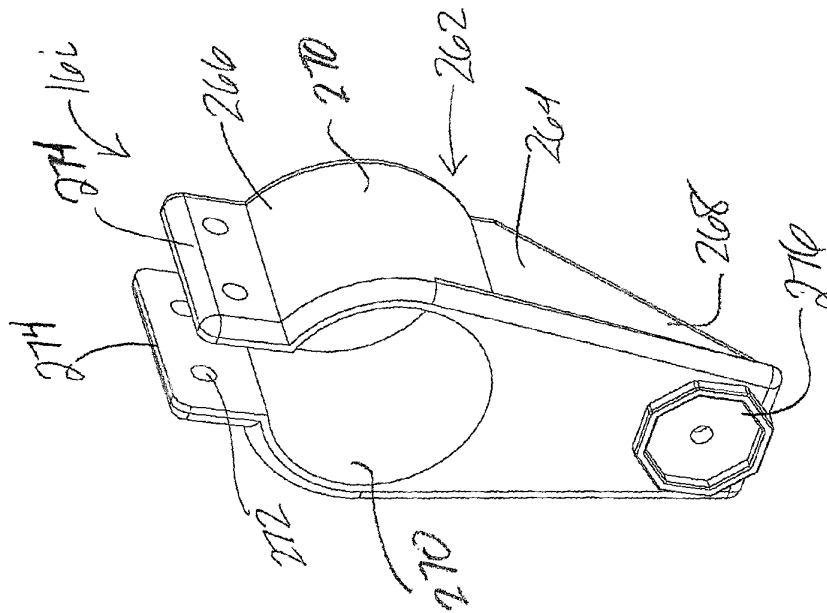


Fig. 28.

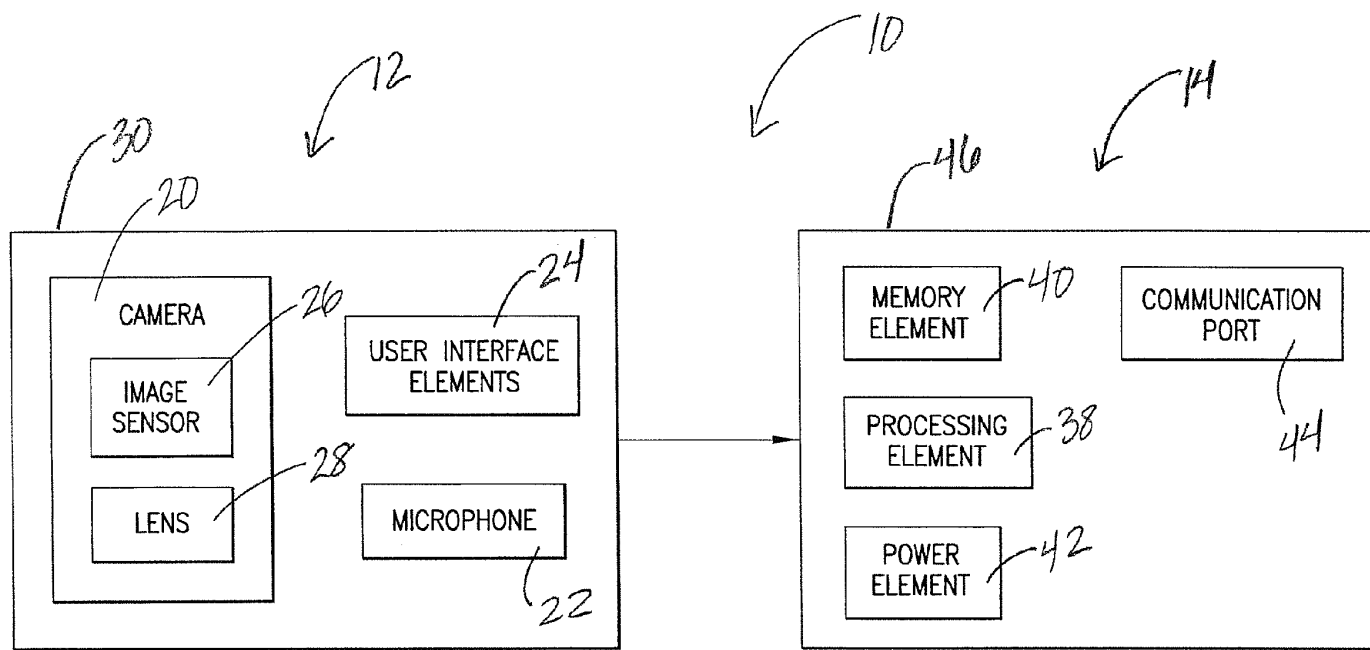


Fig. 30.

