

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Texas, Austin Division on the following

☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 1:22-cv-00801	DATE FILED 8/10/2022	U.S. DISTRICT COURT Western District of Texas, Austin Division
PLAINTIFF FUEL AUTOMATION STATION, LLC		DEFENDANT PERMIAN GLOBAL, INC. AND MANTICORE FUELS, LLC
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 9,586,805	3/7/2017	FUEL AUTOMATION STATION, LLC
2 10,815,118	10/27/2020	FUEL AUTOMATION STATION, LLC
3 10,974,955	4/13/2021	FUEL AUTOMATION STATION, LLC
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY <input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
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Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
 Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/290,371	03/07/2017	9586805	67846-008PUS1	3001

26096 7590 02/15/2017
CARLSON, GASKEY & OLDS, P.C.
400 WEST MAPLE ROAD
SUITE 350
BIRMINGHAM, MI 48009

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Fuel Automation Station, LLC, Birmingham, MI;
Ricky Dean Shock, Victoria, TX;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		
Filing Date		
First Named Inventor	Shock	
Art Unit		
Examiner Name		
Attorney Docket Number	67846-008PUS1	

20	6697705		2004-02-24	Johnson et al.	
21	6755225		2004-06-29	Niedwiecki et al.	
22	6761194		2004-07-13	Blong	
23	6786245		2004-09-07	Eichelberger et al.	
24	7063276		2006-06-20	Newton	
25	7106026		2006-09-12	Moore	
26	7353808		2008-04-08	Kakoo	
27	7415995		2008-08-26	Plummer et al.	
28	7458543		2008-12-02	Cutler et al.	
29	7568507		2009-08-04	Farese et al.	
30	7602143		10-2009 2009-12-19	Capizzo	

Change(s) applied
to document,

1/9/2017

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		
Filing Date		
First Named Inventor	Shock	
Art Unit		
Examiner Name		
Attorney Docket Number	67846-008PUS1	

9	4591115		1986-05-27	DeCarlo	
10	4930665		1990-06-05	Devine	
11	5406988		1995-04-18	Hopkins	
12	5454408		1995-10-03	DiBella et al.	
13	5503199		1996-04-02	Whitley, II et al.	
14	5538051		1996-07-23	Brown et al.	
15	5708424		1998-01-13	Orlando et al.	
16	5884675		03-1999 1000-12-23	Krasnov	
17	6206056		2001-03-27	Lagache	
18	6564615		2003-05-20	Carter	
19	6651706		2003-11-25	Litt	

Change(s) applied
to document,
/J.G./
1/9/2017

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

26096 7590 12/29/2016
CARLSON, GASKEY & OLDS, P.C.
400 WEST MAPLE ROAD
SUITE 350
BIRMINGHAM, MI 48009

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/290,371	10/11/2016	Ricky Dean Shock	67846-008PUS1	3001

TITLE OF INVENTION: MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	03/29/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
NIESZ, JASON KAROL	3754	141-231000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Carlson, Gaskey & Olds, P.C.

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

FUEL AUTOMATION STATION, LLC

Birmingham, MI

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
- ☒ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 501482 (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Matthew L. Koziarz/

Date 2017-01-23

Typed or printed name Matthew L. Koziarz

Registration No. 53154

Electronic Patent Application Fee Transmittal				
Application Number:		15290371		
Filing Date:		11-Oct-2016		
Title of Invention:		MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY		
First Named Inventor/Applicant Name:		Ricky Dean Shock		
Filer:		Matthew L. Koziarz/Andrea DeHart		
Attorney Docket Number:		67846-008PUS1		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				960

Electronic Acknowledgement Receipt

EFS ID:	28130106
Application Number:	15290371
International Application Number:	
Confirmation Number:	3001
Title of Invention:	MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY
First Named Inventor/Applicant Name:	Ricky Dean Shock
Customer Number:	26096
Filer:	Matthew L. Koziarz/Andrea DeHart
Filer Authorized By:	Matthew L. Koziarz
Attorney Docket Number:	67846-008PUS1
Receipt Date:	23-JAN-2017
Filing Date:	11-OCT-2016
Time Stamp:	10:25:33
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$960
RAM confirmation Number	012317INTEFSW00019763501482
Deposit Account	501482
Authorized User	Andrea DeHart

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	IssueFee_Transmittal.pdf	97987	no	1
			1da84cfafb819dcf14fadae8b54a75ebb5300b2d		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30662	no	2
			44bd73b6c701915c5f4ca63ab7ea3fbe6ae0fd8c		
Warnings:					
Information:					
Total Files Size (in bytes):			128649		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

26096 7590 12/29/2016
CARLSON, GASKEY & OLDS, P.C.
400 WEST MAPLE ROAD
SUITE 350
BIRMINGHAM, MI 48009

EXAMINER

NIESZ, JASON KAROL

ART UNIT

PAPER NUMBER

3754

DATE MAILED: 12/29/2016

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

15/290,371

10/11/2016

Ricky Dean Shock

67846-008PUS1

3001

TITLE OF INVENTION: MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	03/29/2017

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

26096 7590 12/29/2016
CARLSON, GASKEY & OLDS, P.C.
400 WEST MAPLE ROAD
SUITE 350
BIRMINGHAM, MI 48009

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/290,371	10/11/2016	Ricky Dean Shock	67846-008PUS1	3001

TITLE OF INVENTION: MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	03/29/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
NIESZ, JASON KAROL	3754	141-231000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
- 3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

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NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/290,371	10/11/2016	Ricky Dean Shock	67846-008PUS1	3001

26096 7590 12/29/2016
CARLSON, GASKEY & OLDS, P.C.
400 WEST MAPLE ROAD
SUITE 350
BIRMINGHAM, MI 48009

EXAMINER

NIESZ, JASON KAROL

ART UNIT	PAPER NUMBER
----------	--------------

3754

DATE MAILED: 12/29/2016

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. 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 12 minutes 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, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 15/290,371	Applicant(s) SHOCK, RICKY DEAN	
	Examiner JASON K. NIESZ	Art Unit 3754	AIA (First Inventor to File) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to application received 10/11/2016.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 1-22. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- a) ☐ All b) ☐ Some *c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|--|
| 1. <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Examiner's Amendment/Comment |
| 2. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____ | 6. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| 3. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 7. <input type="checkbox"/> Other _____. |
| 4. <input type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date _____. | |

/JASON K NIESZ/
Primary Examiner, Art Unit 3754

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Reasons for Allowance

2. The following is a statement of reasons for the indication of allowable subject matter: claims 1-22 is/are allowed primarily because the prior art of record cannot anticipate Applicant's claimed invention by a single reference nor render Applicant's claimed invention obvious by the combination of more than one reference.

Furthermore, the prior art of record does not teach "wherein the reels are arranged on first and second opposed sides in the mobile trailer" as within the context of the claimed invention as disclosed and within the context of the other limitations present in claim 1;

the prior art of record does not teach "and a first group of the hoses are deployable from the first trailer side wall and a second group of the hoses are deployable from the second trailer sidewall" as within the context of the claimed invention as disclosed and within the context of the other limitations present in claim 17.

For example US PGPub 2011/0197988 discloses a mobile fuel delivering system having a plurality of hoses connected to a plurality of manifolds, but doesn't disclose reels arranged on opposed sides of the trailer or hoses deployable from first and second walls of the trailer.

Therefore, the prior art of record cannot anticipate Applicant's claimed invention by a single reference nor render Applicant's claimed invention obvious by the combination of more than one reference.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JASON K. NIESZ whose telephone number is (571)270-3920. The examiner can normally be reached on mon-thu 10-3.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark A. Laurenzi III can be reached on (571) 270-7878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/JASON K NIESZ/

Application/Control Number: 15/290,371

Page 4

Art Unit: 3754

Primary Examiner, Art Unit 3754

Notice of References Cited	Application/Control No. 15/290,371	Applicant(s)/Patent Under Reexamination SHOCK, RICKY DEAN	
	Examiner JASON K. NIESZ	Art Unit 3754	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2011/0197988 A1	08-2011	Van Vliet; J. Todd	B67D7/04	141/1
	B	US-				
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
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	P					
	Q					
	R					
	S					
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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		
	First Named Inventor	Shock	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	67846-008PUS1	

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	2516150		1950-07-25	Samiran	
	2	2769572		1956-11-06	Harman et al.	
	3	2777461		1957-01-15	Wildhaber	
	4	3028010		1962-04-03	Headrick	
	5	3136295		1964-06-09	Gramo	
	6	3547141		1970-12-15	Alexander	
	7	3618643		1971-11-09	Thomson	
	8	4139019		1979-02-13	Bresie et al.	

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Examiner Name		
Attorney Docket Number	67846-008PUS1	

9	4591115		1986-05-27	DeCarlo	
10	4930665		1990-06-05	Devine	
11	5406988		1995-04-18	Hopkins	
12	5454408		1995-10-03	DiBella et al.	
13	5503199		1996-04-02	Whitley, II et al.	
14	5538051		1996-07-23	Brown et al.	
15	5708424		1998-01-13	Orlando et al.	
16	5884675		1999-12-23	Krasnov	
17	6206056		2001-03-27	Lagache	
18	6564615		2003-05-20	Carter	
19	6651706		2003-11-25	Litt	

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20	6697705		2004-02-24	Johnson et al.	
21	6755225		2004-06-29	Niedwiecki et al.	
22	6761194		2004-07-13	Blong	
23	6786245		2004-09-07	Eichelberger et al.	
24	7063276		2006-06-20	Newton	
25	7106026		2006-09-12	Moore	
26	7353808		2008-04-08	Kakoo	
27	7415995		2008-08-26	Plummer et al.	
28	7458543		2008-12-02	Cutler et al.	
29	7568507		2009-08-04	Farese et al.	
30	7602143		2009-12-13	Capizzo	

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Examiner Name		
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31	7628182		2009-12-08	Poulter	
32	7938151		2011-05-10	Hockner	
33	9346662		2016-05-24	Van Vliet et al.	
34	9371830		2016-06-21	Moffitt, Jr.	
35	9371831		2016-06-21	Moffitt, Jr.	

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U.S.PATENT APPLICATION PUBLICATIONS

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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	20070079891		2007-04-12	Farese et al.	
	2	20070164031		2007-07-19	Holz	
	3	20070181212		2007-08-09	Fell	
	4	20160076533		2016-03-17	Moffitt, Jr.	

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Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	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	0177006	WO		2001-10-18	BARTEC COMPONENTEN & SYST GMBH		
	2	2006005686	WO		2006-01-19	SECURITY & ELECTRONIC TECHNOLOGIES GMBH		
	3	2008083830	WO		2008-07-17	SECURITY & ELECTRONIC TECHNOLOGIES GMBH		
	4	2009026607	WO		2009-03-05	BANLAW PIPELINE PTY LTD		
	5	2485832	GB		2012-05-30	GRIFFITHS, Joseph Anthony BRITANNIA 2000 LIMITED		
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NON-PATENT LITERATURE DOCUMENTS								Remove
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.						T ⁵
	1	Oilfield Business: Technologies. Frac Shack Inc. introduces world's first Bi-Fuel Distribution Unit for hydraulic fracturing industry. Texas Oil & Gas: The National Magazine for Oil & Gas in Texas. Vol. 4, Issue 2. 2015. p. 27.						
	2	Frac Shack International. Publications & Endorsements. Retrieved August 23, 2016 from: http://www.fracshack.com						
	3	Frac Shack International. Technology. Retrieved August 23, 2016 from: http://www.fracshack.com						

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4	Frac Shack International. Design Benefits. Retrieved August 23, 2016 from: http://www.fracshack.com
5	Frac Shack International. Publications & Endorsements. Retrieved August 23, 2016 from: http://www.fracshack.com
6	Frac Shack International. Service. Retrieved August 23, 2016 from: http://www.fracshack.com
7	Frac Shack International. Frac Shack Series- Series A. Retrieved August 23, 2016 from: http://www.fracshack.com
8	Frac Shack International. Frac Shack Series- Series B. Retrieved August 23, 2016 from: http://www.fracshack.com
9	Frac Shack International. Frac Shack Series- Series C. Retrieved August 23, 2016 from: http://www.fracshack.com
10	Frac Shack International. Frac Shack Series- Series D. Retrieved August 23, 2016 from: http://www.fracshack.com
11	Frac Shack International. Frac Shack Series- Series E. Retrieved August 23, 2016 from: http://www.fracshack.com
12	Frac Shack International. Frac Shack Series- Series EG. Retrieved August 23, 2016 from: http://www.fracshack.com
13	Mann Tek. Dry Disconnect Couplings. Retrieved July 22, 2016 from: http://www.manntek.com/products/drydisconnectcouplings p. 1-4
14	Mann Tek. Dry Aviation Couplings. Retrieved July 22, 2016 from: http://www.manntek.com/products/dryaviationcouplings p. 1-4

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Application Number		
Filing Date		
First Named Inventor	Shock	
Art Unit		
Examiner Name		
Attorney Docket Number	67846-008PUS1	

15	Water, J. (2013). Better Safe than Sorry: Frac Shack a welcome addition to the oil patch. January 2, 2013. Retrieved August 23, 2016 from: http://www.pipelinenewsnorth.ca/better-safe-than-sorry-1.1123066
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If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature	/JASON K NIESZ/	Date Considered	12/13/2016
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	
First Named Inventor	Shock
Art Unit	
Examiner Name	
Attorney Docket Number	67846-008PUS1

CERTIFICATION STATEMENT

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	/Matthew L. Koziarz/	Date (YYYY-MM-DD)	2016-10-11
Name/Print	Matthew L. Koziarz	Registration Number	53154


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.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Search Notes 	Application/Control No. 15290371	Applicant(s)/Patent Under Reexamination SHOCK, RICKY DEAN
	Examiner JASON K NIESZ	Art Unit 3754

CPC- SEARCHED		
Symbol	Date	Examiner
B67D 7/38, 7/84, 7/40, 7/845, 7/465, 7/3218, 7/36	12/12/2016	JN
B60P 3/065	12/12/2016	JN

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor and Assignee search Conducted, limited with text: (USPAT, USPGPUB, USOCR, FPRS, EPO, JPO, DERWENT, IBMTDB)	12/14/2016	JN
EAS search Conducted, limited with text: (USPAT, USPGPUB, USOCR, FPRS, EPO, JPO, DERWENT, IBMTDB)T	12/14/2016	JN

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
(trailer pump reels hoses valves fluid level sensors).clm.		12/14/2016	JN

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BIB DATA SHEET

CONFIRMATION NO. 3001

SERIAL NUMBER 15/290,371	FILING or 371(c) DATE 10/11/2016 RULE	CLASS 141	GROUP ART UNIT 3754	ATTORNEY DOCKET NO. 67846-008PUS1	
APPLICANTS Fuel Automation Station, LLC, Birmingham, MI; INVENTORS Ricky Dean Shock, Victoria, TX; ** CONTINUING DATA ***** ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 10/20/2016					
Foreign Priority claimed <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No 35 USC 119(a-d) conditions met <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Verified and /JASON KAROL NIESZ/ Acknowledged Examiner's Signature	<input type="checkbox"/> Met after Allowance Initials	STATE OR COUNTRY TX	SHEETS DRAWINGS 19	TOTAL CLAIMS 22	INDEPENDENT CLAIMS 2
ADDRESS CARLSON, GASKEY & OLDS, P.C. 400 WEST MAPLE ROAD SUITE 350 BIRMINGHAM, MI 48009 UNITED STATES					
TITLE MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY					
FILING FEE RECEIVED 1900	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		<input type="checkbox"/> All Fees <input type="checkbox"/> 1.16 Fees (Filing) <input type="checkbox"/> 1.17 Fees (Processing Ext. of time) <input type="checkbox"/> 1.18 Fees (Issue) <input type="checkbox"/> Other _____ <input type="checkbox"/> Credit		

<p><i>Index of Claims</i></p> 	<p>Application/Control No.</p> <p>15290371</p>	<p>Applicant(s)/Patent Under Reexamination</p> <p>SHOCK, RICKY DEAN</p>
	<p>Examiner</p> <p>JASON K NIESZ</p>	<p>Art Unit</p> <p>3754</p>

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

<input checked="" type="checkbox"/> Claims renumbered in the same order as presented by applicant <input type="checkbox"/> CPA <input type="checkbox"/> T.D. <input type="checkbox"/> R.1.47										
CLAIM		DATE								
Final	Original	12/14/2016								
	1	=								
	2	=								
	3	=								
	4	=								
	5	=								
	6	=								
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EAST Search History


EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	118	b67d7/465.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/12/13 08:15
S2	496	b67d7/3218.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/12/13 08:15
S3	824	b67d7/36.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/12/13 08:15
S4	947	b67d7/84.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/12/13 08:15
S5	464	b67d7/38.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/12/13 08:15
S6	496	b67d7/40.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/12/13 08:15
S7	297	b67d7/845.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/12/13 08:15
S8	0	b60p3/065.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/12/13 08:16
S9	506	b60p3/035.cpc.	US-PGPUB;	OR	OFF	2016/12/13

			USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB			08:16
S10	3835	S1 S2 S3 S4 S5 S6 S7 S9	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/12/13 08:16
S11	39	("20070079891" "20070164031" "20070181212" "20160076533" "2516150" "2769572" "2777461" "3028010" "3136295" "3547141" "3618643" "4139019" "4591115" "4930665" "5406988" "5454408" "5503199" "5538051" "5708424" "5884675" "6206056" "6564615" "6651706" "6697705" "6755225" "6761194" "6786245" "7063276" "7106026" "7353808" "7415995" "7458543" "7568507" "7602143" "7628182" "7938151" "9346662" "9371830" "9371831").PN.	US-PGPUB; USPAT	OR	OFF	2016/12/13 08:17
S12	0	((("FUEL") near3 ("AUTOMATION") near3 ("STATION") near3 ("LLC")).AANM.	USPAT	OR	OFF	2016/12/13 08:20
S13	0	((("SHOCK") near3 ("Ricky")).INV.	EPO; JPO; DERWENT	OR	OFF	2016/12/13 08:20
S14	0	((("SHOCK") near3 ("Ricky")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/12/13 08:20
S15	4	wo-2008083830-\$.did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2016/12/13 08:49
S16	31606	"141".clas.	US-PGPUB; USPAT	OR	OFF	2016/12/13 09:25
S17	500	141/231.ccls.	US-PGPUB; USPAT	OR	OFF	2016/12/13 09:25
S18	117	S17 and trailer	US-PGPUB; USPAT	OR	OFF	2016/12/13 09:25
S19	500	S16 and trailer	US-PGPUB; USPAT	OR	OFF	2016/12/13 09:25
S20	58	("20030098017" "20030111129" "20040187950" "20060086411" "20060266430" "20070079891" "20070164031" "20070181212" "20110297271" "2516150" "2769572" "3028010" "3547141" "3618643" "4059134" "4139019" "4591115" "4638842" "4671329" "4770317" "5295521" "5388622" "5406988" "5454408" "5503199" "5538051" "5651400" "5708424" "5769109" "5884675" "5918256" "5944074" "6178990" "6206056" "6478576"	US-PGPUB; USPAT; USOCR	OR	OFF	2016/12/13 10:07

		"6564615" "6637466" "6651706" "6697705" "6755225" "6761194" "6786245" "7020906" "7063276" "7106026" "7353808" "7415995" "7441569" "7458543" "7568507" "7602143" "7628182" "7938151" "8671998").PN. OR ("9346662").URPN.				
S21	16	("20050268971" "20060157149" "3807433" "4313228" "5507326" "5534856" "5785100" "6224353" "6931305" "7536264" "7546256" "7574385" "7689371" "7783435").PN. OR ("7938151").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/12/13 10:08
S22	15	("2160741" "2608988" "3580420" "3807433" "4139019" "4320788" "5944074").PN. OR ("7628182").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2016/12/13 10:08

12/ 14/ 2016 11:56:30 AM
H:\ EAST\ Workspaces\ 15290371.wsp

Issue Classification 	Application/Control No. 15290371	Applicant(s)/Patent Under Reexamination SHOCK, RICKY DEAN	
	Examiner JASON K NIESZ	Art Unit 3754	

CPC					
Symbol				Type	Version
B67D	7	40		F	2013-01-01
B62D	63	08		I	2013-01-01
B60P	3	035		I	2013-01-01
B60P	3	00		I	2013-01-01
B67D	7	62		I	2013-01-01
B67D	7	78		I	2013-01-01
B67D	7	845		I	2013-01-01
E21B	43	26		A	2013-01-01

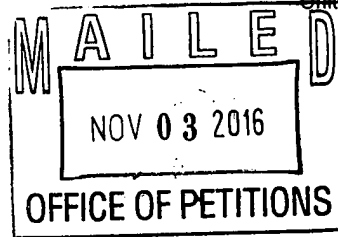
CPC Combination Sets				
Symbol	Type	Set	Ranking	Version

NONE		Total Claims Allowed:	
		22	
(Assistant Examiner)	(Date)	O.G. Print Claim(s)	O.G. Print Figure
/JASON K NIESZ/ Primary Examiner.Art Unit 3754	12/14/2016	1	1
(Primary Examiner)	(Date)		



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400 WEST MAPLE ROAD
SUITE 350
BIRMINGHAM MI 48009



United States Patent and Trademark Office
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Alexandria, VA 22313-1450
www.uspto.gov

Doc Code: TRACK1.GRANT

Decision Granting Request for Prioritized Examination (Track I or After RCE)	Application No.: 15/290,371
<p>1. THE REQUEST FILED <u>October 11, 2016</u> IS GRANTED.</p> <p>The above-identified application has met the requirements for prioritized examination</p> <p>A. <input checked="" type="checkbox"/> for an original nonprovisional application (Track I). B. <input type="checkbox"/> for an application undergoing continued examination (RCE).</p> <p>2. The above-identified application will undergo prioritized examination. The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:</p> <p>A. filing a <u>petition for extension of time</u> to extend the time period for filing a reply; B. filing an <u>amendment to amend the application to contain more than four independent claims, more than thirty total claims</u>, or a multiple dependent claim; C. filing a <u>request for continued examination</u>; D. filing a notice of appeal; E. filing a request for suspension of action; F. mailing of a notice of allowance; G. mailing of a final Office action; H. completion of examination as defined in 37 CFR 41.102; or I. abandonment of the application.</p> <p>Telephone inquiries with regard to this decision should be directed to Brian W. Brown at 571-272-5338.</p> <p>/Brian W. Brown/ [Signature]</p> <p>Petitions Examiner, Office of Petitions (Title)</p>	



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
15/290,371	10/11/2016	3654	1900	67846-008PUS1	22	2

CONFIRMATION NO. 3001

FILING RECEIPT



0000000086819791

26096
CARLSON, GASKEY & OLDS, P.C.
400 WEST MAPLE ROAD
SUITE 350
BIRMINGHAM, MI 48009

Date Mailed: 10/31/2016

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Ricky Dean Shock, Victoria, TX;

Applicant(s)

Fuel Automation Station, LLC, Birmingham, MI;

Power of Attorney: None

Domestic Applications for which benefit is claimed - None.

A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 10/20/2016

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/290,371**

Projected Publication Date: 04/12/2018

Non-Publication Request: No

Early Publication Request: No

Title

MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY

Preliminary Class

242

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 15/290,371			
APPLICATION AS FILED - PART I									
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY			
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)		
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280		
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	600		
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720		
TOTAL CLAIMS (37 CFR 1.16(j))	22 minus 20 =	*				x 80 =	160		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*				x 420 =	0.00		
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00		
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00		
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		TOTAL	1760		
APPLICATION AS AMENDED - PART II									
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)	
	Total (37 CFR 1.16(i))	*	Minus **	=			x =		
	Independent (37 CFR 1.16(h))	*	Minus ***	=			x =		
	Application Size Fee (37 CFR 1.16(s))								
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
				TOTAL ADD'L FEE		TOTAL ADD'L FEE			
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)	
	Total (37 CFR 1.16(i))	*	Minus **	=			x =		
	Independent (37 CFR 1.16(h))	*	Minus ***	=			x =		
	Application Size Fee (37 CFR 1.16(s))								
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
				TOTAL ADD'L FEE		TOTAL ADD'L FEE			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.									

67486-008PUS1

PTO/AIA/01 (06-12)

Approved for use through 01/31/2014. OMB 0651-0032

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

**Title of
Invention**

MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY

As the below named inventor, I hereby declare that:

This declaration
is directed to:



The attached application, or



United States application or PCT international application number _____

filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

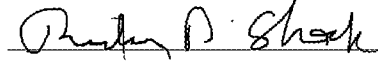
WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Ricky Dean Shock

Date (Optional): October 21, 2016

Signature: 

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. 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 1.11 and 1.14. This collection is estimated to take 1 minute 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.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt

EFS ID:	27296024
Application Number:	15290371
International Application Number:	
Confirmation Number:	3001
Title of Invention:	MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY
First Named Inventor/Applicant Name:	Ricky Dean Shock
Customer Number:	26096
Filer:	Matthew L. Koziarz/Andrea DeHart
Filer Authorized By:	Matthew L. Koziarz
Attorney Docket Number:	67846-008PUS1
Receipt Date:	24-OCT-2016
Filing Date:	
Time Stamp:	10:53:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	Signed_Declaration.pdf	55933	no	1
			b2e73f4fc6b2218aa9cad8284c036c156d6c6839		

Warnings:

Information:	
Total Files Size (in bytes):	55933
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>	

Document code: WFEE

United States Patent and Trademark Office
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		01	FC : 1051	140.00	DA	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		
	First Named Inventor	Shock	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	67846-008PUS1	

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	2516150		1950-07-25	Samiran	
	2	2769572		1956-11-06	Harman et al.	
	3	2777461		1957-01-15	Wildhaber	
	4	3028010		1962-04-03	Headrick	
	5	3136295		1964-06-09	Gramo	
	6	3547141		1970-12-15	Alexander	
	7	3618643		1971-11-09	Thomson	
	8	4139019		1979-02-13	Bresie et al.	

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		
Filing Date		
First Named Inventor	Shock	
Art Unit		
Examiner Name		
Attorney Docket Number	67846-008PUS1	

9	4591115		1986-05-27	DeCarlo	
10	4930665		1990-06-05	Devine	
11	5406988		1995-04-18	Hopkins	
12	5454408		1995-10-03	DiBella et al.	
13	5503199		1996-04-02	Whitley, II et al.	
14	5538051		1996-07-23	Brown et al.	
15	5708424		1998-01-13	Orlando et al.	
16	5884675		1999-12-23	Krasnov	
17	6206056		2001-03-27	Lagache	
18	6564615		2003-05-20	Carter	
19	6651706		2003-11-25	Litt	

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		
Filing Date		
First Named Inventor	Shock	
Art Unit		
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Attorney Docket Number	67846-008PUS1	

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Name/Print	Matthew L. Koziarz	Registration Number	53154

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(22) Date of Filing: **26.11.2010**

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(51) INT CL:
F16L 11/127 (2006.01) **F16L 25/01** (2006.01)
F16L 37/407 (2006.01) **H01R 13/00** (2006.01)

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(58) Field of Search:
INT CL **F16L, H01R**
Other: **EPODOC, WPI**

(54) Title of the Invention: **A fluid supply and data communication system and couplings for use in such a system**
Abstract Title: **A combined fluid coupling and data communication connection**

(57) A combined fluid supply and data communication conduit comprising a fluid supply duct / pipe 2, a data communication cable / wire 10 within the pipe, at least one end of the duct having a coupling 5 comprising a fluid tight valve 8 which is closed when the coupling is uncoupled (shown) and opened when the coupling is coupled, wherein the coupling comprises a data connection terminal 12 connected to the cable. The data cable may be an electrical wire for providing audio / radio link, or may be an optic fibre cable for a camera link, amongst others. The data terminals may be concentric, spring mounted, etc. Contactless RF induction coupling may alternatively be used to transmit data for safety reasons (fig. 7). Preferably air is fed in the pipe to a user on an oil-platform. Other independent claims relate to mating components of a releasable combined fluid supply and communications coupling, a retro-fit data communication connector and a retro-fitted adaptor.

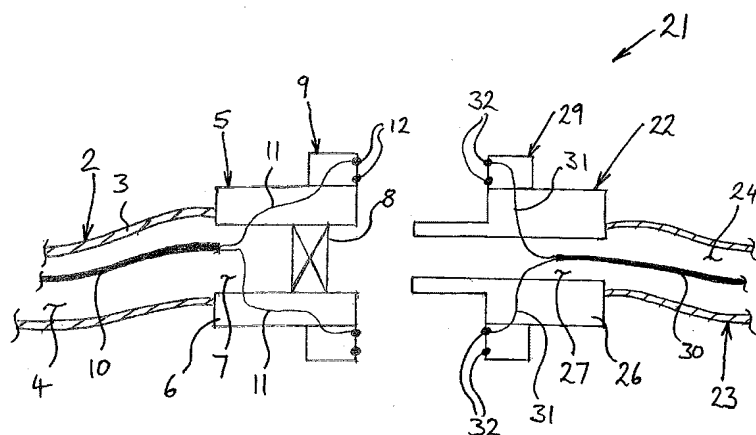


FIGURE 2

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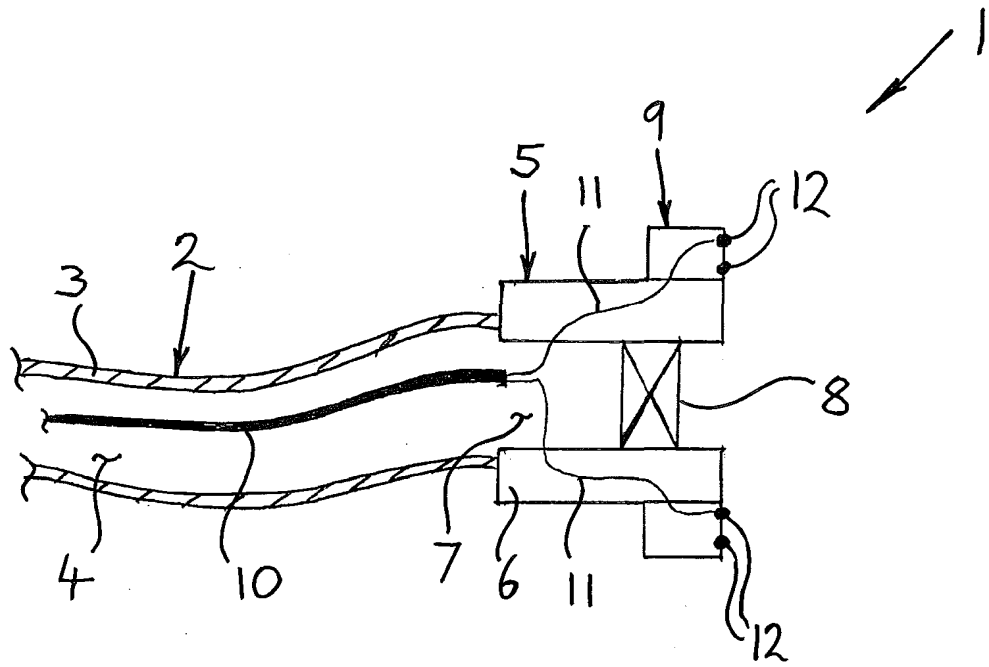