INTERNATIONAL SEARCH REPORT	International application No. PCT/US 2013/062415																		
A. CLASSIFICATION OF SUBJECT MATTER <div style="text-align: right;"> <i>H04N 7/18 (2006.01)</i> <i>H04N 5/77 (2006.01)</i> <i>H04N 5/225 (2006.01)</i> <i>G03B 19/18 (2006.01)</i> <i>A45F 5/02 (2006.01)</i> </div> According to International Patent Classification (IPC) or to both national classification and IPC																			
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) H04N 7/00, 7/18, 5/00, 5/222-5/28, 5/765, 5/77, G03B 19/18, A45F 5/00, A44B 1/26, A42B 3/04, A41D 1/00, B65D 25/52, G05D 15/00, G08B 23/00 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PatSearch (RUPTO internal), USPTO, PAJ, Esp@cenet, DWPI, EAPATIS, PATENTSCOPE, Information Retrieval System of FIPS																			
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Category*</th> <th style="width: 60%;">Citation of document, with indication, where appropriate, of the relevant passages</th> <th style="width: 30%;">Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">X</td> <td>US 5886739 A (C. NORMAN WINNINGSTAD) 23.03.1999, col. 3, lines 5-18, 54-64, col. 4, lines 30-45, 50-52, 65-66, col. 5, lines 15-20, col. 6, lines 41-60, fig. 1</td> <td style="text-align: center;">18</td> </tr> <tr> <td style="text-align: center;">Y</td> <td></td> <td style="text-align: center;">1-17, 19, 20</td> </tr> <tr> <td style="text-align: center;">Y</td> <td>DE 102010019451 A1 (KALKA JOCHEN et al.) 10.11.2011, abstract, [0004], [0006], [0065]-[0068], fig. 2, 3, 11</td> <td style="text-align: center;">1-10, 12, 13, 19, 20</td> </tr> <tr> <td style="text-align: center;">Y</td> <td>US 2003/0106917 A1 (LANCE SHETLER et al.) 12.06.2003, abstract, [0063], fig. 2, 5</td> <td style="text-align: center;">11-17</td> </tr> <tr> <td style="text-align: center;">Y</td> <td>US 2012/0063736 A1 (GORDON SCOTT SIMMONS et al.) 15.03.2012, [0082]</td> <td style="text-align: center;">3, 17</td> </tr> </tbody> </table>		Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	US 5886739 A (C. NORMAN WINNINGSTAD) 23.03.1999, col. 3, lines 5-18, 54-64, col. 4, lines 30-45, 50-52, 65-66, col. 5, lines 15-20, col. 6, lines 41-60, fig. 1	18	Y		1-17, 19, 20	Y	DE 102010019451 A1 (KALKA JOCHEN et al.) 10.11.2011, abstract, [0004], [0006], [0065]-[0068], fig. 2, 3, 11	1-10, 12, 13, 19, 20	Y	US 2003/0106917 A1 (LANCE SHETLER et al.) 12.06.2003, abstract, [0063], fig. 2, 5	11-17	Y	US 2012/0063736 A1 (GORDON SCOTT SIMMONS et al.) 15.03.2012, [0082]	3, 17
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Y		1-17, 19, 20																	
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Y	US 2012/0063736 A1 (GORDON SCOTT SIMMONS et al.) 15.03.2012, [0082]	3, 17																	
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.																			
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<table style="width: 100%;"> <tr> <td style="width: 50%;"> Date of the actual completion of the international search 09 December 2013 (09.12.2013) </td> <td style="width: 50%;"> Date of mailing of the international search report 30 January 2014 (30.01.2014) </td> </tr> </table>		Date of the actual completion of the international search 09 December 2013 (09.12.2013)	Date of mailing of the international search report 30 January 2014 (30.01.2014)																
Date of the actual completion of the international search 09 December 2013 (09.12.2013)	Date of mailing of the international search report 30 January 2014 (30.01.2014)																		
<table style="width: 100%;"> <tr> <td style="width: 50%;"> Name and mailing address of the ISA/ FIPS Russia, 123995, Moscow, G-59, GSP-5, Berezhkovskaya nab., 30-1 Facsimile No. +7 (499) 243-33-37 </td> <td style="width: 50%;"> Authorized officer N. Lavrentieva Telephone No. </td> </tr> </table>		Name and mailing address of the ISA/ FIPS Russia, 123995, Moscow, G-59, GSP-5, Berezhkovskaya nab., 30-1 Facsimile No. +7 (499) 243-33-37	Authorized officer N. Lavrentieva Telephone No.																
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2013/062415