FIGURE 1

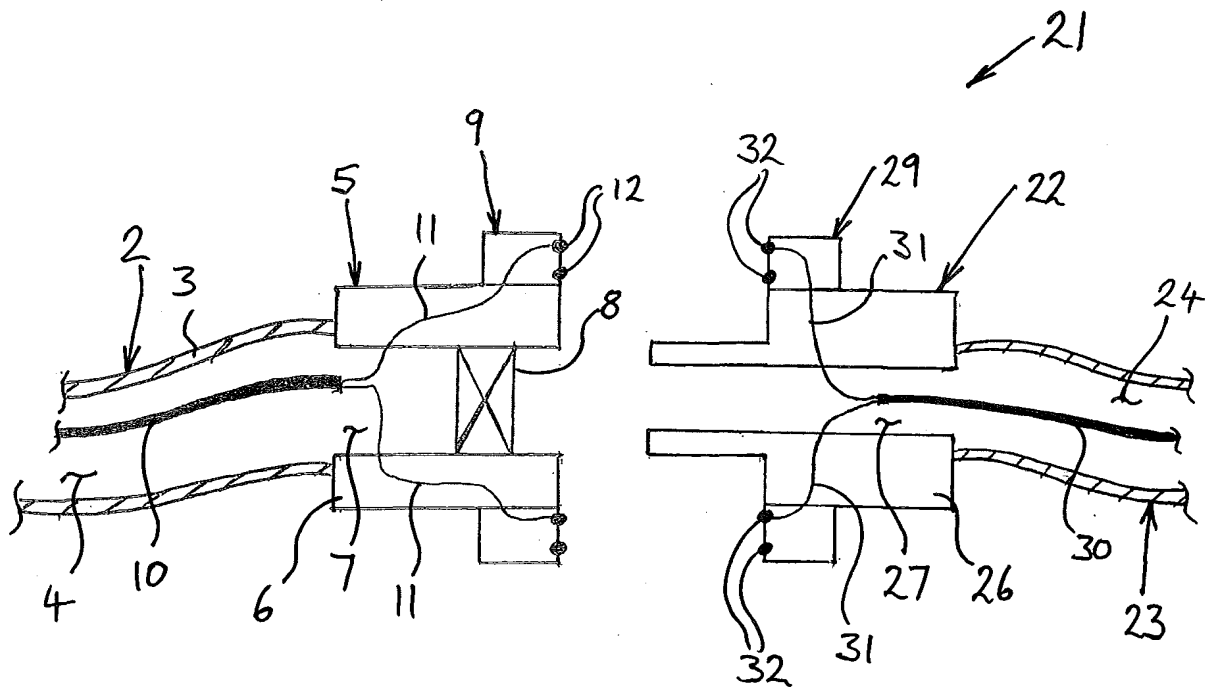


FIGURE 2

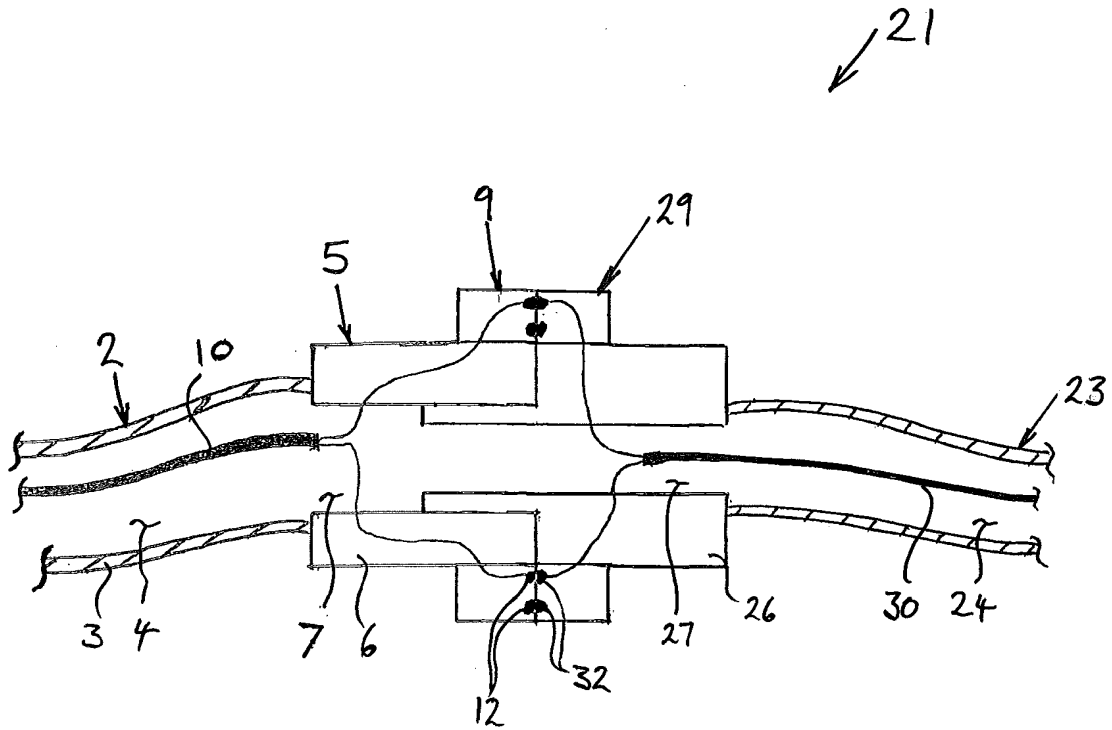


FIGURE 3

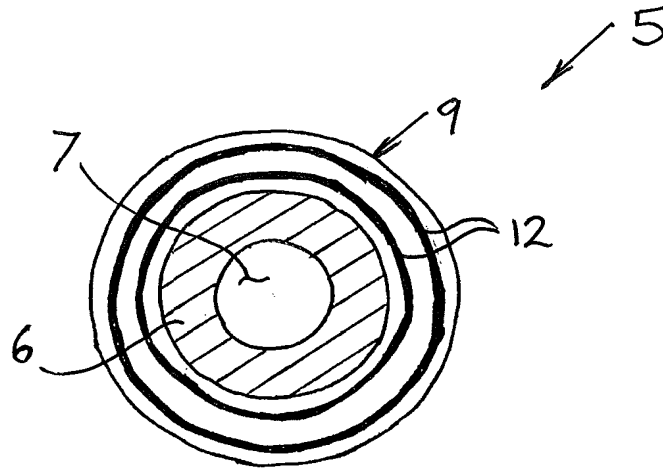


FIGURE 4A

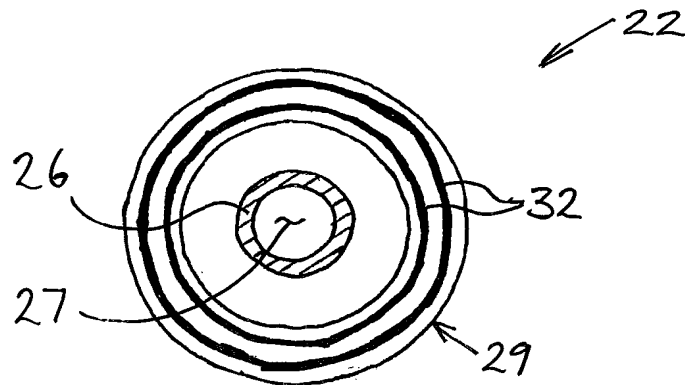


FIGURE 4B

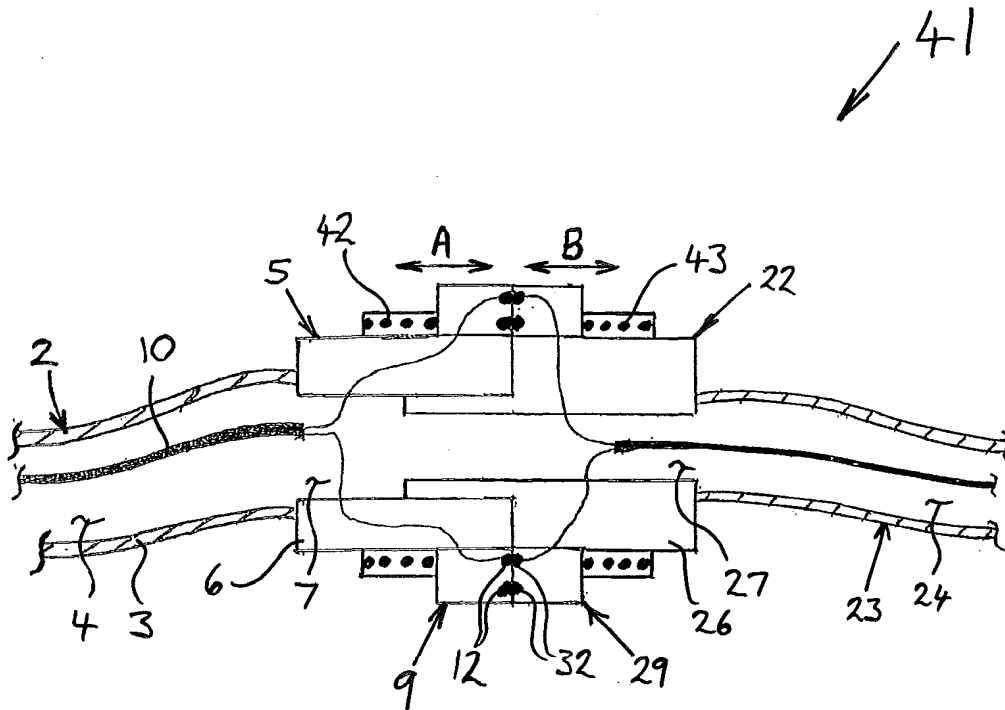


FIGURE 5

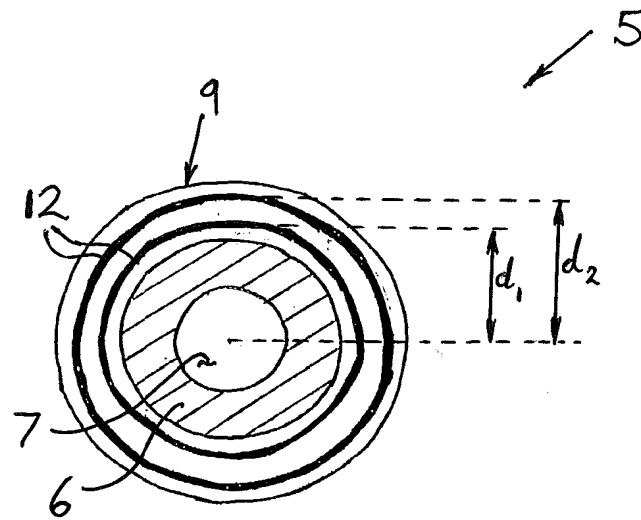


FIGURE 6A

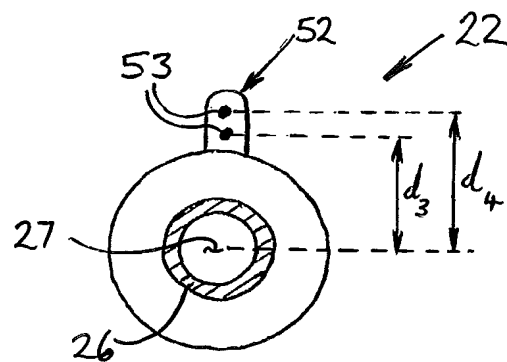


FIGURE 6B

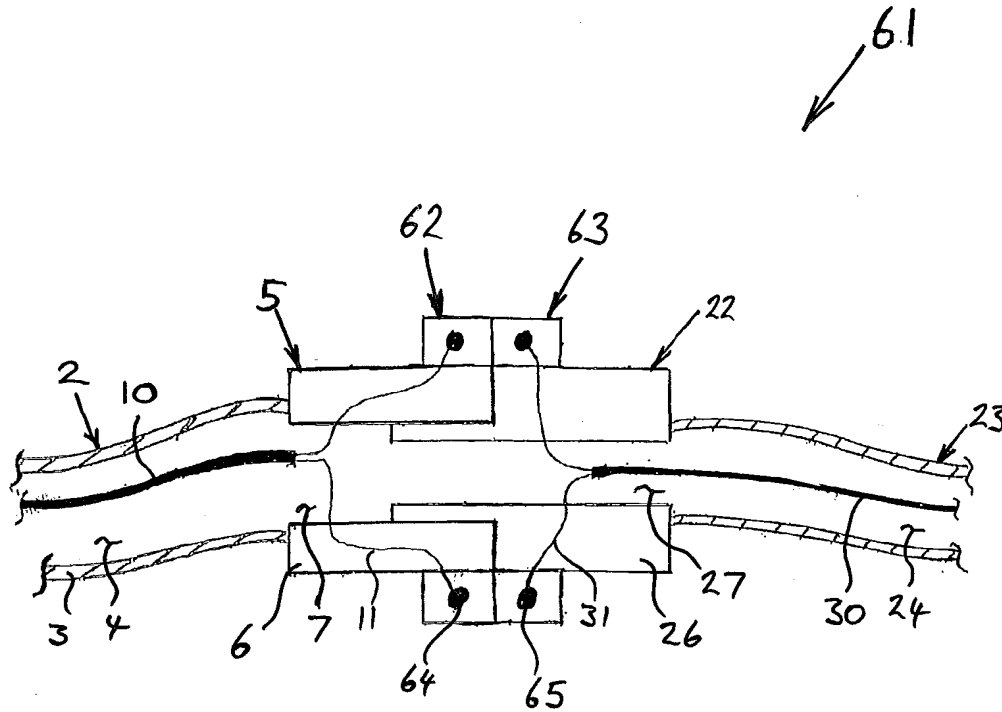


FIGURE 7

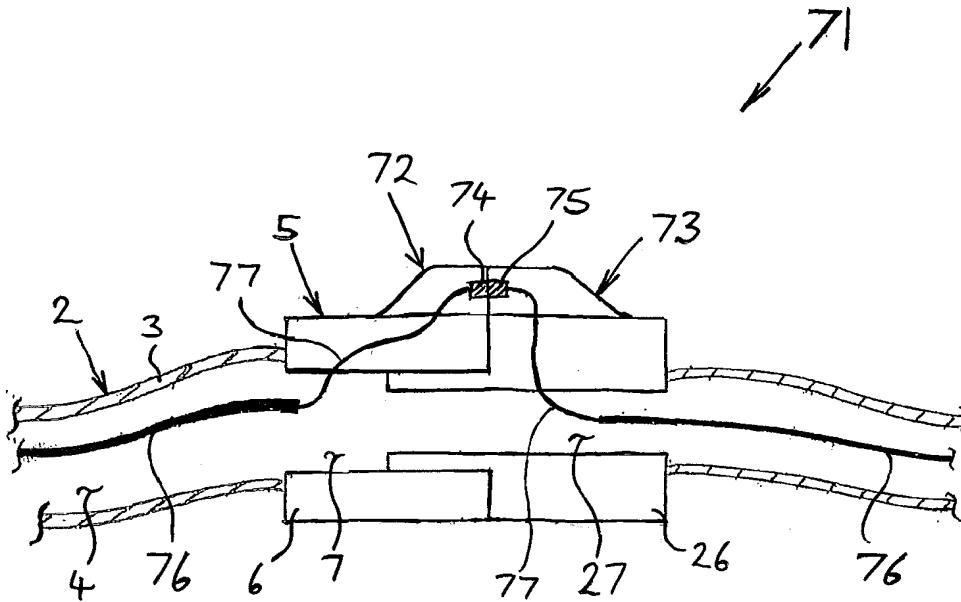


FIGURE 8

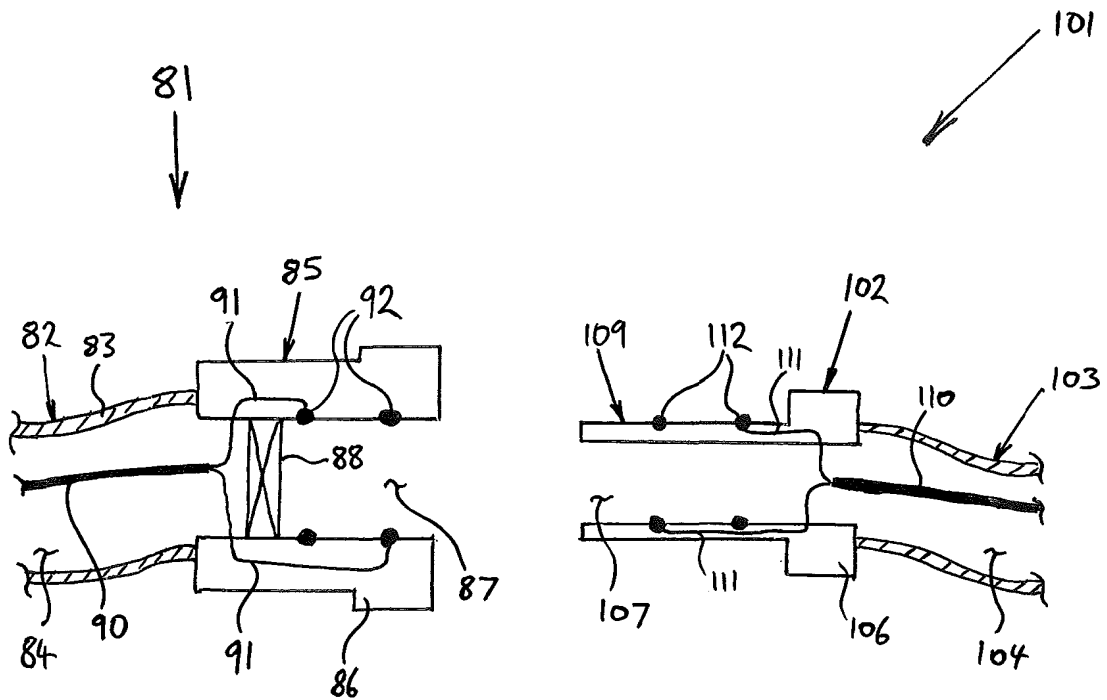


FIGURE 9

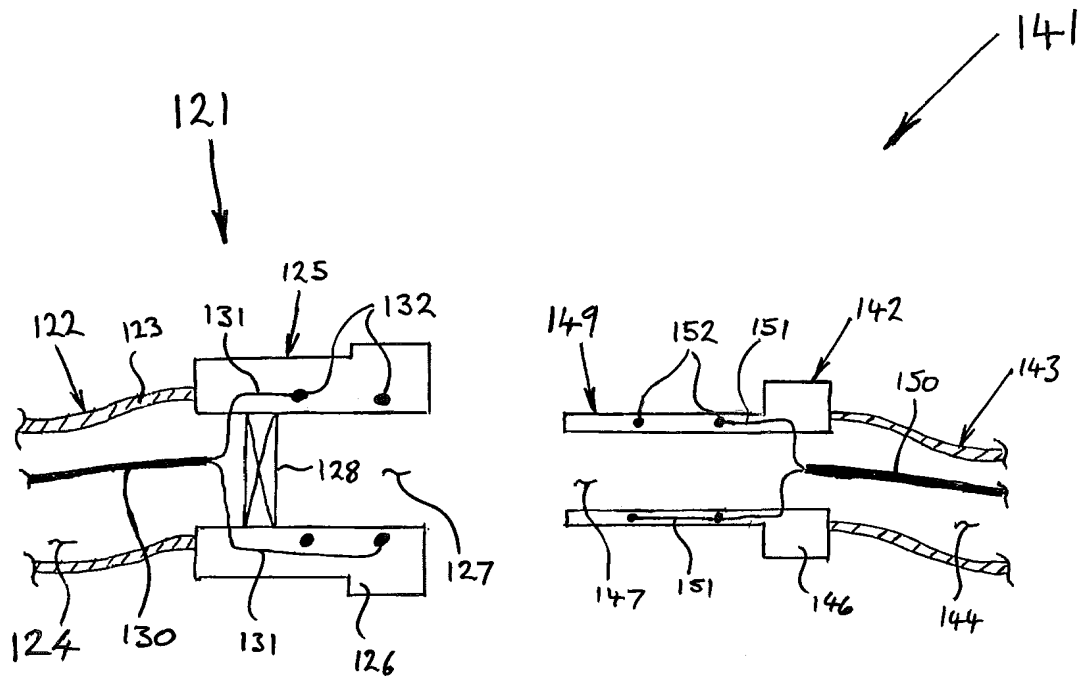


FIGURE 10

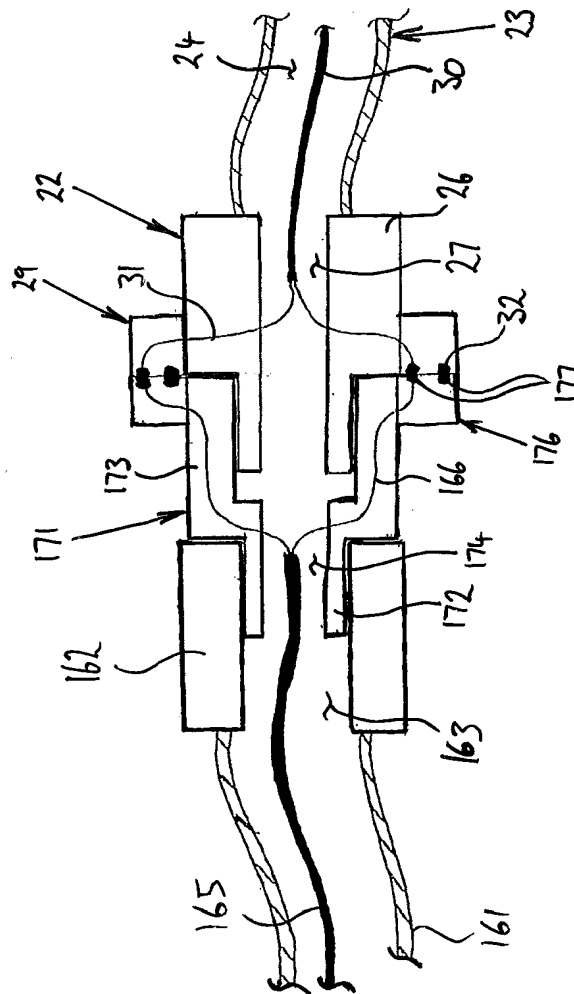


FIGURE 12

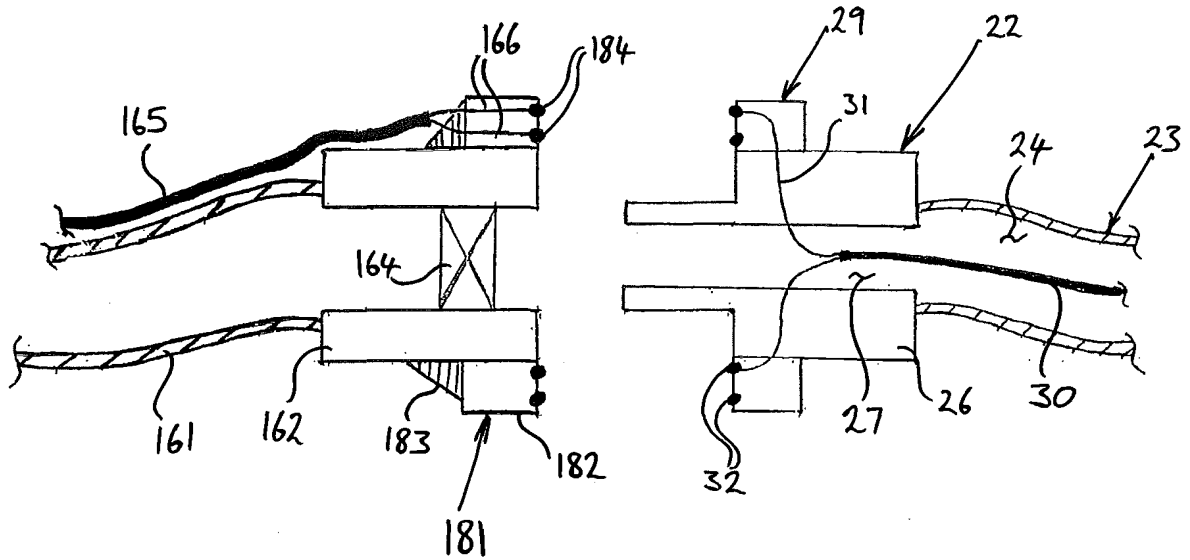


FIGURE 13

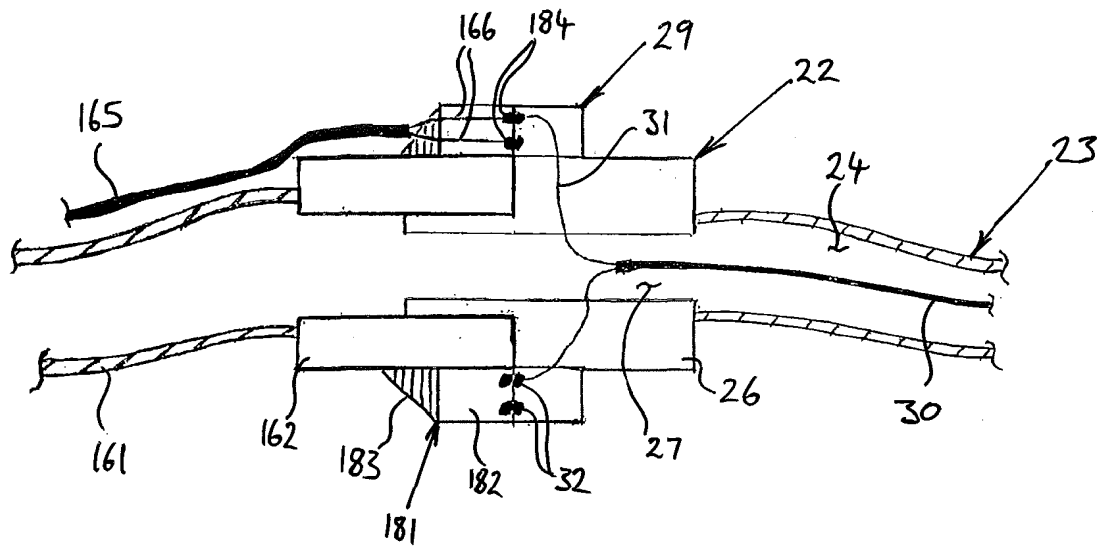
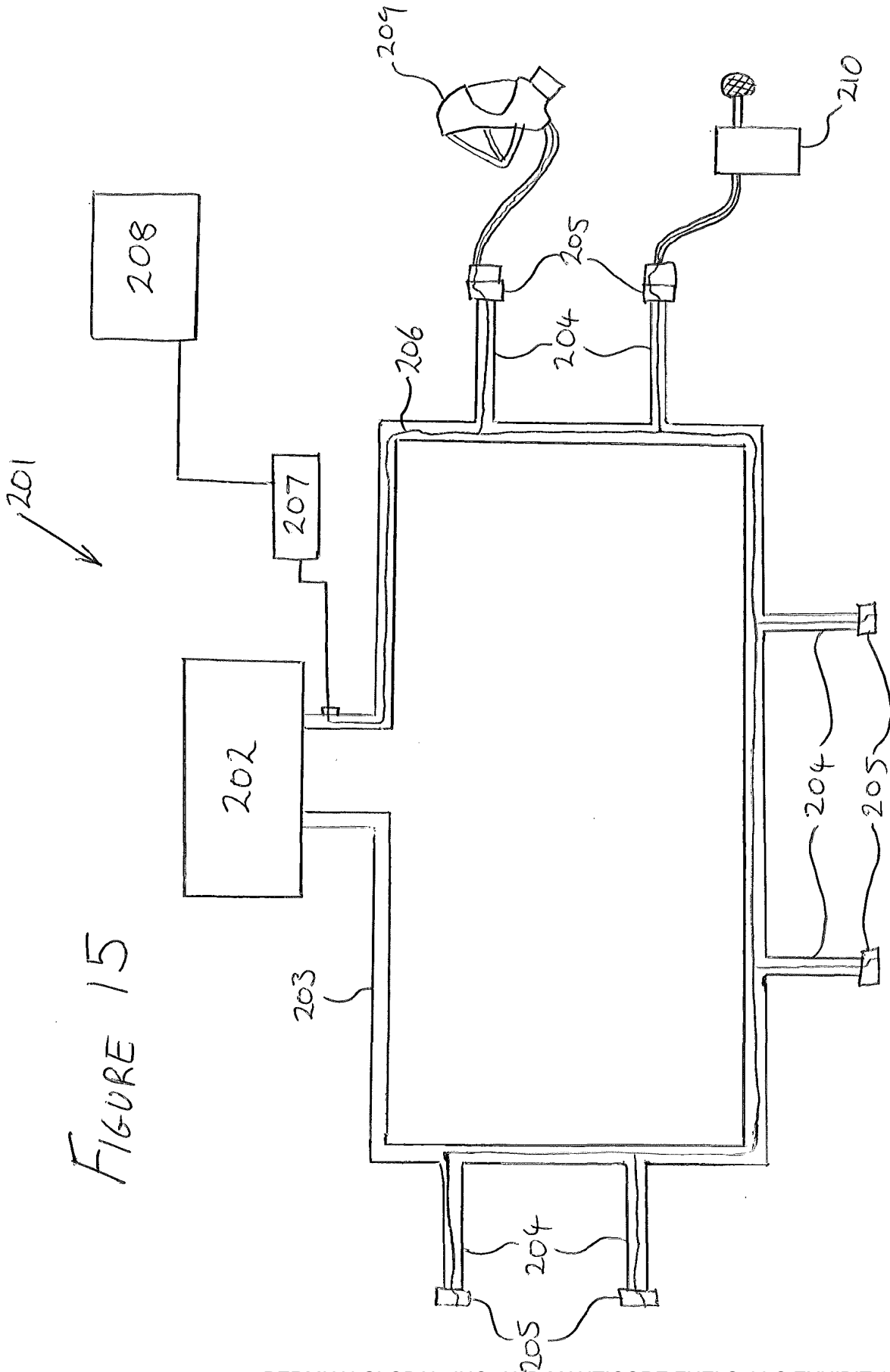


FIGURE 14



A Fluid Supply and Data Communication System and Couplings for use in such a System.

Description

5

The present invention relates to a combined system for fluid supply and data communication, and to couplings for use with such a system, as well as couplings for retrofitting to existing fluid supply systems to create such a combined fluid supply and data communication system.

10

There are various situations where it is necessary to supply fluid from one place to another, or from a source to individual outlets, and also communicate data between those places or source/outlet. One such situation is on off-shore drilling platforms or oil refinery facilities. These facilities are provided with a closed breathable air supply conduit network comprising a mains air supply ring extending around the whole facility through which filtered breathable air is pumped. A plurality of branch lines extend off the main ring, usually in the form of flexible air hoses, which terminate in a valve coupling. Workers on the facilities are required to wear breathing apparatuses at all times. These breathing apparatuses, or 'respirators', also known as 'working sets', include their own self-contained compressed air supply bottles. However, these bottles are only capable of providing 10 – 15 minutes of breathable air supply and are intended solely for emergency evacuation purposes, not for normal day-to-day operational use. At all other times, the worker is required to connect their respirator to one of the branch lines of the mains air supply ring by means of a connector configured to mate with the valve coupling on the end of the branch line air hoses. Connection of the respirator to the valve coupling opens the valve and allows air to flow from the air hose to the worker's respirator. Such fluid couplings are known, for example, sliding ring couplings commonly used in pressurised air supply connections.

30

When a worker in the above-described facility wishes to move around the room or area he is in, the hose can be extended, for example on a tensioned reel, to allow a finite range of freedom up to the maximum hose extension. If the worker wishes to

move beyond that finite range, he moves to the next air hose location, disconnects his respirator from the first air hose which auto-recoils back onto the tensioned reel, and the worker re-connects his respirator to a second air hose at the new location. The facilities are provided with a sufficient number of branch air lines
5 located such that a user can work anywhere on the facility and always have his respirator connected to an air hose for the supply of breathable air thereto.

It will be appreciated that by use of the above air supply system, breathable air can be supplied to workers at any location on the facility in question. However, as well
10 as an air supply, it is also necessary for various data to be communicated between workers, or between a worker and a communication hub or control centre. For example, a worker may be wearing a body-mounted or respirator-mounted video camera so that supervisors can monitor the worker's operation and actions, the signal from which will need to be transmitted to a communication hub/control
15 centre. To provide such data communication, it is necessary to have a separate data communication network on the facility for the worker to connect to. For example, the worker may need to connect a video feed connection from a person-mounted video camera to a video feed network. However, there may well be additional data to be communicated from the worker to a communication hub or control centre,
20 such as a signal from a health-monitoring device worn by the worker, e.g. heart-rate monitor, breathing monitor or other vital statistics monitor. Also, it may be necessary for a control centre to convey information to a worker – for example, if a supervisor identifies a hazardous situation via a fixed CCTV camera in an area near the worker, the supervisor would need to warn the worker to evacuate the area or
25 take certain corrective actions to deal with the hazard. This would require an audio signal to be transmitted from the control centre to an earpiece in the worker's respirator or a headset and for a two-way conversation, the worker would also need an audio signal to be transmitted from a microphone on his person or in the respirator to the control centre. All of the above functional features result in the
30 need for additional connection(s) between the worker and a separate data/communication network, and so more connections for the workers to have between themselves and the facility, and more data communication networks that the facility must have installed therein. This results in a complex arrangement of

personal support systems to which the worker must be connected, which are cumbersome and obstructive for the worker and are complex and expensive to install and maintain on the facility. In normal day-to-day operations, this is a time consuming inconvenience but in an emergency situation, it means that the worker
5 has a lot of equipment connections which are to be uncoupled before he can evacuate the facility.

In addition to all of the above, in potentially explosive working environments such as oil drilling platforms or oil refineries, all electrical equipment and their
10 connections/couplings must be intrinsically safe – that is, there must be no risk of sparks or over-heating of electrical components which may have the potential to cause ignition of a hazardous atmosphere.

It is therefore an object of the present invention to provide a fluid supply and data
15 communication system, and a coupling therefor, which substantially alleviates or overcomes the problems mentioned above.

Accordingly, the present invention provides a combined fluid supply and data communication conduit comprising an enclosed fluid supply duct having at least
20 two distal open ends, and a data communication cable extending within the fluid supply duct, at least one of the distal open ends of the fluid supply duct including a coupling comprising a fluid-tight valve configured to seal closed said at least one distal open end of the fluid supply duct when the coupling is in an un-coupled state and, configured to remain open to allow fluid to pass therethrough when in a
25 coupled state, the coupling further including a data connection terminal connected to the data communication cable within the fluid supply duct and configured to connect to a corresponding terminal of a corresponding coupling to allow combined fluid and data communication through the conduit via said coupling in a coupled state thereof.

30

The present invention also provides A combined fluid supply and data communication coupling comprising a first part having a hollow bore and a valve therein and a first data communication terminal for connection to a first data

communication cable, and a second part having a hollow bore and a second data communication terminal for connection to a second data communication cable, the first and second parts being configured to be releasably coupled to each other such that, when in a coupled state, the valve is open and the hollow bore of the first and second parts are in sealed fluid communication to allow fluid to pass therethrough and the first and second data communication terminals are in contact to allow a data signal to pass from one terminal to the other terminal, and when the first and second parts are in an un-coupled state, the valve is closed to prevent fluid flow therethrough and the data communication terminals are out of contact with each other to prevent data signals passing therebetween.

The present invention also provides a data communication connector for retrofitting to a conventional fluid supply coupling, the connector comprising a mounting portion configured to securely attach the connector to a fluid supply duct or fluid supply coupling, and a data coupling portion configured to be connected to a data communication cable and, in use, to be in contact with a corresponding data coupling portion of a combined fluid supply and data communication coupling for data signals to be transmitted between the data coupling portions.

The present invention also provides a combined fluid supply and data communication adaptor for retrofitting to a conventional fluid supply coupling, the adaptor comprising a main body portion having a hollow bore, and a data coupling portion configured to be connected to a data communication cable and, in use, to be in contact with a corresponding data coupling portion of a combined fluid supply and data communication coupling for data signals to be transmitted between the data coupling portions.

The present invention also provides a combined fluid supply and data communication network comprising a main fluid supply duct coupled at one end to a source of fluid and having a plurality of branch lines in fluid communication therewith, at least one branch line including a coupling at one end thereof including a valve to seal the branch line closed in an un-coupled state, the network further comprising a plurality of data communication cables extending within the main fluid

supply duct and branch lines, at least one cable connected to a communications control unit and at least one cable connected to the at least one coupling at a terminal formed on the at least one coupling, the network configured to simultaneously provide fluid to a fluid-compatible equipment when coupled to the at least one coupling, and to transmit data signals between the communication control unit and an electrical device connected to the terminal on the at least one coupling.

Preferred and/or optional features of the above embodiments of the invention are set out in the claims hereafter.

Embodiments of the present invention will now be described, with reference to the accompanying drawings, in which:

- Figure 1 shows a schematic cross-sectional view of a combined fluid supply and data communication conduit according to a first embodiment of the invention; Figure 2 shows a schematic cross-sectional view of a combined fluid supply and data communication coupling, in an un-coupled state, according to a second embodiment of the invention;
- Figure 3 shows a schematic cross-sectional view of the combined fluid supply and data communication coupling shown in Figure 2, but in a coupled state; Figure 4A shows an end view of a female part of the combined fluid supply and data communication coupling of Figure 2; Figure 4B shows an end view of a male part of the fluid supply and data communication coupling of Figure 2;
- Figure 5 shows a schematic cross-sectional view of an alternative combined fluid supply and data communication coupling of a third embodiment of the invention in a coupled state;
- Figure 6A shows an end view of a female part of a further alternative combined fluid supply and data communication coupling of a fourth embodiment of the invention;
- Figure 6B shows an end view of a male part of the combined fluid supply and data communication coupling of the fourth embodiment of the invention;

Figure 7 shows a schematic cross-sectional view of a further alternative combined fluid supply and data communication coupling of a fifth embodiment of the invention in a coupled state;

Figure 8 shows a schematic cross-sectional view of a further alternative combined
5 fluid supply and data communication coupling of a sixth embodiment of the invention in a coupled state;

Figure 9 shows a schematic cross-sectional view of a combined fluid supply and data communication conduit according to a seventh embodiment of the invention and also a schematic cross-sectional view of a combined fluid supply and data
10 communication coupling, in an un-coupled state, according to an eighth embodiment of the invention;

Figure 10 shows a schematic cross-sectional view of a combined fluid supply and data communication conduit according to a ninth embodiment of the invention and also a schematic cross-sectional view of a combined fluid supply and data
15 communication coupling, in an un-coupled state, according to a tenth embodiment of the invention;

Figure 11 shows a schematic cross-sectional view of a retro-fit adaptor coupling of an eleventh embodiment of the invention in an un-coupled state with a conventional fluid supply coupling and a male coupling part of a combined fluid
20 supply and data communication coupling of the second embodiment of the invention;

Figure 12 shows a schematic cross-sectional view of the retro-fit adaptor of Figure 11 in a coupled state with a conventional fluid supply coupling and a male coupling part of a combined fluid supply and data communication coupling of the second
25 embodiment of the invention;

Figure 13 shows a retro-fit coupling of a twelfth embodiment of the invention mounted to a conventional fluid supply coupling which is in an un-coupled state with a male coupling part of a combined fluid supply and data communication coupling of the second embodiment of the invention;

30 Figure 14 shows the retro-fit coupling of Figure 13 mounted to a conventional fluid supply coupling which is in an un-coupled state with a male coupling part of a combined fluid supply and data communication coupling of the second embodiment of the invention; and

Figure 15 shows a schematic system diagram of a combined fluid supply and data communication network of a thirteenth embodiment of the invention.

Referring now to Figure 1, a combined fluid supply and data communication
5 conduit 1 according to a first embodiment of the invention is shown, and comprises a fluid supply duct 2 in the form of an enclosed flexible hose having an outer peripheral wall 3 defining a central bore 4. A fluid coupling 5 is provided at one distal end of the fluid supply duct 2 and comprises a main body portion 6 having a hollow bore 7 in fluid communication with the central bore 4 of the fluid supply
10 duct 2. The fluid coupling includes a valve 8 which closes the central bore 7 of the fluid coupling 5 when the fluid coupling 5 is in a disconnected or 'uncoupled' state, preventing fluid from flowing out of the fluid supply duct 2 through the fluid coupling 5.

15 The main body portion 6 of the fluid coupling 5 includes a data coupling portion 9 around the perimeter of the distal end of the body portion 6. A data communication cable 10 is disposed within the bore 4 of the fluid supply duct 2 and includes data communication elements 11 which are connected to terminals 12 in the data coupling portion 9.

20

The fluid coupling 5 is a first part of a two-part fluid coupling and comprises a female coupling which is configured to connect with a corresponding male coupling to provide a combined fluid supply and data communication coupling 21 which comprises a second embodiment of the invention and is shown in Figure 2. The
25 features of the female part of the coupling 5 already described above with reference to the combined fluid supply and data communication conduit 1 of the first embodiment of the invention retain the same reference numerals. The combined fluid supply and data communication coupling 21 also comprises a male coupling 22 comprising a main body portion 26 having a hollow bore 27 which, in use, would be
30 in fluid communication with a bore 24 of a fluid supply duct 23, such as an enclosed flexible hose. The male coupling 22 also includes a data coupling portion 29 around the perimeter of the distal end of the body portion 26 remote from the fluid supply duct 23 which includes terminals 32 configured to be connected to data

communication elements 31 of a data communication cable 30 which would be disposed within the bore 24 of the fluid supply duct 23.

5 In the embodiment shown, the data coupling portions 9, 29 of the male and female couplings 5, 22 comprise annular elements extending around the respective main body portions 6, 26, and the terminals 12, 32 are exposed metal contact rings, as shown more clearly in Figures 4A and 4B, which are concentric about the central axis of the bores 7, 27 of the main body portion 6, 26. It will be appreciated that in the un-coupled state shown in Figure 2, the terminals 12, 32 are spaced from each other and so not capable of transmitting data signals between each other. Also in 10 this un-coupled state, the valve 8 in the female coupling 5 is closed and so fluid is prevented from flowing through the bore 7 of the coupling 5 and therefore to/from the fluid supply duct 2.

15 In the coupled state of the fluid supply and data communication coupling shown in Figure 3, the male coupling part 22 is fully inserted into the female part 5 and locked thereto by a conventional known locking means (not shown). In this coupled state, the terminals 12 of the data coupling portion 9 of the female coupling 5 are in contact with the terminals 32 of the data coupling portion 29 of the male coupling 22 and so data signals can be transmitted between the data cable 10 in the fluid 20 supply duct 2 on the female coupling side and the data cable 30 in the fluid supply duct 23 on the male coupling side. Also in this coupled state, the distal end of the male coupling 22 is engaged with and opens the valve 8 of the female coupling 5, thereby rendering the hollow bores 7, 27 of the female and male couplings 5, 22, 25 and therefore the fluid supply ducts 2, 23, in fluid communication.

It will be appreciated that the terminals 12, 32 of the data coupling portions 9, 29 are concentric and symmetrical about the central axis of the female/male couplings 5, 22 respectively. Accordingly, the terminals 12, 32 will always make contact with 30 each other as the female and male couplings 5, 22 are connected into the coupled state, irrespective of the orientation of each coupling 5, 22 about its respective central axis.

In order to ensure a consistent and secure connection between the data coupling portions, it is intended within the scope of the invention that the data coupling portions may be biased towards the distal end of each coupling so that, in a coupled state, the terminals 12, 32 of each coupling 5, 22 are biased into contact with each other. Such an embodiment is shown in Figure 5, which shows an alternative combined fluid supply and data communication coupling 41 of a third embodiment of the invention, in which corresponding features to the combined fluid supply and data communication coupling of the second embodiment of the invention shown in Figures 2 – 4A retain the same reference numerals and description thereof will not be repeated for sake of brevity.

The alternative combined fluid supply and data communication coupling of the third embodiment of the invention differs from that of the second embodiment of the invention in that the data coupling portions 9, 29 are not fixed to the respective main body portions 6, 26 of the couplings 5, 22 but instead are axially slidable thereon about the central axis of the bore 7, 27 of each coupling 5, 22, in a direction shown by arrows A and B respectively. Furthermore, each data coupling portion 9, 29 includes a biasing element in the form of a spring 42, 43 configured to bias the respective data coupling portion 9, 29 toward the other data coupling portion 9, 29 so that in a coupled state of the combined fluid supply and data communication coupling 41, the terminals 12, 32 of each are pushed into contact with each other. This ensures a data connection is maintained even if the coupling 41 is subject to shocks or other physical disruption.

In the second the third embodiments of the invention shown and described above, both data coupling portions include annular terminals 12, 32. However, an alternative configuration of combined fluid supply and data communication coupling 51 of a fourth embodiment of the invention is shown in Figures 6A and 6B, which are end views of the female and male coupling portions 5,22 respectively. Similar features to those of the combined fluid supply and data communication couplings of the second and third embodiments of the invention retain the same reference numerals and description thereof will not be repeated for sake of brevity. The combined fluid supply and data communication coupling 51 of the fourth

embodiment of the invention differs from those of the second and third embodiments of the invention in that the data coupling 52 on the male coupling 22 is not an annular element like on the female coupling 5 but instead is an elongate element extending radially relative to the central axis of the bore 27 of the male coupling 22. Also, the data coupling 52 includes terminals 53 which are point contacts rather than annular contacts. However, the position of the point contacts 53 in a radial direction relative to the central axis of the bore 27 of the male coupling 22 corresponds to the position of the annular terminals 12 in a radial direction relative to the central axis of the bore 7 of the female coupling 5.

Referring to Figures 6A and 6B, this is shown by dimensions $d_1 = d_3$ and dimensions $d_2 = d_4$. Therefore, upon coupling together of the female and male couplings 5, 22, the terminals 12, 53 are aligned and in contact to allow data signals to be transmitted therebetween, and also, as with the second and third embodiments of the invention, the terminals 12, 53 will always make contact with each other as the female and male couplings 5, 22 are connected into the coupled state, irrespective of the orientation of each coupling 5, 22 about its respective central axis.

Although not shown in Figures 6A and 6B, the data couplings 9, 52 may be axially slidable on the main body portions 6, 26 and spring biased into a contact position to provide a more secure and reliable connection, as per the third embodiment of the invention shown in Figure 5 and described above.

The data couplings of the combined fluid supply and data communication couplings of the second to fourth embodiments of the invention described above all include terminals which are exposed and make direct contact with each other in the coupled state of the couplings to enable data signal transmission through them. However, it is intended that alternative configurations of data couplings are to be encompassed within the scope of the invention other than direct contact data couplings. One such alternative is shown in Figure 7 which shows a combined fluid supply and data communication coupling 61 of a fifth embodiment of the invention. Features identical to those of the second embodiment of the invention shown in Figures 2 – 4B retain the same reference numerals and description thereof will not be repeated.

The combined fluid supply and data communication coupling 61 of the fifth embodiment of the invention differs from that of the second embodiment of the invention in that the main body portions 6, 26 of the female and male couplings 5, 22 include modified data coupling portions 62, 63. Each data coupling portion 62, 63 is an annular member with a looped induction element 64, 65 embedded within the body of the annular member and so not exposed on the outside surface of the data coupling 62, 63. Each looped induction element 64, 65 is connected to data communication elements 11, 31 of a respective data communication cable 10, 30.

In use, the male and female couplings 5, 22 are connected together by the male coupling part 22 being fully inserted into the female part 5 and locked thereto by a conventional known locking means (not shown). In this coupled state, the two data coupling portions 62, 63 are in direct contact with each other. However, as the induction elements 64, 65 are embedded within in each data coupling 62, 63, they are not in direct contact with each other. Nevertheless, data signals are able to be transmitted between the data couplings 62, 63 by inductive RF coupling. This would require one of the data communication cables 10, 30 to provide power to one of the induction coils 64, 65, and this could be provided by a battery or other suitable power source.

Although not shown in Figure 7, the male and female couplings 5, 22 could include additional means to secure the inductive connection between the two data couplings 62, 63. For example, the data couplings 62, 63 may be slidable on the respective main body portions 6, 26, as with the third embodiment of the invention shown in Figure 5, and include a biasing means such as a spring to bias the data couplings 62, 63 into contact with each other in the coupled state of the female and male couplings 5, 22. Alternatively, or in addition, the data couplings 62, 63 may include one or more magnets embedded therein to attract the data couplings 62, 63 together to further secure them together in the coupled state. Indeed, any of the data coupling portions of the first to fourth embodiments of the invention may also include magnets therein to further secure them together in the coupled state. It will be appreciated that such measures help to maintain the integrity of the data communication link should the coupling 61 be subjected to physical shocks.

In all embodiments of the invention so far described, data coupling portions have included terminals or induction coils connected to data communication elements of a data communication cable. Such terminals/induction coils would typically be
5 required to be connected to a metallic electrical conductor, and so the data communication elements would be a copper element or similar such electrically conductive element. However, it is intended that alternative data coupling means may be used in a combined fluid supply and data communication coupling within the scope of the invention. Such an alternative is shown in Figure 8 which shows a
10 combined fluid supply and data communication coupling 71 of a sixth embodiment of the invention. Features identical to those of the second embodiment of the invention shown in Figures 2 – 4B retain the same reference numerals and description thereof will not be repeated. The combined fluid supply and data communication coupling 71 of the sixth embodiment of the invention differs from
15 that of the second embodiment of the invention in that the main body portion 6, 26 of the female and male couplings 5, 22 includes modified data coupling portions 72, 73. Each data coupling portion 72, 73 is an elongate lug extending from the outer surface of the respective main body portion 6, 26 in a radial direction relative to the central axis of the bore 7, 27 of the female/male couplings 5, 22, respectively. Each
20 data coupling portion 72, 73 includes an interface element 74, 75. Instead of each of the data coupling portions 72, 73 being connected to an electrically conductive data communication cable as with the previous embodiments, each interface element 74, 75 is an optical connector connected to a remote end of an optical fibre 77 of a fibre-optic data communication cable 76.

25

In use, the male and female couplings 5, 22 are connected together by the male coupling part 22 being fully inserted into the female part 5 and locked thereto by a conventional known locking means (not shown). In this coupled state, the two data coupling portions 72, 73 are in direct contact with each other and are
30 configured such that, when aligned, the interface elements 74, 75 of each data coupling 72, 73, are in direct contact with each other. This establishes an optical connection and enables data signals to be transmitted between the data couplings

72, 73 and thereby between the respective fibre-optic data communication cables 76.

It will be appreciated that with the sixth embodiment of the invention described
5 above, the correct alignment of the two interface elements 74, 75 is essential to
create an effective data communication link. Therefore, the data coupling portions
72, 73 may be configured with cooperating elements to ensure an exact engagement
and alignment with one another in the coupled state. Also, they may be provided
10 with spring biasing means and/or magnetic elements as described above with
reference to the fifth embodiment of the invention to ensure the integrity of the
data communication link should the coupling 71 be subjected to physical shocks.

A further alternative configuration of a combined fluid supply and data
communication conduit 81 of a seventh embodiment of the invention is shown in
15 Figure 9 and comprises a fluid supply duct 82 in the form of an enclosed flexible
hose having an outer peripheral wall 83 defining a central bore 84. A fluid coupling
85 is provided at one distal end of the fluid supply duct 82 and comprises a main
body portion 86 having a hollow bore 87 in fluid communication with the central
bore 84 of the fluid supply duct 82. The fluid coupling includes a valve 88 which
20 closes the central bore 87 of the fluid coupling 85 when the fluid coupling 85 is in a
disconnected or 'uncoupled' state, preventing fluid from flowing out of the fluid
supply duct 82 through the fluid coupling 85.

The combined fluid supply and data communication conduit 81 of the seventh
25 embodiment of the invention differs from that of the first embodiment of the
invention in the configuration of its data coupling portion 89, wherein the main
body portion 86 includes a pair of annular terminals 92 on the inside wall of the
hollow bore 87 which are spaced in an axial direction of the bore 87. A data
communication cable 90 is disposed within the bore 84 of the fluid supply duct 82
30 and includes data communication elements 91 which are connected to the terminals
92.

The fluid coupling 85 is a first part of a two-part fluid coupling and comprises a female coupling which is configured to connect with a corresponding male coupling to provide a combined fluid supply and data communication coupling 101 which comprises an eighth embodiment of the invention and is also shown in Figure 9.

5 The features of the female part of the coupling 85 already described above with reference to the combined fluid supply and data communication conduit 81 of the seventh embodiment of the invention retain the same reference numerals. The combined fluid supply and data communication coupling 101 also comprises a male coupling 102 comprising a main body portion 106 having a hollow bore 107 which,
10 in use, would be in fluid communication with a bore 104 of a fluid supply duct 103, such as an enclosed flexible hose. The male coupling 102 includes an elongate data coupling portion 109 comprising a pair of annular terminals 112 around the outer perimeter of the data coupling portion 109 and which are spaced in an axial direction thereof. The terminals 112 are configured to be connected to data
15 communication elements 111 of a data communication cable 110 which would be disposed within the bore 104 of the fluid supply duct 103.

It will be appreciated that in the un-coupled state shown in Figure 9, the terminals 92, 112 are spaced from each other and so not capable of transmitting data signals
20 between each other. Also in this un-coupled state, the valve 88 in the female coupling 85 is closed and so fluid is prevented from flowing through the bore 87 of the coupling 85 and therefore to/from the fluid supply duct 82.

In a coupled state (not shown) of the fluid supply and data communication coupling 101, the data coupling portion 109 of the male coupling part 102 is fully inserted
25 into the female part 85 and locked thereto by a conventional known locking means (not shown). In this coupled state, the terminals 92 of the data coupling portion 89 of the female coupling 85 are aligned with and in contact with the terminals 112 of the data coupling portion 109 of the male coupling 102 and so data signals can be
30 transmitted between the data cable 90 in the fluid supply duct 82 on the female coupling side and the data cable 110 in the fluid supply duct 103 on the male coupling side. Also in this coupled state, the distal end of the male coupling 102 is engaged with and opens the valve 88 of the female coupling 85, thereby rendering

the hollow bores 87, 107 of the female and male couplings 85, 102, and therefore the fluid supply ducts 82, 103, in fluid communication.

It will be appreciated that the terminals 92, 112 of the data coupling portions 89, 109 are symmetrical about the central axis of the female/male couplings 85, 102 respectively. Accordingly, the terminals 92, 112 will always make contact with each other as the female and male couplings 85, 102 are connected into the coupled state, irrespective of the orientation of each coupling 85, 102 about its respective central axis.

A further alternative configuration of a combined fluid supply and data communication conduit 121 of a ninth embodiment of the invention is shown in Figure 10 and is similar in configuration to the conduit of the seventh embodiment of the invention shown in Figure 9 and similarly comprises a fluid supply duct 122 having an outer peripheral wall 123 defining a central bore 124, a fluid coupling 125 at one distal end of the fluid supply duct 122 comprising a main body portion 126 having a hollow bore 127 in fluid communication with the central bore 124 of the fluid supply duct 122, and a valve 128 which is closed in a disconnected or 'uncoupled' state of the fluid coupling 125.

The combined fluid supply and data communication conduit 121 of the ninth embodiment of the invention differs from that of the seventh embodiment of the invention in that annular terminals 92 on the inside wall of the hollow bore 87 spaced in an axial direction of the bore 87 are omitted and instead a pair of annular induction elements 132 are embedded in the body portion 126 of the coupling 125. A data communication cable 130 is disposed within the bore 124 of the fluid supply duct 122 and includes data communication elements 131 which are connected to the induction elements 132.

The fluid coupling 125 is a first part of a two-part fluid coupling and comprises a female coupling which is configured to connect with a corresponding male coupling to provide a combined fluid supply and data communication coupling 141 which comprises a tenth embodiment of the invention and is also shown in Figure 10.

The features of the female part of the coupling 125 already described above with reference to the combined fluid supply and data communication conduit 121 of the ninth embodiment of the invention retain the same reference numerals. The combined fluid supply and data communication coupling 141 also comprises a male coupling 142 comprising a main body portion 146 having a hollow bore 147 which, in use, would be in fluid communication with a bore 144 of a fluid supply duct 143, such as an enclosed flexible hose. The male coupling 142 includes an elongate data coupling portion 149 comprising a pair of annular induction elements 152 embedded therein and spaced from the surface, and which are spaced in an axial direction of the data coupling portion 149. The induction elements 152 are configured to be connected to data communication elements 151 of a data communication cable 150 which would be disposed within the bore 144 of the fluid supply duct 143.

It will be appreciated that in the un-coupled state shown in Figure 10, the induction elements 132, 152 are spaced from each other and so not capable of transmitting data signals between each other. Also in this un-coupled state, the valve 128 in the female coupling 125 is closed and so fluid is prevented from flowing through the bore 127 of the coupling 125 and therefore to/from the fluid supply duct 122.

In a coupled state (not shown) of the fluid supply and data communication coupling 121, the data coupling portion 149 of the male coupling part 142 is fully inserted into the female part 125 and locked thereto by a conventional known locking means (not shown). In this coupled state, as the induction elements 132, 152 are embedded within in each coupling 125, 142, they are not in direct contact with each other. Nevertheless, data signals are able to be transmitted between the male/female couplings 125, 142 by inductive RF coupling and so data signals can be transmitted between the data cable 130 in the fluid supply duct 122 on the female coupling side and the data cable 150 in the fluid supply duct 143 on the male coupling side. This would require one of the data communication cables 130, 150 to provide power to one of the induction elements 132, 152 and this could be provided by a battery or other suitable power source.

Also in this coupled state, the distal end of the male coupling 142 is engaged with and opens the valve 128 of the female coupling 125, thereby rendering the hollow bores 127, 147 of the female and male couplings 125, 142, and therefore the fluid supply ducts 122, 143, in fluid communication.

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As with the terminals of the seventh/eighth embodiments of the invention, the induction elements 132, 152 are symmetrical about the central axis of the female/male couplings 125, 142 respectively and so will always be aligned with each other as the female and male couplings 125, 142 are connected into the coupled
10 state, irrespective of the orientation of each coupling 125, 142 about its respective central axis.

All of the couplings described above are intended to be 'intrinsically safe' and so could be suitable for use in environments such as off-shore drilling platforms, as
15 described above. The contact-type couplings of the first to fourth, seventh and eighth embodiments of the invention may utilise sufficiently low electrical energy that there is no risk of spark between them or any chance of ignition of an explosive atmosphere which may surround the couplings. The inductive data coupling and the fibre-optic data coupling of the fifth, sixth, ninth and tenth embodiments of the
20 invention have no physically touching contacts and so are inherently intrinsically safe and suitable for use in the hazardous environments described above.

Furthermore, in all cases, the data communication cables are housed within the enclosed fluid supply ducts and so are not exposed to any hazardous external
25 environments, thereby further rendering the conduit and couplings of the invention intrinsically safe. It should be noted, however, that the invention is not intended to be limited to couplings/conduits in which a data coupling portion forms in intrinsically safe connection, as the couplings/conduits of the invention may be equally suitable for use in neutral or non-hazardous/non-explosive environments.
30 Aside from the safety element, the conduit and couplings of the invention are also much more convenient and less cumbersome than conventional systems as both breathable air supply and data communication can be provided to the worker from the facility with a single, convenient coupling and conduit.

Although all embodiments of the invention shown and described above show the respective data communication cables as being disposed within the bores of the fluid supply ducts, it is intended within the scope of the invention that the data
5 communication cables may alternatively be embedded within the walls of the fluid supply ducts, in a dedicated unitary fluid supply and data communication ducting.

Although various couplings and conduits of the invention have been shown and described above, modifications to these exemplary embodiments are intended to fall
10 within the scope of the invention. For example, although each embodiment shows two terminals or two induction elements in each coupling part, only one or more than two terminals/induction elements may be provided. Also, the embodiments show specific configurations of data connection terminals/induction elements in combination with the fluid coupling portions, but various other configurations of
15 data communication coupling means in combination with fluid coupling portions, are intended to fall within the scope of the invention.

The embodiments of the invention so far shown and described comprise conduits and couplings suitable for installation in the type of facilities mentioned above
20 where hazardous/explosive environments may exist, such as oil drilling platforms. However, such existing facilities will already have a network of air supply lines including flexible air hoses with valve couplings thereon, but will not have an integrated data communication system with the air supply network. Therefore, the present invention also provides a solution to retro-fit data communication apparatus
25 and couplings to existing fluid supply equipment to provide combined fluid supply and data communication conduits, couplings and overall system.

A retro-fit adaptor coupling of an eleventh embodiment of the invention is shown in Figure 11 in an uncoupled state, together with a conventional fluid supply pipe
30 161 and a coupling 162 attached to one end thereof. The conventional coupling 162 is a female coupling which includes has a central bore 163 a valve 164 configured to close the bore 163 when the coupling 162 is in a disconnected state. One method of adapting an existing fluid supply system to be a combined fluid supply and data

communication system is to feed data supply cables 165 through all existing fluid supply pipes of the system and centrally connect them to a data control system, data bus or similar unit. Once the data supply cables 165 are installed within the existing fluid supply pipes, they may be connected to a coupling of the invention (such as
5 described above and shown in Figures 1 – 9) which replaces the existing fluid coupling 162 on the end of the fluid supply pipes. Alternatively, an adaptor coupling 171 as shown in Figure 11 may be fitted to the existing fluid coupling 162. In the latter case, the data supply cable 165 would feed through the existing fluid coupling 162 and through the valve 164, thereby holding the valve in an open position at all
10 times whether the fluid coupling 162 is in a coupled or un-coupled state.

The adaptor coupling 171 comprises a male portion 172 and a female portion 173 and has a hollow bore 174 extending therethrough. A valve 175 is disposed in the bore 174. The adaptor also includes a data coupling portion 176 including terminals
15 177.

As the valve 164 of the existing fluid coupling 162 is held open by the data communication cable 165, air is free to escape from the fluid supply pipe therethrough. However, the adaptor coupling 171 is fitted to the fluid coupling 162
20 with the male portion 172 received in the bore 163 of the fluid coupling and locked in place by conventional fluid coupling securing means (not shown). Data communication elements 166 of the data communication cable 165 are connected to the terminals 177 of the data coupling portion 176. The valve 175 of the adaptor coupling 171 is closed when no further combined fluid and data supply coupling is
25 connected thereto and so prevents air from the fluid supply pipe 161 from escaping.

In use, a male coupling 22 part of a combined fluid supply and data communication coupling of the invention can be connected to the adaptor coupling 171. Such a male coupling part 22 is shown in Figure 11 in the un-coupled state with the
30 adaptor coupling 171 and is the same as the male coupling part of the second embodiment of the invention shown in Figures 2 and 3, the features of which retain the same reference numerals and description of its features will not be repeated again to avoid repetition.

The fluid coupling 162, adaptor coupling 171 and male coupling part 22 are shown in the connected/coupled state in Figure 12. The male coupling part 22 is inserted into the female part 173 of the adaptor coupling 171 and locked thereto by a
5 conventional known locking means (not shown). In this coupled state, the terminals 177 of the data coupling portion 176 of the adaptor coupling 171 are in contact with the terminals 32 of the data coupling portion 29 of the male coupling part 22 and so data signals can be transmitted between the data cable 165 in the fluid supply duct 161 on the existing fluid coupling 162 side and the data cable 30 in the fluid supply
10 duct 23 on the male coupling part side. Also in this coupled state, the distal end of the male coupling part 22 is engaged with and opens the valve 175 of the adaptor coupling 171, thereby rendering the fluid supply ducts 161, 23 in fluid communication.

15 Although the adaptor coupling 171 shown in Figures 11 and 12 and described above includes data coupling portions similar to those of the second embodiment of the invention, it will be appreciated that any alternative data coupling means shown and described previously could alternatively be used in an adaptor coupling within the scope of the invention, such as biased data coupling portions, inductive data
20 couplings, fibre optic data couplings, magnetic data coupling securing means, etc. Also, all portions shown as male may be female, and vice versa, within the scope of the invention.

An alternative retro-fit coupling 181 of a twelfth embodiment of the invention is
25 shown in Figure 13 in an uncoupled state. In this embodiment, the retro-fit coupling 181 is fitted to a conventional fluid coupling 162 attached to one end of a conventional fluid supply pipe 161, as shown in Figure 11 and described above. Like features retain the same reference numerals. Unlike the retrofit adaptor coupling 171 shown in Figures 11 and 12, the data communication cable 165 to be retro-
30 fitted to the existing fluid supply system is not fed into the existing fluid supply pipes 161, but remains on the outside thereof and may be secured thereto by conventional means (not shown). The retro-fit coupling 181 is secured to the existing fluid coupling 162 and comprises a data coupling portion 182 and a

mounting means 183. The data coupling portion 182 includes terminals 184 which are connected to the data communication elements 166 of the data communication cable 165. The mounting means may comprise any suitable means within the scope of the invention, for example, a clamp, bracket, adhesive, weld etc.

5

Upon fitment of the retro-fit coupling 181 to the fluid coupling 162, a first part (female part in this case) of a combined fluid supply and data communication coupling is formed. This is then capable of connecting to a corresponding (male) coupling part 22 of a combined fluid supply and data communication coupling, as
10 shown in Figure 13. The male coupling part 22 is the same as that of the second embodiment of the invention shown in Figures 2 and 3, the features of which retain the same reference numerals.

In the coupled state, the male coupling part 22 is inserted into the fluid coupling
15 162 and locked thereto by a conventional known locking means (not shown). In this coupled state, the terminals 185 of the data coupling portion 182 of the retro-fit coupling 181 are in contact with the terminals 32 of the data coupling portion 29 of the male coupling part 22 and so data signals can be transmitted between the data cable 165 which is external of the fluid supply duct 161 on the existing fluid
20 coupling 162 side and the data cable 30 in the fluid supply duct 23 on the male coupling part side, enabling data to be transmitted to/from a data control system, data bus or similar unit. Also in this coupled state, the distal end of the male coupling part 22 is engaged with and opens the valve 164 of the fluid coupling 162, thereby rendering the fluid supply ducts 161, 23 in fluid communication.

25

As mentioned above with the adaptor coupling 171 shown in Figures 11 and 12, although the data coupling portion 182 is similar to those of the second embodiment of the invention, it will be appreciated that any alternative data coupling means shown and described previously could alternatively be used in a
30 retro-fit coupling within the scope of the invention, such as biased data coupling portions (possibly including slidably moveable mounting means for the data coupling portion 182), inductive data couplings, fibre optic data couplings, magnetic data coupling securing means, etc.

The present invention also provides a combined fluid supply and data communication network 201 which is shown schematically in Figure 15. The network comprises an air supply source 202 (e.g. pump, filter, etc.) fluidly coupled to a mains air supply ring 203. Such a ring would extend around a facility such as an oil drilling platform, oil refinery, etc. Branch air lines 204 extend off the main ring 203 and terminate in combined fluid supply and data communication couplings 205 (of any form as described above) for individual workers to connect their respirators/working sets 209 to, as described above. A network of data communication cables 206 extend from a data bus 207 into the mains air ring 203 and into each branch air line 204, each terminating in one of the combined fluid supply and data communication couplings 205. A data control centre 208 is connected to the data bus 207.

In use, a worker can connect his working set 209 to a combined fluid supply and data communication coupling 205 of the network 201 and receive breathable air through the branch air line 204. Simultaneously, any equipment he is wearing or operating on his person, which would be connected to the respirator's combined fluid supply and data communication coupling portion, would be connected to the data communication cable 206 in the network via the combined fluid supply and data communication coupling 205 on the end of the branch air line 204.

Using the above system, data from a user's equipment can be fed to the data bus 207 and received by a data control centre 208. Likewise, the data control centre can transmit data to individual workers connected to the network and to equipment they may have on their person or be coupled to.

Examples of equipment that a worker may couple to the combined fluid supply and data communication network in the above manner may include audio equipment, such as microphones and headsets to allow communication between the worker and a control centre, video equipment, for example a head-mounted camera worn by the worker, health/vital statistic monitoring equipment such as breathing/hearth-rate monitor to be relayed to the data control centre to monitor each individual worker's

health. Also, workers may be provided with locator means such as GPS devices which could relay their position via the combined fluid supply and data communication network to the control centre.

5 In order to provide an intrinsically safe system, it is preferable that the combined fluid supply and data communication network is passive, and power to transmit data signals can come from the equipment coupled to the system via the combined fluid supply and data communication couplings 205, such as battery power provided with the audio/video/health-monitoring equipment, etc.

10

As well as personnel mounted equipment, the combined fluid supply and data communication network of the invention can be used to connect only equipment thereto. For example, an air-quality monitor 210 may include a coupling compatible with the combined fluid supply and data communication coupling 205 on the end of
15 the branch air line 205 to form a data coupling therewith. Although the equipment may likely not need an air supply, it can utilise only the data communication function of the network to feed information from areas on the facility, such as air-quality, to detect toxic/explosive gases in the air, back to the data control centre.

20 Although the above exemplary combined fluid supply and data communication network of the invention is shown and described as an air-supply network, the invention is not limited to such a specific fluid supply, and any other fluid supply system may be included. For example, a combined fluid supply and data communication network of the invention may provide fuel such as gas or liquid fuel
25 such as petrol/diesel/aviation fuel to branch-line supply pipes, which may simultaneously connect to equipment such as pumping equipment, vehicle fuel tank fill level monitoring equipment, vehicle temperature monitoring equipment, fluid volume transfer monitoring equipment, etc. Again, in such use, it would be much by preference that the data communication coupling portion is intrinsically safe to
30 avoid accidents/explosions of any combustible/explosive fluids, in use.

Also, although the exemplary combined fluid supply and data communication network of the invention shown and described above shows the data

communication cables disposed within the fluid supply pipes, they may alternatively be disposed on the outside of the fluid supply pipes (as shown in the embodiments in Figures 13 and 14), or alternatively, may be embedded within the walls of the fluid supply pipes.

5

Claims

1. A combined fluid supply and data communication conduit comprising an enclosed fluid supply duct having at least two distal open ends, and a data
5 communication cable extending within the fluid supply duct, at least one of the distal open ends of the fluid supply duct including a coupling comprising a fluid-tight valve configured to seal closed said at least one distal open end of the fluid supply duct when the coupling is in an un-coupled state and, configured to remain open to allow fluid to pass therethrough when in a coupled state, the coupling
10 further including a data connection terminal connected to the data communication cable within the fluid supply duct and configured to connect to a corresponding terminal of a corresponding coupling to allow combined fluid and data communication through the conduit via said coupling in a coupled state thereof.
- 15 2. A conduit according to claim 1 wherein the data connection terminal includes at least one induction element connected to the data communication cable and which is configured to make an inductive data connection with a corresponding induction element of a corresponding coupling when placed adjacent thereto.
- 20 3. A conduit according to claim 2 wherein the induction element comprises a loop of conductive material embedded in the body of the data connection terminal.
4. A conduit according to claim 1 wherein the data connection terminal includes at least one exposed electrical contact connected to the data
25 communication cable.
5. A conduit according to any of claims 2 to 4 wherein the at least one induction element/electrical contact is an annular member.
- 30 6. A conduit according to claim 5 comprising a plurality of concentric induction elements/electrical contacts.

7. A conduit according to claim 1 wherein the data connection terminal includes at least one optical connector and the data communication cable comprises an optical fibre connected to the optical connector, the optical connector being configured to make an optical data link with a corresponding optical connector of a corresponding coupling when placed adjacent thereto.

8. A conduit according to any preceding claim wherein the coupling further comprises a magnet configured to hold the data connection terminal in contact with a corresponding data connection terminal of a corresponding coupling when placed adjacent thereto in a coupled state of the coupling.

9. A conduit according to any preceding claim wherein the coupling comprises a main body portion and the data connection terminal is disposed on an outer periphery of the main body portion.

10. A conduit according to claim 9 wherein the data connection terminal is slidably mounted on the main body portion.

11. A conduit according to claim 10 wherein the data connection terminal is biased towards a distal end of the coupling.

12. A conduit according to any preceding claim wherein the fluid supply duct defines a central bore and the data communication cable is disposed in the central bore of the fluid supply duct.

13. A conduit according to any of claim 1 to 11 wherein the fluid supply duct comprises a peripheral wall defining a central bore and the data communication cable is disposed within the peripheral wall of the fluid supply duct.

14. A combined fluid supply and data communication coupling comprising a first part having a hollow bore and a valve therein and a first data communication terminal for connection to a first data communication cable, and a second part having a hollow bore and a second data communication terminal for connection to a

second data communication cable, the first and second parts being configured to be releasably coupled to each other such that, when in a coupled state, the valve is open and the hollow bore of the first and second parts are in sealed fluid communication to allow fluid to pass therethrough and the first and second data communication terminals are in contact to allow a data signal to pass from one terminal to the other terminal, and when the first and second parts are in an uncoupled state, the valve is closed to prevent fluid flow therethrough and the data communication terminals are out of contact with each other to prevent data signals passing therebetween.

10

15. A coupling according to claim 14 wherein the first and second data connection terminals each include at least one induction element connected to the first and second data communication cables, respectively, and which are configured to make an inductive data connection with each other when adjacent to each other in the coupled state of the coupling.

15

16. A coupling according to claim 15 wherein the induction elements each comprise a loop of conductive material embedded in the body of the respective first and second data connection terminals.

20

17. A coupling according to claim 14 wherein the first and second data connection terminals each include at least one exposed electrical contact connected to the respective first and second data communication cable.

25

18. A coupling according to any of claims 15 to 17 wherein each of the at least one first and second induction elements/electrical contacts is an annular member.

19. A coupling according to claim 18 comprising a plurality of concentric first and second induction elements/electrical contacts.

30

20. A coupling according to claim 14 wherein the first and second data connection terminals each include at least one optical connector and the first and second data communication cables each comprise an optical fibre connected to the

respective first and second optical connector, the first and second optical connectors being configured to make an optical data link with each other when placed adjacent to each other in the coupled state of the coupling.

5 21. A coupling according to any of claims 14 – 20 further comprising a magnet configured to hold the first and second data connection terminals in contact with each other when placed adjacent to each other in a coupled state of the coupling.

22. A coupling according to any of claims 14 – 21 wherein the first and second
10 coupling parts each comprise a main body portion and each of the first and second data connection terminals are disposed on an outer periphery of the respective main body portions.

23. A coupling according to claim 22 wherein at least one of the first and second
15 data connection terminals is slidably mounted on the respective main body portion.

24. A coupling according to claim 23 wherein the at least one slidably mounted data connection terminal is biased towards the other of the data connection terminals in a coupled state of the coupling.

20 25. A coupling according to any of claims 14 – 24 wherein at least one of the first and second coupling parts is connected to an enclosed fluid supply duct, and a data communication cable extends within the at least one fluid supply duct, the respective first and/or second data connection terminals being connected to the
25 respective data communication cable within the respective fluid supply duct.

26. A coupling according to claim 25 wherein the at least one fluid supply duct defines a central bore and the at least one data communication cable is disposed in the central bore of the at least one fluid supply duct.

30 27. A coupling according to claim 25 wherein the at least one fluid supply duct comprises a peripheral wall defining a central bore and the at least one data

communication cable is disposed within the peripheral wall of the at least one fluid supply duct

28. A data communication connector for retro-fitting to a conventional fluid
5 supply coupling, the connector comprising a mounting portion configured to
securely attach the connector to a fluid supply duct or fluid supply coupling, and a
data coupling portion configured to be connected to a data communication cable
and, in use, to be in contact with a corresponding data coupling portion of a
combined fluid supply and data communication coupling for data signals to be
10 transmitted between the data coupling portions.

29. A connector according to claim 28 wherein the data coupling portion
includes at least one induction element to be connected to a data communication
cable and which is configured to make an inductive data connection with a
15 corresponding induction element of a combined fluid supply and data
communication coupling when placed adjacent thereto.

30. A connector according to claim 29 wherein the induction element comprises
a loop of conductive material embedded in the body of the data coupling portion.

20

31. A connector according to claim 28 wherein the data coupling portion
includes at least one exposed electrical contact to be connected to a data
communication cable.

25 32. A connector according to any of claims 29 to 31 wherein the at least one
induction element/electrical contact is an annular member.

33. A connector according to claim 32 comprising a plurality of concentric
induction elements/electrical contacts.

30

34. A connector according to claim 28 wherein the data coupling portion
includes at least one optical connector to be connected to an optical fibre of a data
communication cable, the optical connector being configured to make an optical

data link with a corresponding optical connector of a combined fluid supply and data communication coupling when placed adjacent thereto.

35. A connector according to any of claims 28 – 34 configured to be mounted
5 on an outer periphery of a substantially cylindrical conventional fluid supply coupling.

36. A combined fluid supply and data communication adaptor for retro-fitting to
a conventional fluid supply coupling, the adaptor comprising a main body portion
10 having a hollow bore, and a data coupling portion configured to be connected to a data communication cable and, in use, to be in contact with a corresponding data coupling portion of a combined fluid supply and data communication coupling for data signals to be transmitted between the data coupling portions.

37. An adaptor according to claim 36 wherein the hollow bore comprises a valve
15 operable to prevent or permit fluid flow through the hollow bore.

38. An adaptor according to claim 37 wherein the main body portion comprises
a first part configured to couple with a conventional fluid supply valve and a second
20 portion configured to couple with a combined fluid supply and data communication coupling.

39. An adaptor according to claim 38 wherein the first portion comprises a male
portion configured to be received in a conventional female fluid supply coupling
25 and the second portion comprises a female portion configured to receive a male portion of a combined fluid supply and data communication coupling.

40. An adaptor according to any of claims 36 – 39 wherein the data coupling
portion includes at least one induction element to be connected to a data
30 communication cable and which is configured to make an inductive data connection with a corresponding induction element of a combined fluid supply and data communication coupling when placed adjacent thereto.

41. An adaptor according to claim 40 wherein the induction element comprises a loop of conductive material embedded in the body of the data coupling portion.

42. A connector according to any of claims 36 – 39 wherein the data coupling
5 portion includes at least one exposed electrical contact to be connected to a data communication cable.

43. A connector according to any of claims 40 – 42 wherein the at least one
10 induction element/electrical contact is an annular member.

44. A connector according to claim 43 comprising a plurality of concentric
induction elements/electrical contacts.

45. A connector according to any of claims 36 – 39 wherein the data coupling
15 portion includes at least one optical connector to be connected to an optical fibre of a data communication cable, the optical connector being configured to make an optical data link with a corresponding optical connector of a combined fluid supply and data communication coupling when placed adjacent thereto.

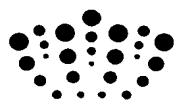
20 46. A combined fluid supply and data communication network comprising a main fluid supply duct coupled at one end to a source of fluid and having a plurality of branch lines in fluid communication therewith, at least one branch line including a coupling at one end thereof including a valve to seal the branch line closed in an un-coupled state, the network further comprising a plurality of data communication
25 cables extending within the main fluid supply duct and branch lines, at least one cable connected to a communications control unit and at least one cable connected to the at least one coupling at a terminal formed on the at least one coupling, the network configured to simultaneously provide fluid to a fluid-compatible equipment when coupled to the at least one coupling, and to transmit data signals between the
30 communication control unit and an electrical device connected to the terminal on the at least one coupling.

47. A network according to claim 46 wherein the source of fluid is a source of compressed breathable air and the network is configured to provide breathable air to breathing equipment coupled to the at least one coupling.

5 48. A network according to claim 46 or claim 47 wherein a data bus is connected between the communications control unit and the data communication cable(s).

49. A network according to any of claims 46 – 48 wherein the network is a passive network and power to transmit data signals between an electrical device
10 connected to the terminal on the at least one coupling and the communications control unit is to be provided by a power source on the electrical device.

15



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Documents considered to be relevant:

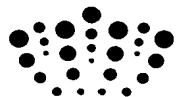
Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-13	DE2333620 A1 (Kernforschung); see air and telephone line quick-release connector with valve, and wiring located within air duct
X	1-13	DE2212656 A1 (Kernforschung); see air and telephone line quick-release connector with valve, and wiring located within air duct
X	1-13	US5810048 A1 (Zeiner); see figure 6-9 relating to electrical wiring and fibre optic cables in fluid connectors with valve
X	1-13	EP1901382 A2 (Yamaha); note various electrical coupling connections in the fluid coupling with valve
A	-	US2002/135179 A1 (Schlumberger); discusses inductive coupling in fluid connectors
A	-	EP0337055 A2 (Teikoku); see electrical terminals of connectors in figures 1 and 2
A	-	US2004/025682 A1 (Festo); see light guides in fluid coupler
A	-	EP1127583 A2 (Siemens); see electrical contacts of fluid coupler in figures

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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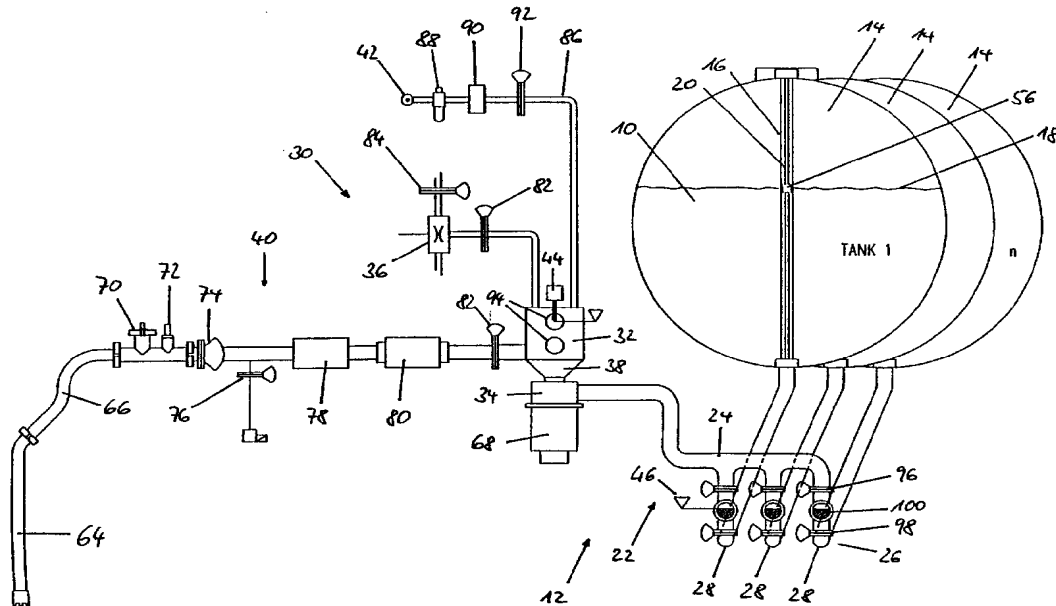
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(54) Title: DEVICE AND METHOD FOR TRANSPORTING A MEDIUM

(54) Bezeichnung: VORRICHTUNG UND VERFAHREN ZUR FÖRDERUNG EINES MEDIUMS



(57) Abstract: The invention relates to a device for transporting a medium (10), comprising a conduit assembly (12) which allows several tanks (14) to be filled and/or drained and comprising fill-level gauges (16), located essentially in the interior of the tanks (14), for determining the position of at least one limiting surface (18) of the medium (10) in the tanks. The invention also relates to a method for transporting a medium (10) by means of a conduit assembly (12), whereby the fill level in several tanks (14) is measured by fill-level gauges (16).