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	RU 2383915 C2 (MICROSOFT CORPORATION) 10.03.2010	1-20
A	GB 2485804 A (NICOLAS BISCHOFF) 30.05.2012	1-20
A	JP 2000137263 A (FUJI PHOTO FILM CO LTD) 16.05.2000	1-20
A	US 6396403 B1 (LENORA A. HANER) 28.05.2002	1-20

Form PCT/ISA/210 (continuation of second sheet) (July 2009)



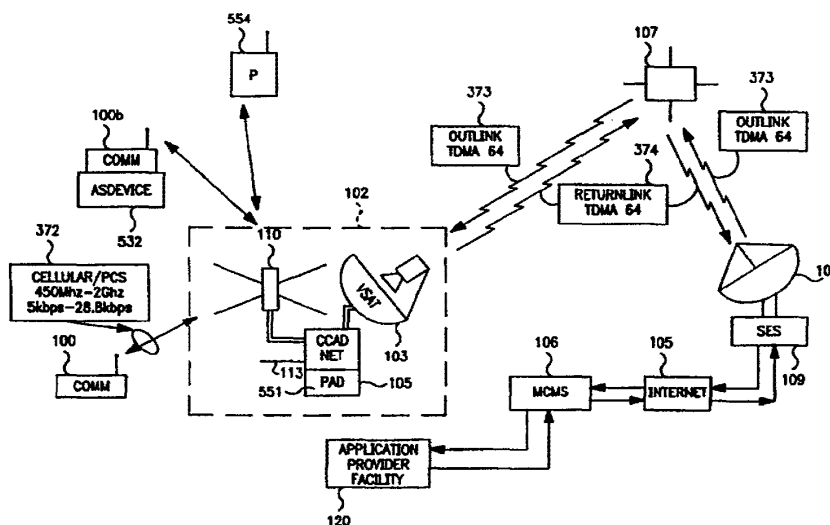
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : H04Q 7/20, 7/22, 7/00	A1	(11) International Publication Number: WO 99/48308 (43) International Publication Date: 23 September 1999 (23.09.99)
(21) International Application Number: PCT/US99/04638 (22) International Filing Date: 2 March 1999 (02.03.99) (30) Priority Data: 09/044,373 18 March 1998 (18.03.98) US (71) Applicant: AERIS COMMUNICATIONS, INC. [US/US]; Suite 201, 1245 South Winchester Boulevard, San Jose, CA 95128 (US). (72) Inventor: LADUE, Christoph, K.; 912 3rd Street, Santa Cruz, CA 95060 (US). (74) Agents: CALDWELL, Gregory, D. et al.; Blakely, Sokoloff, Taylor & Zafman, 7th floor, 12400 Wilshire Boulevard, Los Angeles, CA 90025-1026 (US).		(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>

(54) Title: METHOD AND APPARATUS FOR COMMUNICATING APPLICATION SPECIFIC DATA OVER WIRELESS COMMUNICATION NETWORKS

(57) Abstract

Communicating messages between a cellular mobile radio communicator (100) and a central monitoring station (120) over a communication network that includes a voice channel and a control channel (372). The voice channel conveys data messages and the control channel conveys control messages that manage access to and use of the voice channel. The communicator obtains a message comprising application data, and encodes the message in a sequence of digits associated with a control message to create an encoded message. A remote feature control request is encoded in the sequence of digits associated with the control message to invoke the forwarding of the sequence of digits, including the encoded message, by a telecommunications switching center upon detecting the remote feature control request. The control message and associated sequence of digits are transmitted from the communicator to a base station over the control channel, by passing the voice channel, and then transmitted from the base station to the telecommunications switching center via a satellite communication channel. The telecommunications switching center detects the remote feature control request and forwards the remote feature control request and the encoded message over a communications channel to the central monitoring station in response to detecting the remote feature control request. The encoded message is decoded at the central monitoring station to retrieve the application specific data.



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