[Fortsetzung auf der nächsten Seite]



eurasisches Patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI-Patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Zur Erklärung der Zweibuchstaben-Codes, und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

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(57) Zusammenfassung: Die Erfindung betrifft eine Vorrichtung zur Förderung eines Mediums (10) mit einer Leitungseinrichtung (12), wobei über die Leitungseinrichtung (12) mehrere Tanks (14) befüllbar und/oder entleerbar sind, Füllpegelmesseinrichtungen (16) im wesentlichen im Inneren der Tanks (14) zur Bestimmung der Position mindestens einer Grenzfläche (18) des Mediums (10) in den Tanks vorgesehen sind. Die Erfindung betrifft ferner ein Verfahren zur Förderung eines Mediums (10), bei dem das Medium über eine Leitungseinrichtung (12) transportiert wird, wobei die Füllpegel in mehreren Tanks (14) von Füllpegelmesseinrichtungen (16) gemessen werden.

Vorrichtung und Verfahren zur Förderung eines Mediums

Die Erfindung betrifft eine Vorrichtung zur Förderung eines Mediums nach dem Oberbegriff des Anspruchs 1. Die Erfindung betrifft ferner ein Verfahren zur Förderung eines Mediums nach dem Oberbegriff des Anspruchs 18.

Gattungsgemäße Vorrichtungen und gattungsgemäße Verfahren werden beispielsweise in der Milchwirtschaft oder beim Vertrieb von Treibstoffen verwendet.

Im Bereich der Milchwirtschaft fährt ein Tankwagen regelmäßig bestimmte Milcherzeuger an und entnimmt die dort zum Beispiel im Laufe eines Tages angefallene Milch aus einem oder mehreren Vorratsbehältern. Bei dieser Milchannahme ist es wichtig, dass die entnommene Menge Milch genau gemessen und registriert wird, da auf dieser Grundlage eine spätere Abrechnung zwischen dem Erzeuger und dem Abnehmer erfolgt. Diese Messung der Milchmenge unterliegt dem Eichrecht, welches vorschreibt, wie die Messung zu erfolgen hat und welche Genauigkeiten eingehalten werden müssen (DIN 19217).

Eine Möglichkeit zur Durchführung einer Messung, welche dem Eichrecht genügt, besteht in der Verwendung von Durchflusszählern, wobei allerdings sicherzustellen ist, dass Luft-

beimengungen, die beim Ansaugen der Milch insbesondere zu Beginn und am Ende des Annahmeporgangs zwangsweise entstehen, nicht in das Durchflussmessgerät gelangen und dort zu Messfehlern führen. Derartige Luftbeimengungen werden durch das Einfügen von Gasmessverhütern und Gasabscheidern vermieden, welche auch als Luftabscheider bezeichnet werden. Grundsätzlich sind Luftabscheider als Zwischenbehälter zwischen dem zu befüllenden Tank und dem Entnahmebehälter angeordnet. Die zu fördernde Milch verbleibt eine Weile in dem Luftabscheider, so dass sich Lufteinschlüsse in der Milch zurückbilden können. Erst dann wird die Milch beispielsweise durch einen Durchflussszähler in den zu befüllenden Tank geleitet, um eine der Eichpflicht genügende Mengenbestimmung durchzuführen.

Aus dem Einsatz von Luftabscheidern ergeben sich jedoch einige Nachteile. Zum einen wird die Gesamtapparatur aufwendig, da es sich bei den Gasabscheidern und den Gasmessverhütern um komplizierte mechanische Gebilde mit großem Volumen und großem Gewicht handelt; dies hat eine Reduzierung des zulässigen Zuladegewichts bei den Sammelfahrzeugen zur Folge. Weiterhin sind die Luftabscheider stets nur für eine begrenzte Durchflussmenge zugelassen, was die gesamte Saugleistung des Sammelfahrzeuges begrenzt.

In der DE 198 39 112.9 wurde bereits eine Anordnung beschrieben, welche ohne den Einsatz von Luftabscheidern auskommt. Die Entbehrlichkeit der Luftabscheider beruht insbesondere darauf, dass in dem zu befüllenden Tank eine hochgenaue Volumenbestimmung durch Einsatz einer Füllpegelmess-einrichtung erfolgt. Es ist daher nicht mehr unbedingt erforderlich, eine Mengenbestimmung bei der strömenden Flüssigkeit durchzuführen, so dass auch die oben besprochenen Messfehler aufgrund von Lufteinschlüssen vermieden werden.

Da der Tank gleichzeitig als Luftabscheider wirkt, kann mit einer hochgenauen Füllpegelmesseinrichtung der Eichpflicht genügt werden.

Ein weiterer mit den Luftabscheidern in Verbindung stehender Nachteil ist zu nennen. Grundsätzlich soll bei der Milchannahme verhindert werden, dass sich unterschiedliche Partien der Rohmilch miteinander vermischen. Dies gewinnt gerade in jüngster Zeit zunehmend an Bedeutung, da das Qualitätsbewusstsein der Verbraucher immer mehr steigt. Beispielsweise wollen die Verbraucher von Biomilch sich darauf verlassen können, dass ihre Milch nicht zusammen mit herkömmlicher Rohmilch vermischt bzw. vermischt wird. Aber auch sonst wird die Milch in unterschiedlichste Qualitätsstufen unterteilt - derzeit unterscheidet man bis zu neun Qualitätsstufen. Arbeitet man nun mit Luftabscheidern, um der erforderlichen Eichpflicht zu genügen, so ist unmittelbar ersichtlich, dass ein großer Aufwand zu treiben ist, um eine Vermischung von Milch verschiedener Qualitätsstufen zu vermeiden. Ohne eine aufwendige Förder- und Leitungstechnik würde es zu Vermischungen der aktuell entnommenen Milch mit Milch aus einem vorangehenden Entnahmevorgang (Haftmilch) im Luftabscheider kommen.

Aus der gattungsbildenden DE 197 50 950 A1 ist ein Sicherungssystem für eine aus mehreren Tanks bestehende Tankanordnung bekannt, mit der das durch eine Leitungseinrichtung erfolgende Befüllen und/oder Entleeren der Tanks kontrolliert werden kann. Zur Bestimmung der Füllmenge in den Tanks ist ferner im Inneren jedes Tanks eine Füllpegelmesseinrichtung zur Bestimmung der Position mindestens einer Grenzfläche des Mediums im Tank vorgesehen.

Es ist nun **A u f g a b e** der Erfindung, eine Vorrichtung bzw. ein Verfahren zur Förderung eines Mediums zu schaffen, bei der bzw. durch das eine Befüllung eines von mehreren Tanks mit einem sich von den in die anderen Tanks zu füllenden Medien unterscheidenden Medium ohne großen Aufwand und bei Gewährleistung allenfalls geringer Vermischung des einzufüllenden Mediums mit den anderen Medien möglich ist.

Diese Aufgabe wird durch eine Vorrichtung mit den Merkmalen des Anspruchs 1 bzw. durch ein Verfahren mit den Merkmalen des Anspruchs 18 gelöst.

Die Erfindung baut auf der gattungsgemäßen Vorrichtung dadurch auf, dass über die Leitungseinrichtung mehrere Tanks befüllbar und/oder entleerbar sind, dass Füllpegelmesseinrichtungen im Wesentlichen im Inneren der Tanks zur Bestimmung der Position mindestens einer Grenzfläche des Mediums in den Tanks vorgesehen sind. Auf diese Weise ist es möglich, eine der Eichpflicht genügende Volumenbestimmung durchzuführen. Weiterhin kann die Rohmilch entsprechend den unterschiedlichen Qualitätsstufen beim Annahmeprogang ohne Kontamination getrennt werden.

Zu diesem Zweck weist die erfindungsgemäße Leitungseinrichtung eine Verteilereinrichtung mit einer Primärseite und einer Sekundärseite auf, wobei die Sekundärseite einzelne, mit den Tanks in Verbindung stehende, absperrbare Verteilerwege aufweist. Diese Verteilereinrichtung dient der die Qualität der Milch sichernden Trennung von Milch unterschiedlicher Qualitätsstufen, beispielsweise der Trennung von herkömmlicher Rohmilch und Biomilch.

Ferner weist die Verteilereinrichtung Füllstandmeseinrichtungen auf, welche den Verteilerwegen zugeordnet sind. Über

die Füllstandmesseinrichtungen wird die Förderleistung des Mediums überwacht. Ferner dienen die Füllstandmesseinrichtungen in der Verteilereinrichtung der Bereitstellung eines Ausgangssignals bei der Vorbereitung des Systems für die Milchannahme in den nächsten Tank, nämlich dann, wenn die Milch in ausreichendem Maße aus dem Annahmesystem verdrängt wurde.

Die Vorrichtung ist preiswerter und leichter aufgrund der Entbehrlichkeit der Luftabscheider. Ferner nimmt sie weniger Platz ein. Da die Saugleistung nicht durch einen Luftabscheider begrenzt wird, kann eine höhere Förderleistung bereitgestellt werden.

Bevorzugt steht die Primärseite mit einer Ansaugeinrichtung in Verbindung. Diese Ansaugeinrichtung dient der Förderung der Milch aus einem von dem Lieferanten bereitgestellten Behälter.

Die Ansaugeinrichtung weist vorteilhafterweise einen ersten Ansaugbehälter, eine Kreiselpumpe und einen Ejektor auf. Über den Ejektor, welcher nach dem Prinzip einer Wasserstrahlpumpe arbeitet, kann ein Unterdruck in dem Ansaugbehälter erzeugt werden. Durch diesen Unterdruck wird zumindest ein Verteilerweg der Verteilereinrichtung bis zu einem vorbestimmten Füllstand befüllt. Nachfolgend übernimmt die Kreiselpumpe die Förderung, wobei der als Vakuumpumpe arbeitende Ejektor nur bei Bedarf optional zugestellt werden kann. Ob ein solcher Bedarf vorliegt, wird vorzugsweise in der Verteilereinrichtung durch Füllstandmessung ermittelt.

In dem Ansaugbereich der Kreiselpumpe ist vorteilhafterweise ein Strudelbrecher angeordnet. Dieser vermindert die Menge der in die Kreiselpumpe eintretenden Luft, welche an-

sonsten den Wirkungsgrad der Kreiselpumpe erheblich vermindern könnte.

Es ist nützlich, wenn die Ansaugereinrichtung mit einer Zuleitung verbindbar ist. Diese Zuleitung verbindet die Ansaugereinrichtung mit dem Behälter des Lieferanten. Die Ansaugereinrichtung ist jedoch nicht zwingend mit einer Zuleitung verbunden, was insbesondere im Hinblick auf die unten beschriebene Abgabe der Milch aus den Tanks zu erklären ist.

Weiterhin ist es bevorzugt, wenn die Ansaugereinrichtung mit einem Druckluftanschluss verbindbar ist. Über diesen kann bei der Beendigung der Milchannahme in einen bestimmten Tank Druckluft zugeführt werden, welche die restliche Milch aus dem Ansaugsystem entfernt; somit steht die Anlage für die Annahme von Milch in einen weiteren Tank zur Verfügung.

Die Ansaugereinrichtung weist vorzugsweise eine Füllstandmesseinrichtung auf. Ein Ausgangssignal dieser Füllstandmesseinrichtung lässt beispielsweise erkennen, dass die Ansaugarbeit des Ejektors von der Kreiselpumpe übernommen werden kann.

Es ist bevorzugt, dass zwischen der Ansaugereinrichtung und der Primärseite der Verteilereinrichtung eine Abgabeöffnung vorgesehen ist und dass die mit den Tanks in Verbindung stehenden Verteilerwege auf der Sekundärseite der Verteilereinrichtung über eine Umpumpleitung mit der Ansaugvorrichtung in Verbindung stehen. Diese Anordnung der erfindungsgemäßen Vorrichtung dient der selektiven Abgabe der Milch aus einem ausgewählten Tank über den Ansaugbehälter. Dies hat den Vorteil, dass dieselben Komponenten, welche schon bei der Annahme der Milch verwendet wurden, bei-

spielsweise der Ansaugbehälter und der Ejektor, für die Abgabe der Milch genutzt werden können.

Bei einer anderen bevorzugten Ausführungsform der Erfindung umfasst die Ansaugeinrichtung eine Impellerpumpe. Impellerpumpen sind selbstansaugend, wodurch sich das System vereinfacht. Weiterhin sind Impellerpumpen preiswert, was nochmals Vorteile mit sich bringt. Im Vergleich zu dem System mit Vakuumpumpe und Kreiselpumpe ist allerdings zu bemerken, dass die Milch weniger schonend angenommen wird; ferner ist die Saugleistung geringer als bei dem System mit Kreiselpumpe und separater Vakuumpumpe. Man wird je nach der gewünschten Anwendung die Vor- und Nachteile der Ausführungsform gegeneinander abwägen und das entsprechende System zum Einsatz bringen.

Bei dieser Ausführungsform ist es besonders bevorzugt, dass für jeden Tank eine Ansaugvorrichtung, insbesondere eine Impellerpumpe vorgesehen ist. Damit wird eine Vermischung der unterschiedlichen Annahmepartien in der Ansaugeinrichtung vermieden.

Eine weitere Ausführungsform der Erfindung arbeitet darüber, dass in den Tanks ein erster Unterdruck erzeugbar ist. Durch den Unterdruck in den Tanks wird das flüssige Produkt beim Öffnen eines entsprechenden Ventils in den Tank hineingesaugt. Eine Vermischung der Milch in einer Ansaugvorrichtung wird also auch hierdurch wirkungsvoll vermieden.

Besonders vorteilhaft ist bei dieser Ausführungsform, wenn mit dem Tank ein zweiter Ansaugbehälter verbindbar ist, in dem ein zweiter Unterdruck erzeugbar ist, wobei der erste Unterdruck unabhängig von dem zweiten Unterdruck erzeugbar

ist. Diese Anordnung hat den Vorteil, dass zunächst ein relativ kleiner Ansaugbehälter evakuiert wird, während der Tank seinen bereits erzeugten Unterdruck in seinem großen Volumen aufrechterhält. Erst wenn der Ansaugbehälter gefüllt ist, was durch einen Sensor detektiert werden kann, wird über die Betätigung von Ventilen das Produkt von dem Ansaugbehälter in den Tank befördert. Durch die Tatsache, dass der erste Unterdruck in dem Tank unabhängig von dem zweiten Unterdruck in dem Ansaugbehälter erzeugt wird, wird verhindert, dass durch Lufteinfall zu Beginn oder am Ende der Annahme ein vorzeitiger Druckanstieg in dem Tank entsteht; ein solcher hätte zur Folge, dass das große Tankvolumen daraufhin neu evakuiert werden müsste.

Bei der Ausführungsform mit Ansaugbehälter ist besonders zu bevorzugen, dass das Volumen des zweiten Ansaugbehälters mindestens so groß ist, wie das Volumen des Ansaugsystems. Der Ansaugbehälter kann somit die gesamte Milch annehmen, welche sich in dem Ansaugsystem (Schlauch plus Verrohrung) befindet. Auch dies ist im Hinblick auf die Vermeidung der Vermischung aufeinanderfolgender Annahmepartien nützlich.

Besonders vorteilhaft ist die erfindungsgemäße Vorrichtung, wenn die Füllpegelmesseinrichtung einen nach dem magnetostriktiven Prinzip arbeitenden, mit einer Rechenvorrichtung gekoppelten, transsonaren Wegaufnehmer aufweist, der mit dem Peilstab und mindestens einem Schwimmer ausgestattet ist, wobei der Schwimmer mit mindestens einem Magneten ausgestattet ist. Das magnetostriktive Prinzip beruht auf dem Phänomen, dass zwei sich kreuzende Magnetfelder eine Verformung des Metalls, in dem diese gebündelt sind, hervorrufen. Gibt man nun in den Peilstab einen Erregerstromimpuls, so resultiert daraus ein bezüglich des Peilstabes axialsymmetrisches Erregermagnetfeld. Dieses wechselwirkt

mit den kreuzenden Magnetfeldern der Schwimmermagnete, wodurch eine kurzzeitige Deformation und ein daraus entstehender Ultraschallimpuls in dem als Wellenleiter wirkenden Peilstab erzeugt wird. Aus der Laufzeit des Ultraschallimpulses durch den Peilstab bis zu einem vorzugsweise am Peilstab endseitig angeordneten Empfänger lässt sich in Kenntnis der Schallgeschwindigkeit in dem Wellenleiter auf die Position der Magnete und somit des Schwimmers rückschließen. Durch die derart ausgestattete Vorrichtung ist es möglich, die Position des Schwimmers bis zu einer Größenordnung von $< 10 \mu\text{m}$ zu messen. Transsonare Wegaufnehmer sind ferner langzeitstabil und erfüllen somit die strengen gesetzlichen Vorschriften hinsichtlich der Eichung und der Messgenauigkeit.

Vorzugsweise ist eine Steuereinrichtung vorgesehen, welche die Förderung des Mediums in Abhängigkeit der Messsignale der Füllpegelmesseinrichtung der Tanks und/oder der Füllstandmesseinrichtungen der Verteilereinrichtung und/oder der Füllstandmesseinrichtung der Ausgangseinrichtung steuert. Mit einem oder mehreren dieser Parameter ist unter Verwendung einer Steuereinrichtung eine zuverlässige Automatisierung der Milchannahme bzw. der Abgabe der Milch möglich, wobei sich insbesondere eine unerwünschte Vermischung vermeiden lässt.

Ebenso kann vorteilhaft sein, dass mindestens ein Drucksensor und/oder mindestens ein Temperatursensor und/oder mindestens eine Volumenstrommesseinrichtung vorgesehen sind, während Ausgangssignale der Steuereinrichtung als Eingangssignale zuführbar sind. Mit diesen weiteren Parametern lässt sich die Qualitätssicherung bei der Milchannahme bzw. der Milchabgabe weiter verbessern.

Es kann vorteilhaft sein, dass die Verbindungen der Leitungseinrichtung mit anderen Systemkomponenten mit Leseeinrichtung und codierten Einrichtungen (TAGs) ausgestattet sind, so dass über eine Steuerung die korrekte Zuordnung der Komponenten überprüfbar ist. Beispielsweise kann so sichergestellt werden, dass eine Milchannahme oder Abgabe nur erfolgt, wenn sämtliche Systemkomponenten korrekt verbunden sind.

Bei dem erfindungsgemäßen Verfahren, wie es in Anspruch 18 definiert ist, wird zur Befüllung einer der Tanks das Medium in einen mit dem zu befüllenden Tank verbundenen Verteilerweg einer Verteilereinrichtung der Leitungseinrichtung gefördert. Gegen Ende der Befüllung wird gemeinsam mit dem Medium auch Luft in die Leitungseinrichtung gefördert. Durch Erfassen des Füllstandes in der Verteilereinrichtung wird die Befüllung so lange fortgesetzt, bis der erfasste Füllstand unter ein vorgegebenes Niveau fällt. Sobald dies auftritt, wird der geöffnete Verteilerweg zur Beendigung der Befüllung geschlossen. Auf diese Weise wird erreicht, dass die Leitungseinrichtung bis zu dem gesperrten Verteilerweg von Mediumresten frei ist. Gleichzeitig enthält der gesperrte Verteilerweg zwischen der Sperrstelle und dem Tank ein definiertes Volumen, so dass das in den Tank gefüllte Gesamtvolumen des Mediums problemlos und sehr genau berechnet werden kann.

Das Verfahren ist besonders dadurch vorteilhaft, dass ein Tank ausgewählt wird, welcher mit dem Medium zu befüllen ist, dass in einer Ansaugereinrichtung ein Unterdruck zur Befüllung der Leitungseinrichtung erzeugt wird, dass in der Ansaugereinrichtung ein Füllstand ermittelt wird und dass in Abhängigkeit des ermittelten Füllstandes die Förderung des Mediums durch die Leitungseinrichtung in den ausgewählten

Tank beginnt und die Erzeugung des Unterdrucks beendet wird. Somit wird sichergestellt, dass die Füllstandermittlung in der Ansaugereinrichtung als Kriterium für den Verfahrensablauf dienen kann, insbesondere auch für die Bestimmung der Beendigung der Befüllung. Dass die Befüllung beendet werden soll, zeigt sich daran, dass der Füllstand in der Ansaugereinrichtung unter einen vorbestimmten Wert fällt.

Vorzugsweise wird nach der Befüllung des ausgewählten Tanks mindestens ein weiterer Tank befüllt. Dies ist möglich, damit der Füllstandermittlung, insbesondere nach einem Austreiben der Milch aus dem Annahmesystem durch Druckluft, sichergestellt ist, dass das Annahmesystem hinreichend von Milchresten der vorangehenden Annahme befreit ist.

Vorzugsweise wird nach der Erzeugung des Unterdruckes in der Ansaugereinrichtung eine Kreiselpumpe zur Förderung des Mediums betrieben. Eine solche Kombination von Vakuumpumpe, zum Beispiel unter Einsatz eines Ejektors, und einer Kreiselpumpe ermöglicht eine große Förderleistung; ferner wird hierdurch eine schonende Förderung der Milch erreicht.

Besonders bevorzugt ist, dass die den Unterdruck erzeugende Vakuumpumpe unterstützend zu der Kreiselpumpe betrieben wird, wenn der in der Ansaugereinrichtung ermittelte Füllstand unter ein vorgegebenes Niveau fällt. Fällt beispielsweise der in der Ansaugereinrichtung ermittelte Füllstand unter das vorbestimmte Niveau, so kann dies an einer unzureichenden Förderleistung der Kreiselpumpe liegen. In dem Fall kann automatisch veranlasst werden, dass die Vakuumpumpe in Betrieb genommen wird, so dass der Füllstand in dem jeweiligen Verteilerweg wieder sein Sollniveau erreicht.

In diesem Zusammenhang ist es besonders bevorzugt, dass die Inbetriebnahme der Kreislumpumpe und/oder die unterstützende Inbetriebnahme der Vakuumpumpe und/oder die Beendigung der Befüllung eines Tanks auch in Abhängigkeit des ermittelten Füllstandes in der Verteilereinrichtung gesteuert wird bzw. werden. Die Füllstandermittlung in der Verteilereinrichtung dient also gleichzeitig der Steuerung mehrerer Vorgänge während des Verfahrensablaufes.

Vorzugsweise werden vor der Befüllung eines weiteren Tanks Reste des Mediums von der Vakuumpumpe abgesaugt. Dies unterstützt, dass bei der nächsten Milchannahme keine unerwünschte Vermischung mit Restmilch aus einer vorangehenden Milchannahme auftritt.

In diesem Zusammenhang ist es auch nützlich, dass vor der Befüllung eines weiteren Tanks Druckluft in das System eingespeist wird, bis in der Verteilereinrichtung ein vorbestimmter Füllstand erreicht ist. Wiederum wird also der Füllstand in der Verteilereinrichtung zur Steuerung eines Vorganges während des erfindungsgemäßen Verfahrens verwendet.

Vorzugsweise wird das Medium aus dem Tank abgegeben, indem ein Tank ausgewählt wird, mindestens ein Teil des Mediums über eine Umpumpleitung in einen Ansaugbehälter gedrückt wird und das Medium aus dem Ansaugbehälter durch eine zwischen dem Ansaugbehälter und der Verteilereinrichtung angeordneten Abgabeöffnung abgegeben wird. Somit wird auch bei der Abgabe der Milch sichergestellt, dass keine Vermischung auftritt. Besonders vorteilhaft ist dabei, dass Systemkomponenten zum Einsatz kommen, welche schon bei der Annahme der Milch nützlich waren.

Ferner kann vorteilhaft sein, wenn in einem Tank ein erster Unterdruck erzeugt wird, so dass der Tank mit dem geförderten Medium befüllt wird. Bei diesem Verfahren ist eine zusätzliche Ansaugvorrichtung entbehrlich, so dass auch naturgemäß eine Vermischung in einer solchen Ansaugvorrichtung nicht auftreten kann.

In diesem Zusammenhang kann es besonders nützlich sein, dass in einem zweiten Ansaugbehälter, welcher mit dem Tank in Verbindung steht, ein zweiter Unterdruck unabhängig von dem ersten Unterdruck erzeugt wird, wobei zunächst der zweite Ansaugbehälter und danach der Tank mit dem geförderten Medium befüllt werden. Dies hat den Vorteil, dass zunächst der relativ kleine Ansaugbehälter evakuiert wird, während der großvolumige Tank seinen bereits erzeugten Unterdruck aufrechterhält. Erst wenn der Ansaugbehälter gefüllt ist, was beispielsweise durch einen Sensor detektiert werden kann, wird durch eine Umschaltung von Ventilen und den Unterdruck im Tank das Produkt, vorzugsweise durch ein Rückschlagventil, in den Tank befördert. Indem der Unterdruck in dem Ansaugbehälter unabhängig von dem Unterdruck im Tank erzeugt wird, wird verhindert, dass ein Lufteinfall zu Beginn oder am Ende der Annahme zu einem vorzeitigen Druckanstieg im Tank führt. Dies hätte zur Folge, dass das große Tankvolumen neu evakuiert werden müsste.

Der Erfindung liegt die überraschende Erkenntnis zugrunde, dass es möglich ist, sowohl den strengen Eichvorschriften als auch den Qualitätsanforderungen genügt werden kann. Dies wird einerseits durch eine hochpräzise Volumenbestimmung innerhalb eines Tanks durch eine Füllpegelmesseinrichtung erreicht, was zusätzliche Luftabscheider entbehrlich macht. Ferner kann die Qualität der Milch auf diese Weise gesichert werden. Die erfindungsgemäße Vorrichtung ist im

Vergleich zu den Vorrichtungen des Standes der Technik preiswerter und leichter; sie nimmt weniger Platz ein, und sie ist in der Lage eine höhere Leistung zu erbringen. Die Vorrichtung ermöglicht es, ohne erheblich vergrößerten apparativen Aufwand Milch mit zahlreichen unterschiedlichen Qualitätsniveaus anzunehmen. Beim Stand der Technik war es erforderlich für jede Qualitätsstufe einen separaten Luftabscheider zu verwenden; bei der Erfindung ist lediglich eine entsprechende Anzahl von Tanks und eine demgemäße Auslegung des Leitungssystems erforderlich.

Die Erfindung wird nun mit Bezug auf die begleitenden Zeichnungen anhand von Ausführungsformen beispielhaft beschrieben.

Fig. 1 zeigt eine erste Ausführungsform einer erfindungsgemäßen Vorrichtung;

Fig. 2 zeigt einen Ausschnitt der Vorrichtung aus Fig. 1 mit einer Erweiterung;

Fig. 3 zeigt eine zweite Ausführungsform einer erfindungsgemäßen Vorrichtung;

Fig. 4 zeigt einen Ausschnitt der Vorrichtung aus Fig. 3 mit einer Erweiterung;

Fig. 5 zeigt eine erste Tankanordnung, welche im Rahmen der Erfindung einsetzbar ist;

Fig. 6 zeigt eine zweite Tankanordnung, welche im Rahmen der Erfindung einsetzbar ist;

Fig. 7 zeigt eine dritte Tankanordnung, welche im Rahmen der Erfindung einsetzbar ist;

Fig. 8 zeigt eine spezielle Ausführungsform einer Verteilereinrichtung, welche im Rahmen der Erfindung einsetzbar ist.

Fig. 1 zeigt eine erste Ausführungsform einer erfindungsgemäßen Vorrichtung. Eine Mehrzahl mit einem Medium 10 gefüllter oder befüllbarer Tanks 14 ist mit einer Leitungseinrichtung 12 verbunden. Innerhalb der Tanks 14 sind Füllpegelmesseinrichtungen 16 vorgesehen. Die Füllpegelmesseinrichtungen 16 umfassen einen Peilstab 20 und einen Schwimmer 56, so dass mit der Füllpegelmesseinrichtung 16 eine Grenzfläche 18 des Mediums 10 messbar ist. Die Leitungseinrichtung 12 umfasst eine Ansauglanze 64, einen Ansaugschlauch 66 und eine Zuleitung 40 zu einer Ansaugereinrichtung 30 mit einem Ansaugbehälter 32. Der Ansaugbehälter 32 steht über einen Strudelbrecher 38 mit einer Kreiselpumpe 34 in Verbindung, welche von einem Antriebsmotor 68 antreibbar ist. Die Kreiselpumpe 34 ist mit der Primärseite 24 einer Verteilereinrichtung 22 verbunden. Die Sekundärseite 26 der Verteilereinrichtung 22 mündet über Verteilerwege 28, von denen hier beispielhaft drei Stück dargestellt sind, in die Tanks 14.

Die Zuleitung 40 zu dem Ansaugbehälter 32 ist mit weiteren Komponenten versehen: einem Vakuumschalter 70, einem Temperaturfühler 72, einem Scheibenventil 74, einem Milch-Prüf-Ring-Ventil (MPR-Ventil) 76, einem Volumenstrommesser 78, einem Online-Probennehmer 80 sowie einem weiteren Scheibenventil 82. An dem Ansaugbehälter 32 ist ein Ejektor 36 über ein Ventil 83 angeordnet. Der Ejektor 36 ist mit einem Druckluftventil 84 ausgestattet. Ferner steht der Ansaugbe-

hälter 32 mit einem Druckluftanschluss 42 in Verbindung. Eine Druckluftleitung 86 ist mit einem Druckluftreduzierer 88, einem Filter 90 (z.B. 200 µm) und einem Absperrventil 92 ausgestattet. Der Ansaugbehälter 32 ist mit einer Füllstandmesseinrichtung 44 und mit Schaugläsern 94 versehen. Auch die Verteilereinrichtung 22 ist auf ihren verschiedenen Verteilwegen 28 mit Füllstandmesseinrichtungen 46 ausgestattet. Die Verteilereinrichtung 22 ist sowohl auf ihrer Primärseite als auch auf ihrer Sekundärseite 26 mit Scheibenventilen 96, 98 ausgestattet. Ferner sind Schaugläser 100 vorgesehen.

Bei einer Milchannahme funktioniert die erfindungsgemäße Vorrichtung beispielsweise wie folgt. Zu Beginn der Annahme wird auf der Grundlage der anzunehmenden Milchqualität (Vorgabe) der entsprechende Tank 14 (Tanksegment) gewählt. Zu diesem Zweck wird das entsprechende Ventil 96 an der Verteilereinrichtung 22 geöffnet. Ein (nicht gezeigtes) Rückschlagventil verhindert das Rückströmen von Milch, welche sich eventuell bereits in dem Tank 14 befindet. Daraufhin wird in dem Ansaugbehälter 32 ein Unterdruck erzeugt. Dies erfolgt über den Ejektor 36 in Verbindung mit dem Ventil 82 und dem Druckluftventil 84. Im Prinzip kann der Ejektor 36 durch eine andersartige Vakuumpumpe ersetzt werden. Wenn der Unterdruck einen gewissen Wert erreicht hat beginnt die Förderung der Milch. Zu diesem Zeitpunkt sind das Scheibenventil 74 und das Ventil 82 geöffnet. Der Vakuumschalter 70 detektiert den Unterdruck. Über die Ansauglanze 64 und den flexiblen Ansaugschlauch 66 wird die Milch am Temperaturfühler 72 vorbei gefördert. Der Temperaturfühler 72 dient einer zusätzlichen Qualitätssicherung. Danach gelangt die Milch in den Volumenstrommesser 78, in dem der aktuelle Volumenstrom ermittelt wird. Aus den Werten des Volumenstrommessers 78 (Geschwindigkeit und Füllgrad) wird

durch eine nicht dargestellten Steuereinheit zusammen mit beliebigen anderen Werten der Online-Probennehmer 80 angesteuert. Die Probe wird in eine (nicht dargestellte) Probenflasche abgefüllt; auch dies dient der Qualitätssicherung. Sobald die Milch in dem Ansaugbehälter 32 das mit einem Dreieck gekennzeichnete Niveau erreicht hat, wird der Antriebsmotor 68 der Kreislaspumpe 34 aktiviert, und die Kreislaspumpe 34 drängt die Milch in eine Leitung, welche zur Primärseite 24 der Verteilereinrichtung 22 führt. Um sicherzustellen, dass die Sogwirkung der Kreislaspumpe 34 keinen Trichter (Paraboloiden) zieht, ist im Einstrombereich der Kreislaspumpe 34 ein Strudelbrecher 38 angebracht. Eventuell eintretende Luft würde zwar die Messung des Milchvolumens nicht verfälschen, da die Milch im Tank 14 ausreichende Zeit zum Ausgasen hat; eine Entlüftung empfiehlt sich jedoch, um den Wirkungsgrad der Kreislaspumpe 34 zu verbessern bzw. aufrechtzuerhalten. Sobald die Kreislaspumpe 38 läuft, kann die Vakuumpumpe bzw. der Ejektor 12 abgeschaltet werden, da die Kreislaspumpe 32 nun für die Förderung der Milch sorgt. Lediglich wenn das Niveau im Ansaugbehälter 32 unter das mit einem Dreieck gekennzeichnete vorbestimmte Niveau abfällt, was an den Schaugläsern 94 zu beobachten ist, greift der Ejektor 36 unterstützend ein. Dieser Niveaunachweis erfolgt über die Füllstandmessenrichtung 44 in dem Ansaugbehälter 32. Gegen Ende des Annahmeporgangs wird Luft mitangesaugt, das Niveau im Ansaugbehälter 32 fällt, und der Ejektor 36 saugt das Ansaugsystem von Milchresten frei. Zusätzlich ist in der beschriebenen Ausführungsform ein Milch-Prüf-Ring-Ventil 76 (MPR-Ventil) vorgesehen, welches sicherstellt, dass keine neue Annahme gestartet werden kann, bevor die laufende Annahme abgeschlossen ist. Dies geschieht dadurch, dass das MPR-Ventil 76 öffnet und somit das Ansaugsystem mit Luft flutet. Nachfolgend wird das Ventil 82, welches als Rückschlag-Absperr-

ventil ausgelegt sein kann, geschlossen, woraufhin das System leer gedrückt wird. Dieses Leerdrücken des Systems erfolgt durch die Anwendung von Druckluft, welche am Druckluftanschluss 42 angelegt wird und so in den Ansaugbehälter 32 gelangt. Die Druckluft wird über einen Druckluftreduzierer 88 mit Filter und Wasser-Öl-Abscheider und ein Absperrventil 92 geleitet und dabei auf einen Druck reduziert, welcher für das System ungefährlich ist. Dieser Druck ist aber so groß, dass er die Milch in den höchsten Tank 14 befördern kann. Der Tank 14 ist zu diesem Zeitpunkt belüftet. Ein Feinfilter 90 stellt sicher, dass die lebensmittelrechtlichen Anforderungen eingehalten werden (200 µm). Die Milch wird solange aus dem Ansaugbehälter verdrängt, bis das mit einem Dreieck gekennzeichnete Niveau in der Verteilereinrichtung 22 erreicht ist. Dies wird durch die Füllstandmesseinrichtung 46 nachgewiesen. Da die Leitungseinrichtung 12 bzw. die Verteilereinrichtung 22 in diesem Bereich geringe Querschnitte aufweist, wird der Messfehler minimiert. Die Füllstandmesseinrichtung 46 kann in der Praxis ein Niveauschalter sein, aber auch eine stetig messende Einrichtung, insbesondere eine Peilstabeinrichtung.

Die Verrohrung des Systems ist strömungstechnisch so gestaltet, dass keine Siphons oder Vertiefungen vorhanden sind. Auf diese Weise wird sichergestellt, dass die Milch selbstständig abfließt. Somit ist die verbleibende Haftmilchmenge gering, und bei der nächsten Annahme findet nur eine minimale Kontamination statt.

Im Hinblick auf die Volumenbestimmung der angenommenen Milch ist zu bemerken, dass das Volumen zwischen dem mit einem Dreieck gekennzeichneten Übergabenniveau der Verteilereinrichtung 22 und dem Tank 14 für die Berechnung des Gesamtvolumens addiert werden muss.

Fig. 2 zeigt einen Ausschnitt der in Fig. 1 dargestellten Vorrichtung. Allerdings weist die dargestellte Vorrichtung zusätzliche Komponenten auf, welche bei der Abgabe von Milch aus den Tanks zum Einsatz kommen. Gleiche Bezugszeichen verweisen auf gleiche Komponenten.

Zusätzlich ist an der Sekundärseite der Verteilereinrichtung 22 eine Umpumpleitung 50 über die Scheibenventile 98 angeschlossen. Diese Umpumpleitung führt über ein Umpumpscheibenventil 104 zum Ansaugbehälter 32. Ferner ist die Umpumpleitung 50 mit einem Entrestventil 110 versehen. Zwischen der Kreispumpe 34 und der Primärseite 24 der Verteilereinrichtung 22 ist ein Abgabescheibenventil 106 angeordnet. Zwischen diesem Abgabescheibenventil 106 und der Kreispumpe 34 befindet sich eine als Ventil ausgelegte Abgabeöffnung 48. Im Bereich der Abgabeöffnung 48 ist zusätzlich ein Füllstandmesser 108 vorgesehen.

Bei der Milchabgabe aus einem Tank 14 funktioniert die Vorrichtung wie folgt. Das Ventil 82 ist anfänglich geschlossen, und das System ist leergedrückt. Das Leerdrücken hat beispielsweise nach einer vorangehenden Milchannahme stattgefunden. Nun wird der gewünschte Tank 14 (Tanksegment) ausgewählt, indem das entsprechende Ventil 98 geöffnet wird. Ebenso wird das Umpumpscheibenventil 104 geöffnet. Die Milch wird nun über die Schwerkraft in den Ansaugbehälter 32 gedrückt oder über einen Unterdruck von dem Ejektor 36 bzw. einer beliebigen Vakuumpumpe angesaugt. Das Ventil 106 ist zu diesem Zeitpunkt bereits geschlossen. Das Ventil der Abgabeöffnung 48 wird geöffnet. Daraufhin wird die Kreispumpe 34 aktiviert. Folglich wird die Milch über die Abgabeöffnung 48 abgegeben.

Findet eine Teilabgabe der Milch statt, so wird nur die entstandene Niveaudifferenz in dem entsprechenden Tanksegment über die Füllpegelmesseinrichtung 16 ermittelt und entsprechend volumenmäßig umgerechnet.

Bei einer vollständigen Entleerung des Tanks 14 sind, je nach Vorgeschichte (Teilabgabe) die zusätzlichen Volumina, beispielsweise das Volumen der Umpumpleitung 50, zu verrechnen. Das letzte Teilvolumen vom gezeigten Füllstand in der Verteilereinrichtung 22 bis zum Rückschlagventil 102 wird durch einen kurzen Druckstoß befördert, wobei das Scheibenventil 96 und das Abgabescheibenventil 106 geöffnet sind, während das Ventil der Abgabeöffnung 48 geschlossen ist. Folglich wird das letzte Teilvolumen in den Bereich gedrückt, welcher zu dem Tank 14 führt, sowie in das Volumen der Umpumpleitung 50. Der jeweilige Sensor 46 weist diesen Zustand nach. Anschließend wird das Teilvolumen durch Unterdruck in den Ansaugbehälter 32 befördert. Zum Abschluss der Abgabe wird das System leergedrückt - das Abgabescheibenventil 106 ist geschlossen, das Ventil der Abgabeöffnung 48 ist geöffnet. Dieses Leerdrücken erfolgt, bis der Sensor 108 anspricht. Insgesamt wurde auf diese Weise eine volumenmäßig erfasste Abgabe ohne wesentliche Kontamination durchgeführt.

Ebenso ist es möglich, eine Schwerkraftabladung durchzuführen. Dabei führt das jeweilige Ventil 98 direkt in den zu befüllenden Behälter.

Auch Kombinationen des Umpumpverfahrens und der Schwerkraftabladung sind selbstverständlich denkbar.

Fig. 3 zeigt eine andere Ausführungsform einer erfindungsgemäßen Vorrichtung. Vergleichbare Komponenten sind mit den

gleichen Bezugszeichen gekennzeichnet. Die Besonderheit an dieser Ausführungsform besteht darin, dass als Ansaugeinrichtung 30 eine Impellerpumpe 52 vorgesehen ist. Die Impellerpumpe 52 ist über ein Ventil 114 mit der Primärseite 24 der Verteilereinrichtung 22 verbunden. Von dem Ventil 114 stromabwärts in Richtung Verteilereinrichtung 22 gesehen, kann zusätzlich ein Druckluftanschluss 42 vorgesehen sein. Da dieser optional ist, ist er vorliegend mit unterbrochenen Linien dargestellt.

Da die Impellerpumpe 52 selbstansaugend ist, vereinfacht sich das System erheblich. Beispielsweise ist keine zusätzliche Vakuumpumpe, zum Beispiel als Ejektor ausgelegt, vorgesehen. Jedoch wird die Milch durch die Impellerpumpe 52 nicht so schonend aufgenommen, wie dies zum Beispiel durch die Kombination Vakuumpumpe/Kreiselpumpe der in Fig. 1 dargestellten Ausführungsform geschieht; ferner bringt eine Impellerpumpe 52 nicht dieselbe Leistung wie die Kombination Vakuumpumpe/Kreiselpumpe gemäß Fig. 1. Als Vorteil der Impellerpumpe 52 ist jedoch noch zu nennen, dass sie eine preiswertere Lösung darstellt.

Die Impellerpumpe 52 saugt die Milch an und drückt sie bei geöffnetem Ventil 114 in den ausgewählten Tank 14. Wenn der Vakuumschalter 70 anspricht, wird die Impellerpumpe 52 für eine bestimmte Zeit weiterbetrieben, damit die Restmilch aus dem Ansaugsystem entfernt wird. Daraufhin wird die Impellerpumpe 52 abgeschaltet, und das Ventil 114 wird geschlossen. Das Ventil 92 wird geöffnet, während das Ventil 112 geschlossen bleibt. Hierdurch wird die im Rohrsystem verbliebene Milch bis auf das mit einem Dreieck gekennzeichnete Niveau in der Verteilereinrichtung 22 gedrückt. Nachfolgend wird das Ventil 92 geschlossen, und das Rohrsystem wird über das Ventil 112 entlüftet. Die Leitung,

welche den Druckluftanschluss 42 mit der Leitungseinrichtung 12 verbindet, kann durch ein (nicht dargestelltes) Ventil vor dem Eindringen von Milch geschützt werden; hierdurch vereinfacht sich die Reinigung der Anlage.

Sowohl bei der Ausführungsform gemäß Fig. 3 als auch bei der Ausführungsform gemäß Fig. 1 kann es unter Umständen nützlich sein, jede Leitung mit einer eigenen Pumpe zu versehen. Dies bietet sich insbesondere bei Impellerpumpen 52 an, da diese nur schwer vollständig zu entleeren sind. Reste in der Impellerpumpe 52 würden jedoch zu einer Kontamination führen.

In Fig. 4 ist ein Teil der in Fig. 3 gezeigten Vorrichtung dargestellt, welche mit derjenigen in Fig. 3 vergleichbar ist. Gleiche Komponenten sind mit gleichen Bezugszeichen gekennzeichnet.

Zusätzliche Komponenten dienen dazu, mit dem System eine Abgabe durchzuführen, wobei diese Komponenten im wesentlichen denjenigen aus Fig. 2 entsprechen. Auch hier sind gleiche Bezugszeichen für ähnliche Komponenten verwendet. Die Vorgänge zur Abgabe der Milch über die Abgabeöffnung 48 sind mit denjenigen in Fig. 2 vergleichbar, so dass eine erneute Beschreibung nicht erforderlich ist.

In Fig. 5 ist eine Vorrichtung dargestellt, welche im Rahmen der Erfindung vorteilhaft einsetzbar ist. Wiederum ist ein Tank 14 gezeigt, welcher mit einem Medium 10, beispielsweise Milch gefüllt ist. Das Medium 10 hat eine Grenzfläche 18, welche durch die Füllpegelmesseinrichtung 16 mit ihrem Peilstab 20 gemessen wird. An dem Tank 14 ist eine Leitungseinrichtung 12 angeschlossen. An dieser sind

ein Ansaugschlauch 118, eine Kupplung 120, ein Ventil 122 und ein Sensor 124 angeordnet.

Die Vorrichtung gemäß Fig. 5 wird mit einem in dem Tank 14 erzeugten Unterdruck betrieben. Bei dieser Vorrichtung wirken sich die Vorteile der Füllpegelmesseinrichtung 16 mit Peilstab 20 besonders deutlich aus. Bei Tanks 14, welche mit Unterdruck arbeiten, wird der ganze Tank bis zu einem gewissen Unterdruck evakuiert. Der minimale Druck ist dabei durch die Formstabilität des Tanks bestimmt. Durch diesen Unterdruck wird dann das Flüssigprodukt bei Öffnen des entsprechenden Ventils 122 in den Tank 14 hineingesaugt. Dabei entstehen besonders geringe Kontaminationen. Bei der in Fig. 5 dargestellten Ausführungsform findet die Befüllung und die Abgabe an derselben Seite des Tanks 14 statt. Das System ist beispielhaft ohne Probenahme dargestellt, was im Ausland nach wie vor häufig gefragt ist. Über den flexiblen Ansaugschlauch 118, der über eine Kupplung 120 mit dem Befüll-Abgabe-Stutzen verbunden ist, gelangt das Produkt nach dem Öffnen des Ventils 122 in den Tank 14. Die Füllpegelmesseinrichtung 16 mit ihrem Peilstab 20 kann neben der Volumenbestimmung auch als Überfüllsicherung dienen. Um bei einer volumenmäßig erfassten Abgabe sicherzustellen, dass auch die ganze Leitungseinrichtung 12 entleert ist, ist ein Sensor 124 vorgesehen.

Fig. 6 zeigt eine weitere Vorrichtung, welche im Rahmen der vorliegenden Erfindung vorteilhaft einsetzbar ist. Auch hier handelt es sich um ein Unterdrucksystem. Im Unterschied zu Fig. 5 findet hier jedoch die Befüllung des Tanks 14 von oben statt, während die Abgabe an der Unterseite des Tanks 14 erfolgt. Die Leitungseinrichtung 12 auf der Befüllseite weist ein Ventil 128 auf, ebenso wie die Lei-

tungseinrichtung 12 auf der Abgabeseite ein Ventil 122 aufweist.

Fig. 7 ist eine erweiterte Variante der Ausführungsform gemäß Fig. 6. Zusätzlich ist hier ein Ansaugbehälter 54 vorgesehen. Diese Anordnung hat den Vorteil, dass zunächst der relativ kleine Ansaugbehälter 54 evakuiert wird, während der Tank 14 seinen bereits erzeugten Unterdruck aufrechterhält. Erst wenn der Ansaugbehälter 54 gefüllt ist, was durch den Sensor 130 detektiert wird, wird das Ventil 128 geschlossen, und das Ventil 122 wird geöffnet. Durch den Unterdruck im Tank 14 wird das Produkt durch das Rückschlagventil 132 in den Tank 14 befördert. Dabei ist es besonders vorteilhaft, wenn der Unterdruck im Ansaugbehälter 54 nicht mit dem Unterdruck im Tank 14 verbunden ist. Dadurch wird verhindert, dass ein Lufteinfall zum Beginn oder am Ende der Annahme zu einem vorzeitigen Druckanstieg im Tank 14 führt; denn sollte dies eintreten, so müsste das große Volumen des Tanks 14 erneut evakuiert werden. Der Ansaugbehälter 54 ist so dimensioniert, dass er das Volumen des Ansaugsystems aufnehmen kann.

In Fig. 8 ist eine Verteilereinrichtung 22 dargestellt, welche im Rahmen der vorliegenden Erfindung vorteilhaft eingesetzt werden kann. An den Verbindungen zwischen den Schläuchen 134 und den jeweiligen Leitungen 136, 138 sind Leseeinrichtungen 58 und codierte Einrichtungen 60 (TAGs) angeordnet. Die Leseeinrichtungen 58 sind in der Lage, den Code der TAGs 60 zu lesen und das Ergebnis einer Steuerung 62 einzugeben. Die Übertragung von den Leseeinrichtungen 58 kann über eine feste Verkabelung oder über eine Fernübertragungseinrichtung 140 erfolgen. Letztere kann beispielsweise Funk- oder Infrarotsignale aussenden. Ferner kann in dem System eine Überfüllsicherung 142 angeordnet sein. Das

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System kann nun so ausgelegt sein, dass die Ventile 146 zu den Tanks 14 nur dann von der Steuerung zum Öffnen freigegeben werden, wenn von den Leseeinrichtungen 58 die richtigen von den TAGs 60 gelesenen Codes bzw. die entsprechenden Lesesignale übertragen werden. Dies erhöht die Sicherheit bei der Milchannahme, da so ein unbeabsichtigtes Vermischen durch ein falsches Anschließen verhindert wird. Um zusätzlich beispielsweise Manipulationen entgegenzutreten, können die Verbindungen zwischen den Leitungen und den Schläuchen durch eine Plombe 144 versiegelt sein.

Sofern eine mechanische Plombe vorgesehen ist und angebracht ist, könnten die TAGs und TAG-Reader landseitig entfallen.

Die in der vorstehenden Beschreibung, in der Zeichnung sowie in den Ansprüchen offenbarten Merkmale der Erfindung können sowohl einzeln als auch in beliebiger Kombination für die Verwirklichung der Erfindung wesentlich sein.

Ansprüche

1. Vorrichtung zur Förderung eines Mediums, mit einer Leitungseinrichtung (12), über die mehrere Tanks (14) befüllbar und/oder entleerbar sind, und mit einer Füllpegelmesseinrichtung (16) im Inneren jedes Tanks (14) zur Bestimmung der Position mindestens einer Grenzfläche (18) des Mediums (10) in dem Tank (14),
dadurch gekennzeichnet,
 - dass die Leitungseinrichtung (12) eine Verteilereinrichtung (22) mit einer Primärseite (24) und einer Sekundärseite (26) aufweist,
 - dass die Sekundärseite (26) einzelne, mit den Tanks (14) in Verbindung stehende, absperrbare Verteilerwege (28) aufweist und
 - dass jedem Verteilerweg (28) eine Füllstandsmesseinrichtung (46) zum Messen des Füllstandes in der Verteilereinrichtung (22) zugeordnet ist.
2. Vorrichtung nach Anspruch 1,
dadurch gekennzeichnet,
dass die Primärseite (24) der Verteilereinrichtung (22) mit einer Ansaugereinrichtung (30) in Verbindung steht.
3. Vorrichtung nach Anspruch 2,
dadurch gekennzeichnet,

dass die Ansaugeinrichtung (30) einen ersten Ansaugbehälter (32), eine Kreislumppe (34) und einen Ejektor (36) aufweist.

4. Vorrichtung nach Anspruch 3,
dadurch gekennzeichnet,
dass im Ansaugbereich der Kreislumppe (34) ein Strudelbrecher (38) angeordnet ist.
5. Vorrichtung nach einem der Ansprüche 2 bis 4,
dadurch gekennzeichnet,
dass die Ansaugeinrichtung (30) mit einer Zuleitung (40) verbindbar ist.
6. Vorrichtung nach einem der Ansprüche 2 bis 5,
dadurch gekennzeichnet,
dass die Ansaugeinrichtung (30) mit einem Druckluftanschluss (42) verbindbar ist.
7. Vorrichtung nach einem der Ansprüche 2 bis 6,
dadurch gekennzeichnet,
dass die Ansaugeinrichtung (30) eine Füllstandmessenrichtung (44) aufweist.
8. Vorrichtung nach einem der Ansprüche 2 bis 7,
dadurch gekennzeichnet,
 - dass zwischen der Ansaugeinrichtung (30) und der Primärseite (24) der Verteilereinrichtung (22) eine Abgabeöffnung (48) vorgesehen ist und
 - dass die mit den Tanks (14) in Verbindung stehenden Verteilerwege (28) auf der Sekundärseite (26) der Verteilereinrichtung (22) über eine Umpumpleitung (50) mit der Ansaugvorrichtung (30) in Verbindung stehen.

9. Vorrichtung nach einem der Ansprüche 2 bis 8,
dadurch gekennzeichnet,
dass die Ansaugeinrichtung (30) eine Impellerpumpe (52) umfasst.
10. Vorrichtung nach Anspruch 1,
dadurch gekennzeichnet,
dass für jeden Tank (14) eine Ansaugeinrichtung (30),
insbesondere eine Impellerpumpe (52) vorgesehen ist.
11. Vorrichtung nach Anspruch 1,
dadurch gekennzeichnet,
dass in zumindest einem der Tanks (14) ein erster Unterdruck erzeugbar ist.
12. Vorrichtung nach Anspruch 11,
dadurch gekennzeichnet,
dass mit dem Tank (14) ein zweiter Ansaugbehälter (54) verbindbar ist, indem ein zweiter Unterdruck erzeugbar ist, wobei der erste Unterdruck unabhängig von dem zweiten Unterdruck erzeugbar ist.
13. Vorrichtung nach Anspruch 12,
dadurch gekennzeichnet,
dass das Volumen des zweiten Ansaugbehälters (54) mindestens so groß ist wie das Volumen des restlichen Ansaugsystems.
14. Vorrichtung nach einem der vorangehenden Ansprüche,
dadurch gekennzeichnet,
- dass als Füllpegelmesseinrichtung (16) ein nach dem magnetostriktiven Prinzip arbeitender, mit einer Rechenvorrichtung gekoppelter, transsonarer Wegaufneh-

mer mit mindestens einem Peilstab (20) und mindestens einem Schwimmer (56) vorgesehen ist und
- dass der Schwimmer (56) mit mindestens einem Magneten versehen ist.

15. Vorrichtung nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, dass eine Steuereinrichtung vorgesehen ist, welche die Förderung des Mediums (10) in Abhängigkeit der Messsignale der Füllpegelmesseinrichtungen (16) der Tanks (14) und/oder der Füllstandmesseinrichtungen (46) der Verteilereinrichtung (22) und/oder der Füllstandmeseinrichtung (44) der Ansaugereinrichtung (30) steuert.
16. Vorrichtung nach Anspruch 15, dadurch gekennzeichnet, dass mindestens ein Drucksensor und/oder mindestens ein Temperaturfühler (72) und/oder mindestens eine Volumenstrommeseinrichtung (48) vorgesehen sind, deren Ausgangssignale der Steuereinrichtung als Eingangssignale zuführbar sind.
17. Vorrichtung nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, dass die Verbindungen der Leitungseinrichtung (12) mit anderen Systemkomponenten mit Leseinrichtungen (58) und codierten Einrichtungen (60) (TAGs) ausgestattet sind, so dass über eine Steuerung die korrekte Zuordnung der Komponenten überprüfbar ist.
18. Verfahren zur Förderung eines Mediums (10), bei dem das Medium über eine Leitungseinrichtung (12) in Tanks (14) gefördert wird und bei dem die Füllpegel in den Tanks

- (14) von Füllpegelmesseinrichtungen (16) gemessen werden,
dadurch gekennzeichnet,
- dass das Medium (10) zur Befüllung einer der Tanks (4) in eine Verteilereinrichtung (22) der Leitungseinrichtung (12) gefördert wird, wobei die Verteilereinrichtung (22) für jeden Tank (14) einen mit diesem in Verbindung stehenden Verteilerweg (28) aufweist,
- dass ein Tank (14) ausgewählt wird, welcher mit dem Medium (10) zu befüllen ist,
- dass der Verteilerweg (28) des zu befüllenden Tanks (14) geöffnet wird,
- dass zumindest während der Befüllung des Tanks (14) der Füllstand in der Verteilereinrichtung (22) erfasst wird und
- dass in Abhängigkeit von dem in der Verteilereinrichtung (22) erfassten Füllstand der geöffnete Verteilerweg (28) zur Beendigung der Befüllung geschlossen wird.
19. Verfahren nach Anspruch 18,
dadurch gekennzeichnet,
- dass in einer Ansaugereinrichtung (30) ein Unterdruck zur Befüllung der Leitungseinrichtung (12) erzeugt wird,
- dass in der Ansaugereinrichtung (30) ein Füllstand ermittelt wird und
- dass in Abhängigkeit des ermittelten Füllstandes die Förderung des Mediums (10) durch die Leitungseinrichtung (12) in den ausgewählten Tank (14) beginnt und die Erzeugung des Unterdrucks beendet wird.
20. Verfahren nach Anspruch 18 oder 19,
dadurch gekennzeichnet,

dass nach der Befüllung des ausgewählten Tanks (14) mindestens ein weiterer Tank (14) befüllt wird.

21. Verfahren nach einem der Ansprüche 18 bis 20,
dadurch gekennzeichnet,
dass nach der Erzeugung des Unterdruckes in der Ansaug-
einrichtung (30) eine Kreislumpumpe (34) zur Förderung
des Mediums (10) betrieben wird.
22. Verfahren nach Anspruch 21,
dadurch gekennzeichnet,
dass eine zur Erzeugung des Unterdrucks dienende Vaku-
umpumpe (36) unterstützend zu der Kreislumpumpe (34) be-
trieben wird, wenn der in der Ansaugereinrichtung (30)
ermittelte Füllstand unter ein vorgegebenes Niveau
fällt.
23. Verfahren nach Anspruch 21 oder 22,
dadurch gekennzeichnet,
dass die Inbetriebnahme der Kreislumpumpe (34) und/oder
die unterstützende Inbetriebnahme der Vakuumpumpe (36)
auch in Abhängigkeit des ermittelten Füllstandes in der
Verteilereinrichtung (22) gesteuert werden bzw. wird.
24. Verfahren nach einem der Ansprüche 18 bis 23,
dadurch gekennzeichnet,
dass vor der Befüllung eines weiteren Tanks (14) Reste
des Mediums (10) von der Vakuumpumpe abgesaugt werden.
25. Verfahren nach einem der Ansprüche 18 bis 23,
dadurch gekennzeichnet,
dass vor der Befüllung eines weiteren Tanks (14) Druck-
luft in das System eingespeist wird, bis in der Vertei-

lereinrichtung (22) ein vorbestimmter Füllstand erreicht ist.

26. Verfahren nach einem der Ansprüche 18 bis 25, dadurch gekennzeichnet, dass das Medium (10) aus einem Tank (14) abgegeben wird, indem
- ein Tank (14) ausgewählt wird,
 - mindestens ein Teil des Mediums (10) über eine Um-
pumpleitung (50) in einen Ansaugbehälter (32) gedrückt wird und
 - das Medium (10) aus dem Ansaugbehälter (32) durch eine zwischen dem Ansaugbehälter (32) und der Verteilereinrichtung (22) angeordnete Abgabeöffnung (48) abgegeben wird.
27. Verfahren nach einem der Ansprüche 18 bis 26, dadurch gekennzeichnet, dass in einem Tank (14) ein erster Unterdruck erzeugt wird, so dass der Tank (14) mit dem geförderten Medium (10) befüllt wird.
28. Verfahren nach Anspruch 27, dadurch gekennzeichnet, dass in einem zweiten Ansaugbehälter (54), welcher mit dem Tank (14) in Verbindung steht, ein zweiter Unterdruck unabhängig von dem ersten Unterdruck erzeugt wird, wobei zunächst der zweite Ansaugbehälter (54) und danach der Tank (14) mit dem geförderten Medium (10) befüllt wird.

Fig. 1

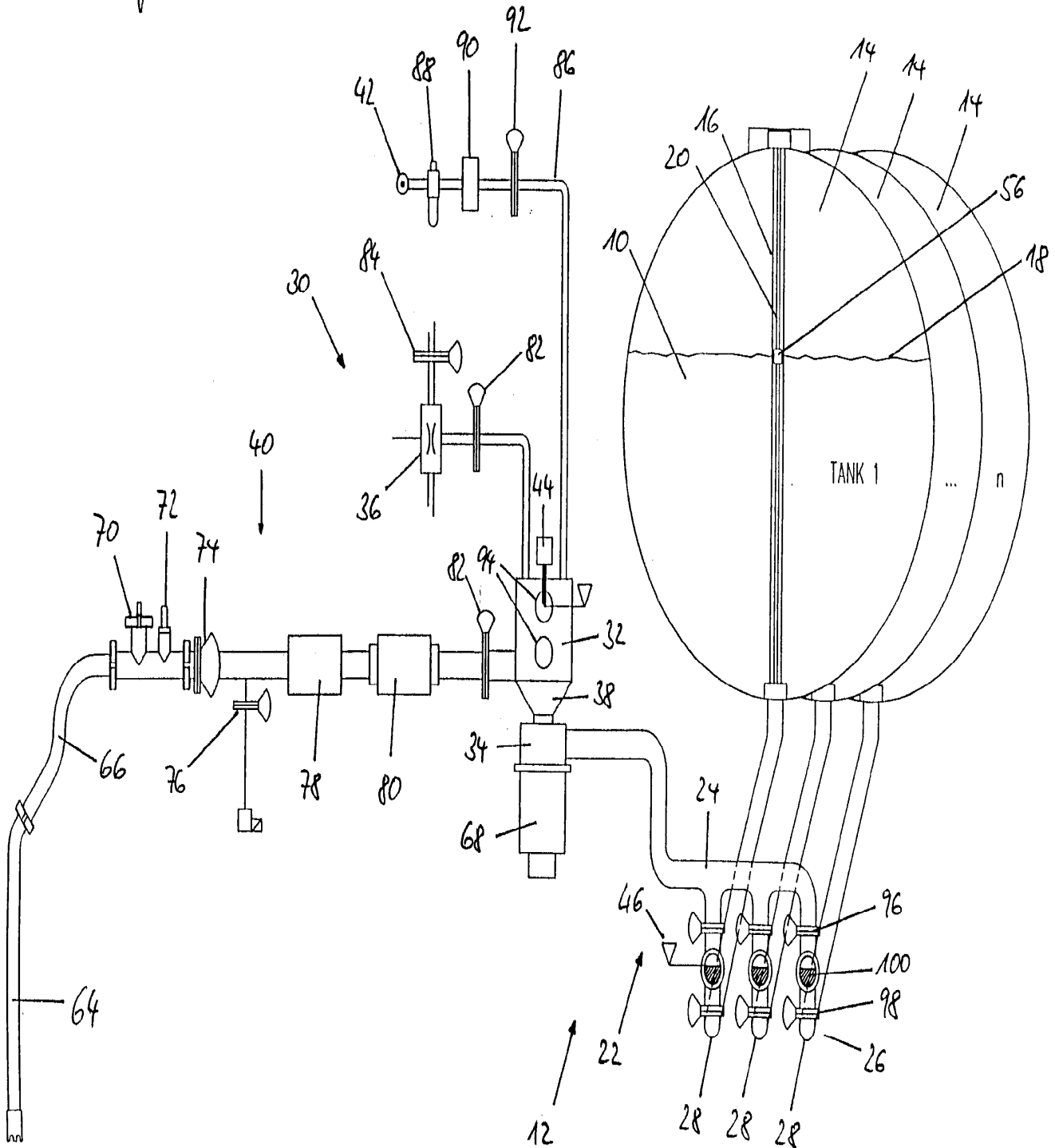


Fig. 2

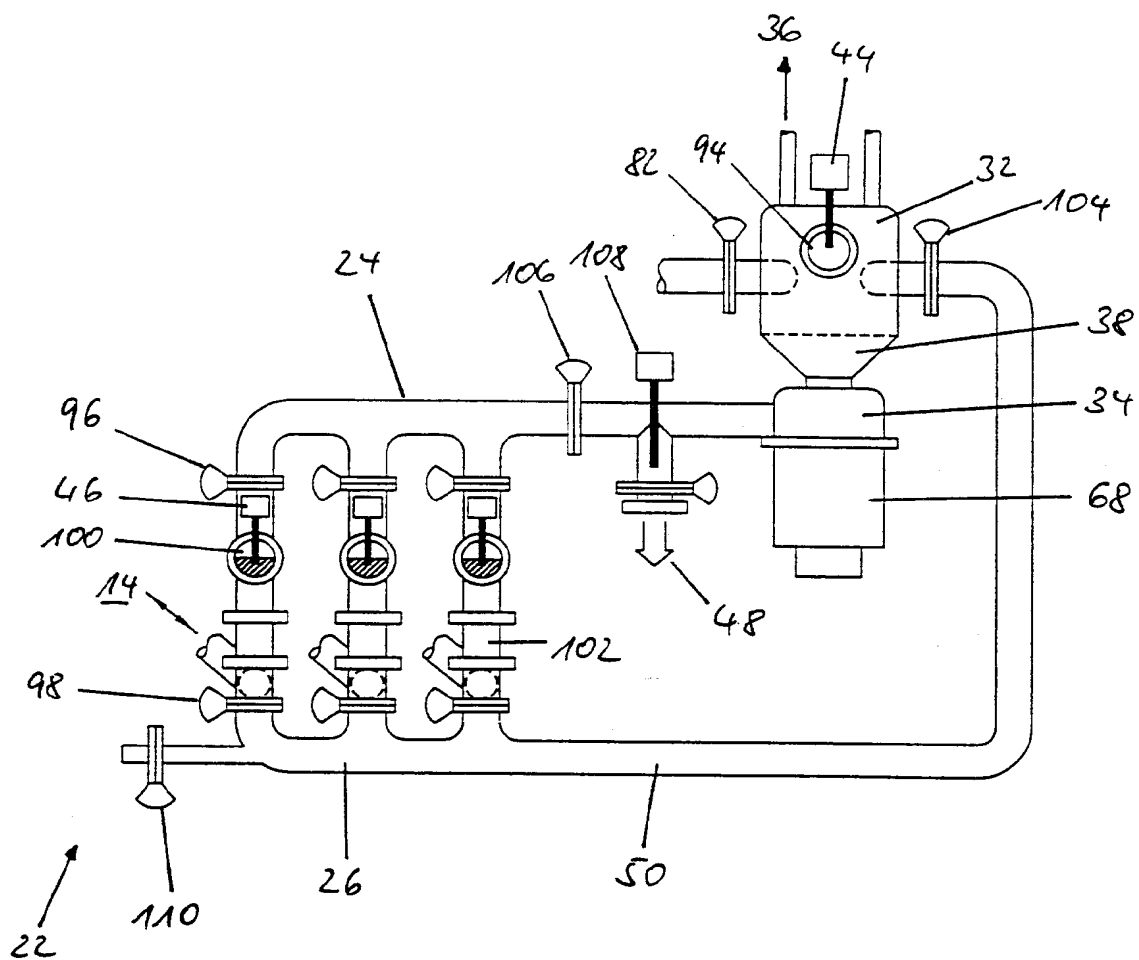


Fig. 3.

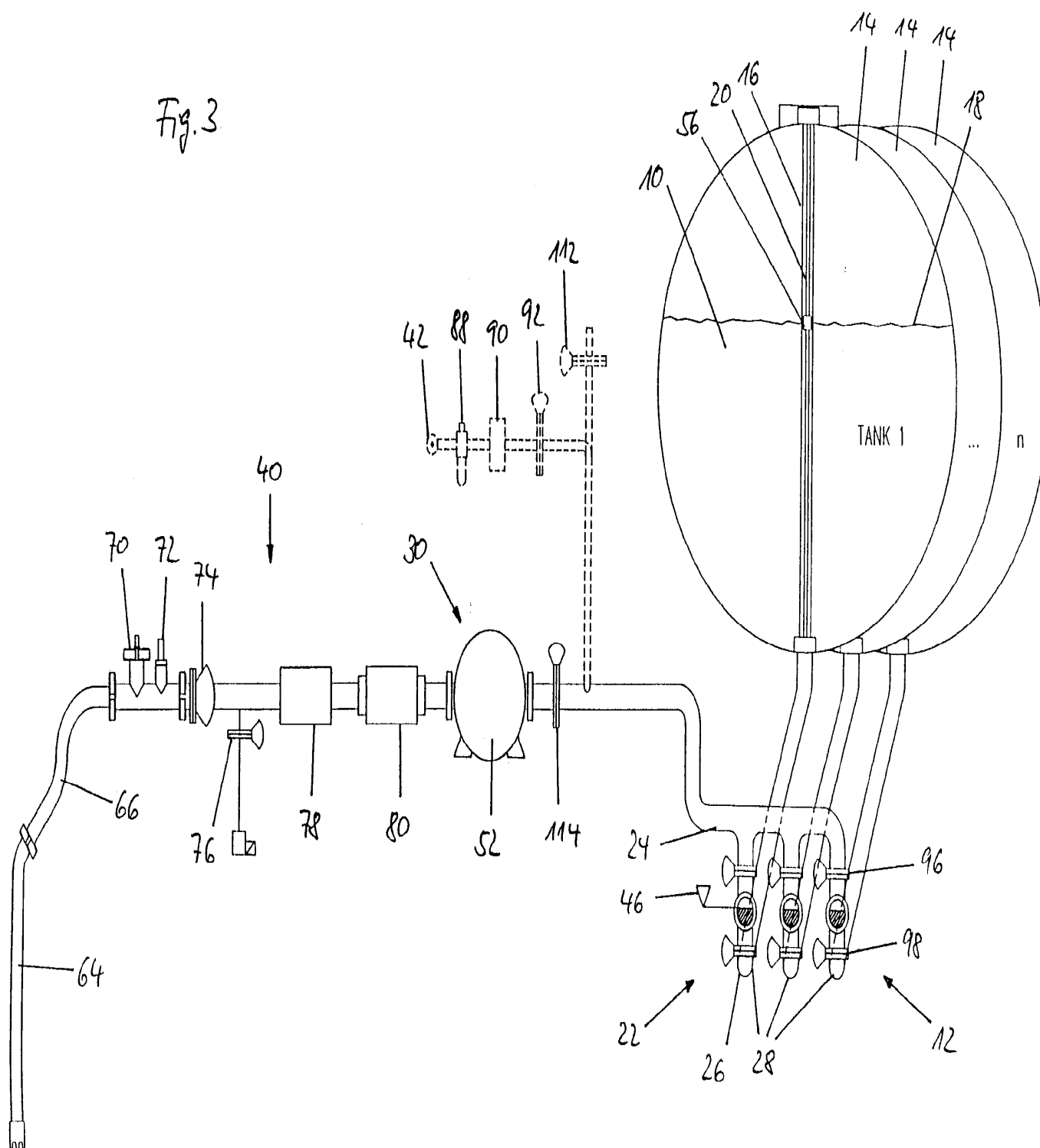


Fig. 4

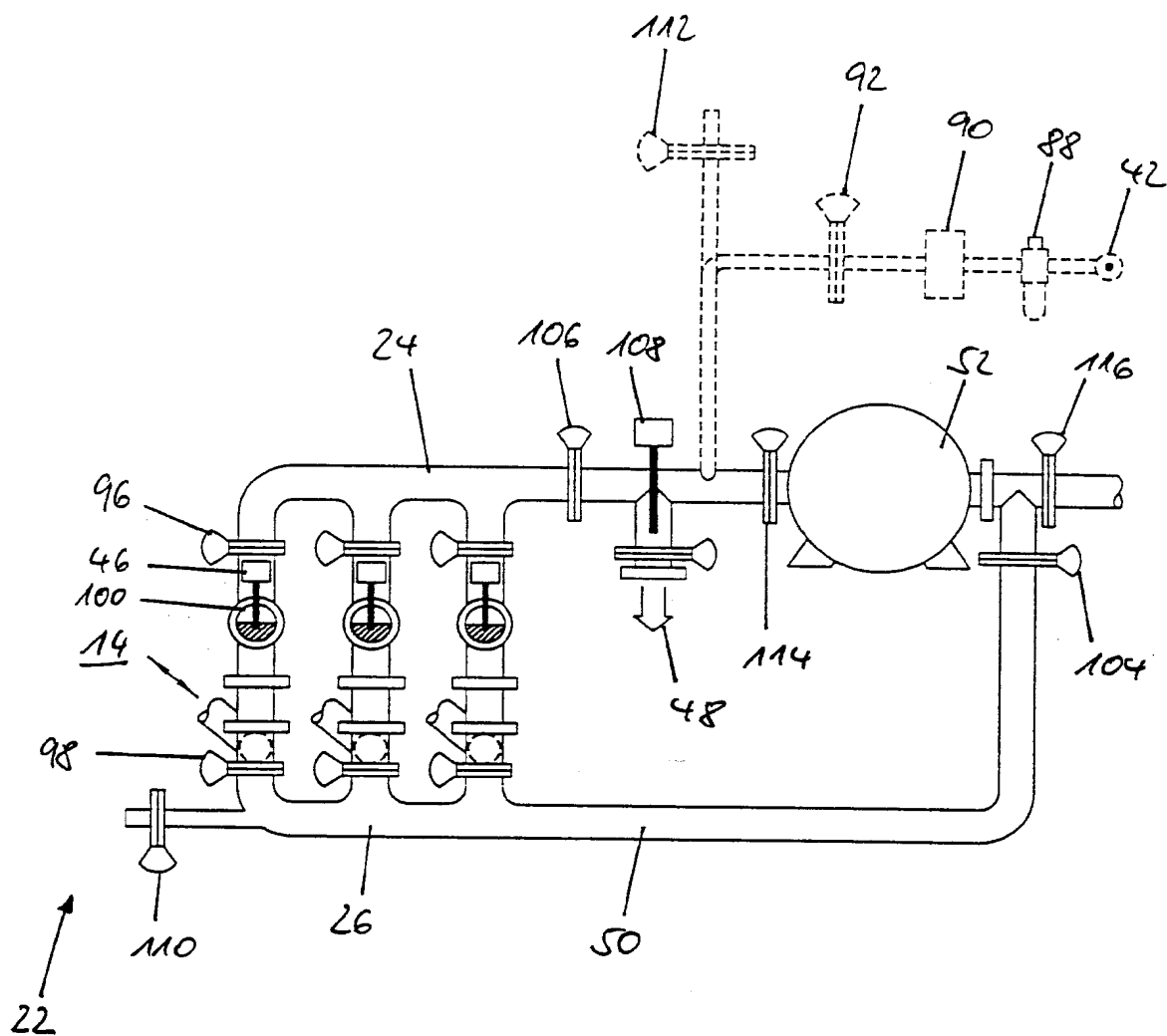


Fig. 5

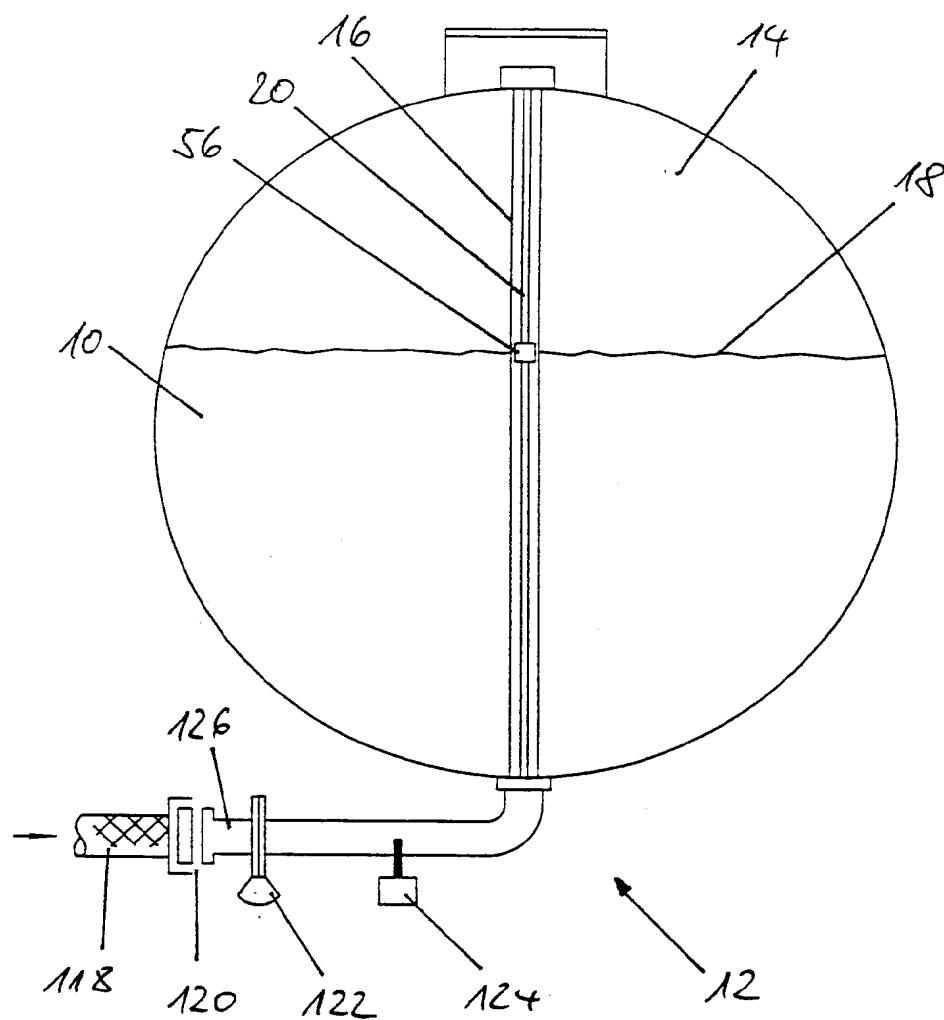


Fig. 6

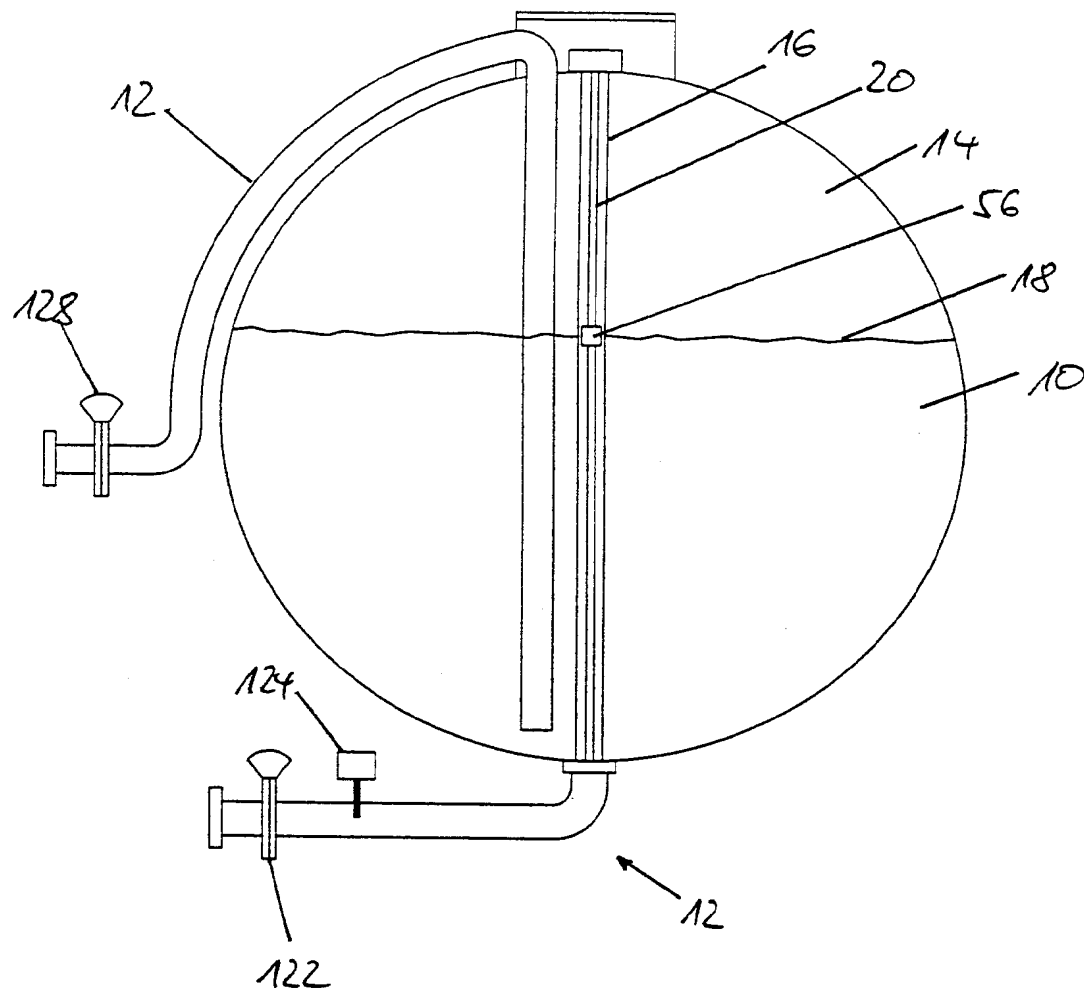


Fig. 7

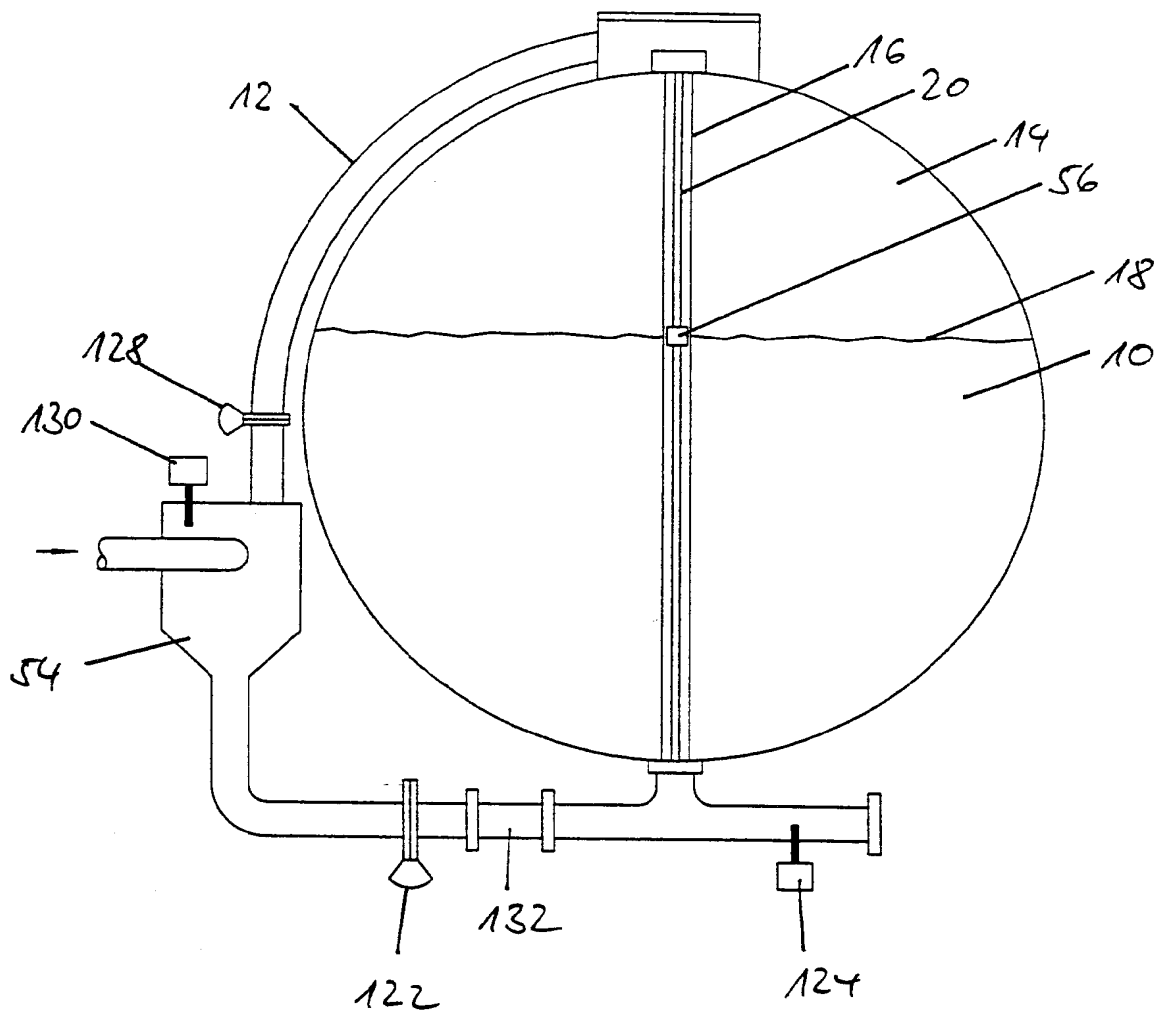
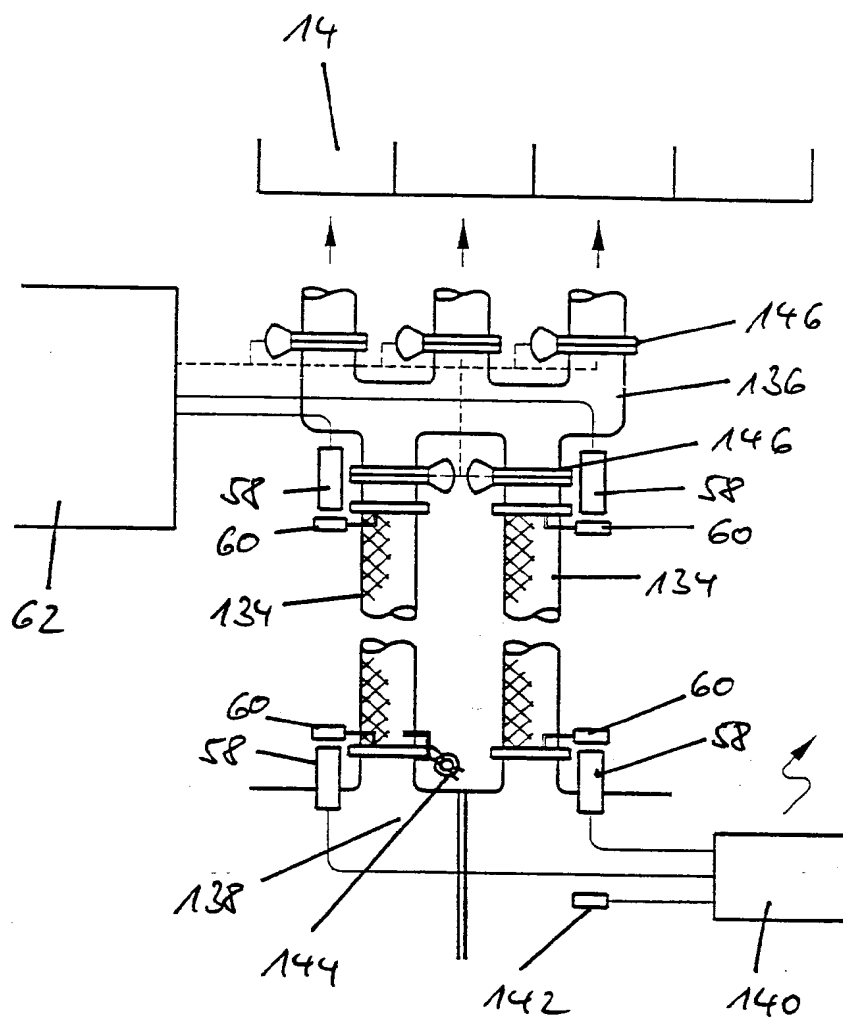


Fig. 8



INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/03915

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B67D5/02 B67D5/33 B67D5/58

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)

IPC 7 B67D

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 practical, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 799 833 A (GREEN THOMAS S ET AL) 1 September 1998 (1998-09-01)	1
A	column 3, line 15 - line 16 column 3, line 35 figure 1	18
Y	DE 198 39 112 A (BARTEC COMPONENTEN & SYST GMBH) 9 March 2000 (2000-03-09) cited in the application	1
A	column 6, line 43 - line 46 EP 0 258 811 A (HACKMAN AB OY) 9 March 1988 (1988-03-09) column 2, line 18 - line 21 column 2, line 44 - line 53 column 4, line 1 - line 6 figure 1	1, 18
-/--		

☒ Further documents are listed in the continuation of box C.

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/03915

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

International Application No

PCT/EP 01/03915

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INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen

PCT/EP 01/03915

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES

IPK 7 B67D5/02 B67D5/33 B67D5/58

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Recherchierte Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)

IPK 7 B67D

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Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

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C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie ^o	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
Y	US 5 799 833 A (GREEN THOMAS S ET AL) 1. September 1998 (1998-09-01)	1
A	Spalte 3, Zeile 15 - Zeile 16 Spalte 3, Zeile 35 Abbildung 1	18
Y	DE 198 39 112 A (BARTEC COMPONENTEN & SYST GMBH) 9. März 2000 (2000-03-09) in der Anmeldung erwähnt Spalte 6, Zeile 43 - Zeile 46	1
A	EP 0 258 811 A (HACKMAN AB OY) 9. März 1988 (1988-03-09) Spalte 2, Zeile 18 - Zeile 21 Spalte 2, Zeile 44 - Zeile 53 Spalte 4, Zeile 1 - Zeile 6 Abbildung 1	1,18
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Z Veröffentlichung, die Mitglied derselben Patentfamilie ist

Datum des Abschlusses der internationalen Recherche

10. Juli 2001

Absendedatum des internationalen Recherchenberichts

17/07/2001

Name und Postanschrift der Internationalen Recherchenbehörde
Europäisches Patentamt, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
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Bevollmächtigter Bediensteter

Martínez Navarro, A.

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen

PCT/EP 01/03915

C.(Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Beitr. Anspruch Nr.
A	US 4 601 409 A (DIREGOLO JOSEPH A) 22. Juli 1986 (1986-07-22) ---	
A	WO 99 65094 A (FITTER JOHAN CHRISTIAAN) 16. Dezember 1999 (1999-12-16) -----	

INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Internationales Aktenzeichen

PCT/EP 01/03915

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
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DE 19839112 A	09-03-2000	WO 0012972 A EP 1105701 A	09-03-2000 13-06-2001
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WO 9965094 A	16-12-1999	AU 4053999 A EP 1090434 A	30-12-1999 11-04-2001

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES
PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro



(43) Internationales Veröffentlichungsdatum
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PCT

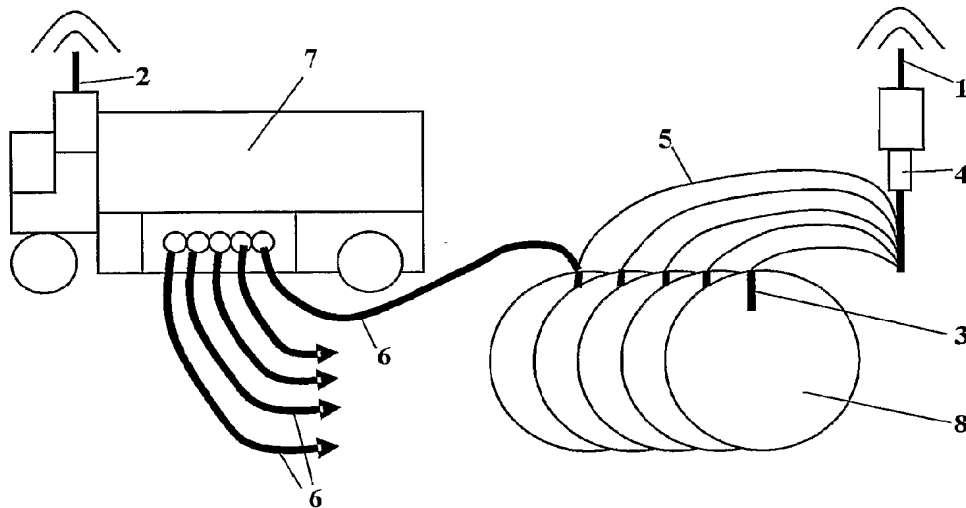
(10) Internationale Veröffentlichungsnummer
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- (51) Internationale Patentklassifikation⁷: **B60P 3/22**, B60S 5/02
- (21) Internationales Aktenzeichen: PCT/EP2005/053128
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1. Juli 2005 (01.07.2005)
- (25) Einreichungssprache: Deutsch
- (26) Veröffentlichungssprache: Deutsch
- (30) Angaben zur Priorität:
A1207/2004 15. Juli 2004 (15.07.2004) AT
- (71) Anmelder (für alle Bestimmungsstaaten mit Ausnahme von US): **SECURITY & ELECTRONIC TECHNOLOGIES GMBH** [AT/AT]; Aumühlweg 3, A-2544 Leobersdorf (AT).
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- (74) Anwälte: **MÜLLNER, Erwin** usw.; Postfach 159, Weihburggasse 9, A-1014 Wien (AT).
- (81) Bestimmungsstaaten (soweit nicht anders angegeben, für jede verfügbare nationale Schutzrechtsart): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Bestimmungsstaaten (soweit nicht anders angegeben, für jede verfügbare regionale Schutzrechtsart): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), eurasisches (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC,

[Fortsetzung auf der nächsten Seite]

(54) Title: SAFETY DEVICE TO PREVENT OVERFILLING

(54) Bezeichnung: MEHRFACHÜBERFÜLLSICHERUNG



(57) Abstract: The invention relates to a device for preventing overfilling of a plurality of fuel tanks (8) at a gasoline station, in the event that fuel tanks are filled simultaneously by multi-chamber tank vehicles (7). The fuel tanks (8) are equipped with filling level threshold indicators (3) linked to a transmitter (1) for wireless transmission of a signal. A receiver (2) mounted in the tank vehicle (7) is provided to control one or several tank valves. In order to ensure safe closure of the tank valves, the filling level threshold indicators (3) of the fuel tanks (8) at the gasoline station are connected each to a signal line (5) leading to a common interface (4). Only one transmitter (1) along with an interrogation control device is provided for connecting to said interface (4) and cooperates with the receiver (2) mounted in the tank vehicle (7). The receiver is connected to a control for receiving address-coded signals from the transmitter (1), said control being connected to an actuating device for selectively disconnecting the tank valves of the tank vehicle (7).

[Fortsetzung auf der nächsten Seite]



NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Veröffentlicht:

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Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

(57) Zusammenfassung: Anordnung zur Überfüllsicherung einer Mehrzahl von Treibstofftanks (8) einer Tankstelle, die gleichzeitig durch Mehrkammer-Tankfahrzeuge (7) befüllt werden, wobei die Treibstofftanks (8) Füllstand-Grenzwertgeber (3) aufweisen, die mit einem Sender (1) zur drahtlosen Übertragung eines Signals verbunden sind, und wobei ein Empfänger (2) am Tankfahrzeug (7) zur Steuerung eines oder mehrerer Tankventile vorgesehen ist. Um eine sichere Abschaltung zu gewährleisten, ist vorgesehen, dass sämtliche Füllstands-Grenzwertgeber (3) der Treibstofftanks (8) an der Tankstelle mit jeweils einer Signalleitung (5) verbunden sind, die zu einer gemeinsamen Schnittstelle (4) führen, und lediglich ein Sender (1) zusammen mit einer Abfrageschaltung zum Anschluss an die Schnittstelle (4) vorgesehen ist, welcher Sender (1) mit einem am Tankfahrzeug (7) angeordneten Empfänger (2) zusammenwirkt, der mit einer Schaltung zum Empfang adresscodierter Signale des Senders (1) verbunden ist, die an eine Steuerung zur selektiven Abschaltung der Tankventile am Tankfahrzeug (7) angeschlossen ist.

Beschreibung

MEHRFACHÜBERFÜLLSICHERUNG

Technisches Umfeld

- [001] Die Erfindung bezieht sich auf eine Anordnung zur Überfüllsicherung einer Mehrzahl von Treibstofftanks gemäß dem Oberbegriff des Anspruchs 1.
- [002] Durch die DE 20016410 U --, wurde ein Tankfahrzeug bekannt, das mehrere Kammern aufweist, die mit je einem Ventil versehen sind, das zum Befüllen und Entleeren der entsprechenden Kammer dient. In diesen Kammern ist je ein Füllstandssensor angeordnet, wobei die Füllstandssensoren mit einem Rechner verbunden sind, der die Füll- und Abgabemengen der einzelnen Kammern berechnet. Dabei ist dieser Rechner über eine drahtlose Übertragungsstrecke mit einer Bedieneinheit verbunden, die Anzeige- und Eingabeelemente zur Überwachung und Steuerung zum Befüllen oder Entleeren der Tanks einer Tankstelle aufweist und mit der die erforderlichen Operationen, wie das Ansteuern von Ventilen überwacht werden können.
- [003] Bei dieser Lösung ergibt sich jedoch der Nachteil, dass eine Überwachung des Füllstandes nur indirekt erfolgen kann. Dabei hängt aber die Möglichkeit der Vermeidung einer Überfüllung von dem Zusammenspiel der Füllstandsanzeiger mit dem Rechner ab, in dessen Speicher den jeweiligen Kammern bzw. Tanks entsprechende Algorithmen eingegeben sein müssen. Da die Kammern bzw. Tanks eines Tankfahrzeuges meist keine einfachen und leicht berechenbaren Formen aufweisen, ergeben sich dabei meist entsprechende Ungenauigkeiten.
- [004] Beim Befüllen von Tanks von Tankstellen ergibt sich immer das Problem, dass ein Überfüllen der meist unterirdisch angelegten Tanks schon aus Umweltschutzgründen vermieden werden muss. Dazu sind meist optische oder Thermistor-Grenzwertgeber vorgesehen, wobei diese beobachtet werden müssen, um dann die weitere Zufuhr von Kraftstoff in die Tanks der Tankstelle zu unterbinden. Dabei ergeben sich aber entsprechende Unsicherheiten.

Offenbarung der Erfindung

Technisches Problem

- [005] Ziel der Erfindung ist es, diese Nachteile zu vermeiden und eine Einrichtung der eingangs erwähnten Art vorzuschlagen, bei der beim Befüllen von Tanks einer Tankstelle ein Überfüllen sicher vermieden ist und andererseits die Kapazität der Tanks weitgehend ausgenutzt werden kann.

Technische Lösung

- [006] Erfindungsgemäß wird dies bei einer Anordnung der eingangs erwähnten Art durch die kennzeichnenden Merkmale des Anspruches 1 erreicht.
- [007] Durch die vorgeschlagenen Maßnahmen kann das Erreichen eines vorgegebenen Füllstandes auf einfache Weise übertragen und ein automatisches Schließen der entsprechenden Zuflussventile eingeleitet werden. Dabei kann jedes Tankfahrzeug einen entsprechenden Empfänger fest eingebaut haben und auch den Sender mitführen. Dieser kann einfach auf die Schnittstelle, eben den Stecker, aufgesteckt und nach Beendigung des Füllvorganges wieder abgenommen werden. Dabei kann aufgrund der Abfrageschaltung das Erreichen des jeweiligen vorgesehenen maximalen Füllstandes eines jeden einzelnen Tanks einer Tankstelle abgefragt werden.
- [008] Da der Sender mit einem bestimmten Tankfahrzeug stets mitgeführt werden kann, kann dieser exakt auf die Übertragungsfrequenz des Empfängers abgestimmt werden und es erübrigt sich ein allfälliges Einstellen einer entsprechenden Übertragungsfrequenz auf einen Empfänger.
- [009] Durch die Merkmale des Anspruchs 2 ergibt sich der Vorteil, dass eine Überprüfung von Identifizierungs codes auf einfache Weise durchgeführt werden kann.
- [010] Durch die Merkmale des Anspruchs 3 ergibt sich der Vorteil, dass das Füllen der Tanks einer Tankstelle praktisch weitgehend automatisiert werden kann. Es genügt dazu, die entsprechenden Schlauchverbindungen herzustellen und den Sender auf der Schnittstelle zu montieren. Nach der Aktivierung des Senders können die entsprechenden Ventile geöffnet werden und der Füllvorgang gestartet werden. Bei Erreichen des vorgesehenen maximalen Füllstandes bewirkt die Übertragung eines vom Füllstand-Grenzwertgeber erzeugten Signals zum Empfänger ein Schließen des entsprechenden Ventils.

Kurze Beschreibung von Zeichnungen

- [011] Die Erfindung wird nun an Hand der Zeichnung näher erläutert. Die einzige Figur zeigt schematisch eine erfindungsgemäße Anordnung.

Die beste Art und Weise, die Erfindung auszunutzen

- [012] Im Bereich einer nicht näher dargestellten Tankstelle sind in Fig. 1 mehrere Tanks bzw. Treibstofftanks 8 angeordnet. In jedem dieser Tanks 8 ist ein Füllstands-Grenzwertgeber 3 angeordnet, die bei Erreichen eines vorbestimmten Pegels, zweckmäßigerweise des Maximalpegels, in den Tanks 8 ein Signal erzeugen.
- [013] Bei diesen Grenzwertgebern 3 kann es sich um bekannte optische Systeme handeln. Bei diesen wird Licht ausgesandt und an einem Glasprisma an der Sonde definiert gebrochen und auf ein lichtempfindliches Element zurückgeworfen. Wird das Prisma von der Flüssigkeit erreicht, so ändert sich der Brechungsindex und es kommt weniger oder gar kein Licht auf das lichtempfindliche Element zurück, wodurch ein Signal

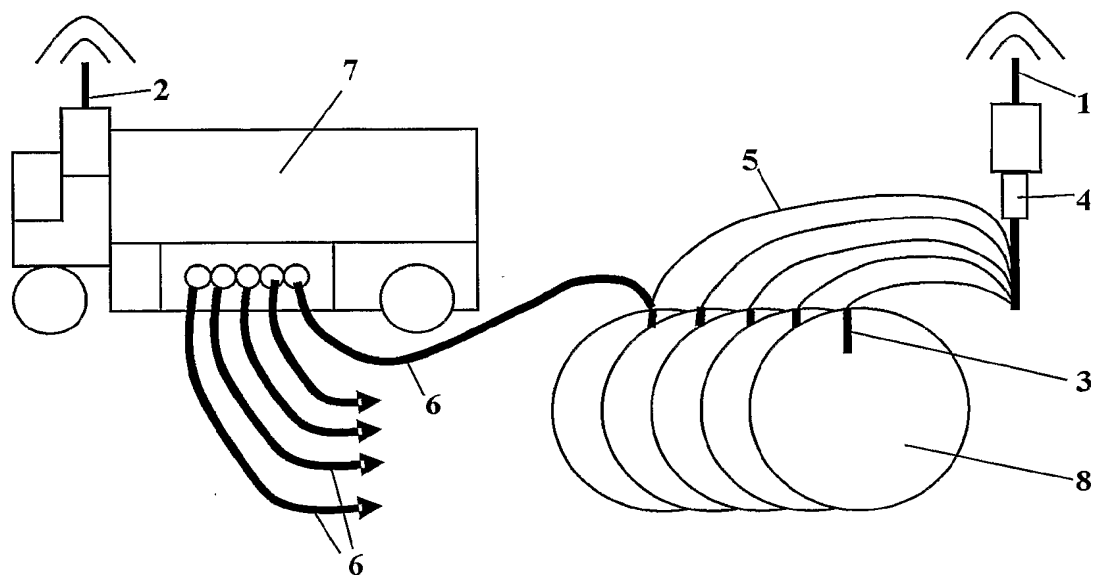
ausgelöst wird.

- [014] Diese Füllstands-Grenzwertgeber 3 sind über elektrische Leitungen 5 mit einer Schnittstelle 4 verbunden, die im einfachsten Fall durch einen Stecker gebildet sein kann.
- [015] Auf diese Schnittstelle 4 kann ein transportabler Sender 1 aufgesteckt werden, der vorzugsweise mit einer Abfrageschaltung, z.B. einem Multiplexer, versehen sein kann. Dieser Sender 1 wird zweckmäßigerweise mit einem Tankfahrzeug 7 mitgeführt, in dem ein Empfänger 2 eingebaut ist, der mit dem Sender 1 kommunizieren kann.
- [016] Beim Befüllen der Tanks 3 werden Schläuche 6 vom Tankfahrzeug 7 zu den Tanks 8 verlegt und an die letzteren angeschlossen.
- [017] Nach dem Aktivieren des Senders 1 wird eine drahtlose Kommunikationsverbindung zwischen dem Sender 1 und dem Empfänger 2 aufgebaut. Vorteilhafterweise wird dabei eine Funkverbindung aufgebaut, wobei der Sender 1 und der Empfänger 2, die vorzugsweise als Messumformer aufgebaut sind, aufeinander abgestimmt und kodiert sind. Auf diese Weise wird ausgeschlossen, dass ein anderes System, das sich in der Reichweite des Senders 1 bzw. des Empfängers 2 befindet, Einfluss auf die Verbindung zwischen diesen nehmen kann. Dabei kann das Funkprotokoll digital ausgeführt sein.
- [018] Während der Kommunikation zwischen dem Sender 1 und dem Empfänger 2 und einer dem Sender 1 zugeordneten Abfrageschaltung können die einzelnen Füllstands-Grenzwertgeber 3 in den einzelnen Tanks 8 in rascher Folge abgefragt werden und die Informationen an den Sender 1 übertragen werden. Damit es nicht möglich ist, dass sich Sender 1 und/oder Empfänger 2 unterschiedlicher Anordnungen unbeabsichtigt beeinflussen, wird die Kommunikation zwischen Sender 1 und Empfänger 2 einer Anordnung kodiert.
- [019] Der Sender 1 ist zweckmäßigerweise mit einer Auswerteschaltung verbunden, die bei Eintreffen eines entsprechenden, das Erreichen des vorgesehenen maximalen Pegelstandes anzeigenden Signals ein den an den betreffenden Tank 8 angeschlossenen Schlauch 6 steuerndes Ventil absperrt.
- [020] Dabei kann vorgesehen sein, dass alle Ventile oder nur einzelne, in der Folge des Eintreffens entsprechender, dem maximalen Füllstand entsprechender Signale gesperrt/verschlossen werden.
- [021] Die Funkverbindung zwischen dem auf der Schnittstelle 4 montierten Sender 1 und dem in dem Tankfahrzeug 7 mitgeführten Empfänger 2 kann auf einem geeignetem Frequenzband, wie z.B. dem SRD-Band (Short Range Device – ehemals LPD, Low Power Device genannt) erfolgen.

Ansprüche

- [001] Anordnung zur Überfüllsicherung einer Mehrzahl von Treibstofftanks (8) einer Tankstelle, die insbesondere gleichzeitig durch Mehrkammer-Tankfahrzeuge (7) befüllt werden und wobei die Treibstofftanks (8) Füllstand-Grenzwertgeber (3), wie z.B. optische oder Thermistor Sonden, aufweisen, die mit einem Sender (1) zur drahtlosen Übertragung eines Signals bei Erreichen des Grenzwertes verbunden sind, und wobei ein Empfänger (2) am Tankfahrzeug (7) zur Steuerung eines Tankventils vorgesehen ist, **dadurch gekennzeichnet**, dass sämtliche Füllstands-Grenzwertgeber (3) der Treibstofftanks (8) an der Tankstelle mit jeweils einer Signalleitung (5) verbunden sind, die zu einer gemeinsamen Schnittstelle (4) in Form eines Steckers führen, dass lediglich ein Sender (1) zusammen mit einer Abfrageschaltung, z.B. einer Multiplexschaltung, zum Anschluss an den Stecker vorgesehen ist, welcher Sender (1) mit einem gemeinsamen, am Tankfahrzeug (7) angeordneten Empfänger (2) zusammenwirkt, der mit einer synchronisierten Multiplexschaltung bzw. einer Schaltung zum Empfang adresscodierter Signale des Senders (1) verbunden ist, die an eine Steuerung zur selektiven Abschaltung der Tankventile am Tankfahrzeug (7) angeschlossen ist.
- [002] Anordnung nach Anspruch 1, **dadurch gekennzeichnet**, dass Sender (1) und Empfänger (2) jeweils als Messumformer zur Abgabe, zum Empfang und zur Konkordanzüberprüfung von Identifizierungscodes ausgebildet sind.
- [003] Anordnung nach Anspruch 1 oder Anspruch 2, **dadurch gekennzeichnet**, dass der an die Schnittstelle (4) bzw. den Stecker anschließbare Sender (1) bei Anschluss an diesen und bei Anliegen eines Bereitschaftssignals eines jeden Grenzwertgebers (3) selektive Einschaltsignale an den Empfänger am Tankfahrzeug (7) übermittelt, zur selektiven Freigabe des Öffnens der einzelnen Ventile der Kammern des Tankfahrzeuges (7).

[Fig. 001]



INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2005/053128

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B60P3/22 B60S5/02

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)
IPC 7 B60P B60S

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 practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 668 240 A (ALFONS HAAR MASCHINENBAU GMBH & CO) 23 August 1995 (1995-08-23) abstract column 1, lines 26-37 column 5, lines 30-46 figure 1	1-3
A	US 6 224 353 B1 (ISEMAN ZAN) 1 May 2001 (2001-05-01) abstract figure 1	1
A	DE 200 16 410 U1 (INDUSTRIEWERKE SAAR GMBH) 1 February 2001 (2001-02-01) cited in the application abstract paragraph '0005!	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

27 October 2005

Date of mailing of the international search report

07/11/2005

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Christensen, J

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PC1/EP2005/053128

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0668240	A	23-08-1995	AT 144964 T 15-11-1996
		DE 4404876 C1	18-05-1995
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		ZA 9500712 A	12-10-1995
US 6224353	B1	01-05-2001	NONE
DE 20016410	U1	01-02-2001	NONE

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen

PCT/EP2005/053128

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
 IPK 7 B60P3/22 B60S5/02

Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
 IPK 7 B60P B60S

Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

EPO-Internal, WPI Data, PAJ

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	EP 0 668 240 A (ALFONS HAAR MASCHINENBAU GMBH & CO) 23. August 1995 (1995-08-23) Zusammenfassung Spalte 1, Zeilen 26-37 Spalte 5, Zeilen 30-46 Abbildung 1	1-3
A	US 6 224 353 B1 (ISEMAN ZAN) 1. Mai 2001 (2001-05-01) Zusammenfassung Abbildung 1	1
A	DE 200 16 410 U1 (INDUSTRIEWERKE SAAR GMBH) 1. Februar 2001 (2001-02-01) in der Anmeldung erwähnt Zusammenfassung Absatz '0005!	1

☐ Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

☒ Siehe Anhang Patentfamilie

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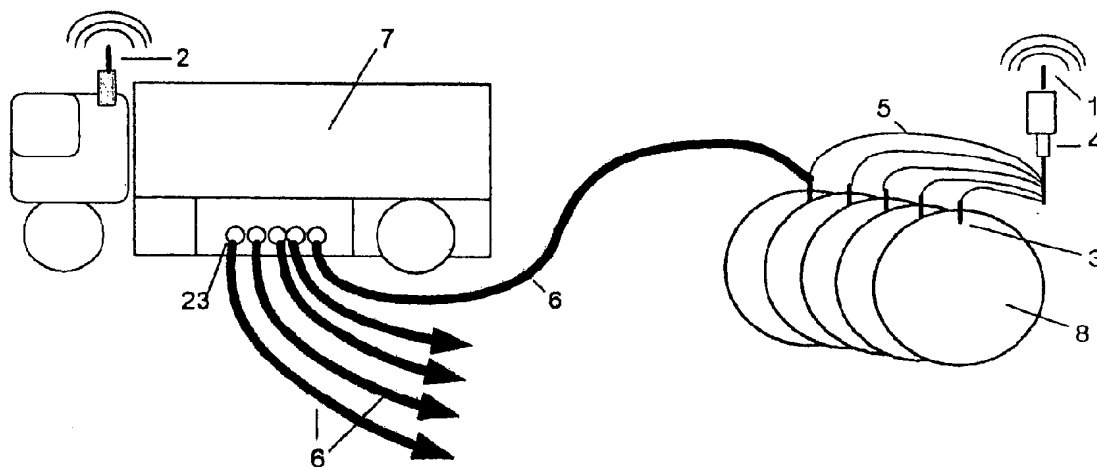
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[Fortsetzung auf der nächsten Seite]

(54) Title: ARRANGEMENT FOR SECURING FUEL TANKS AGAINST OVERFLOWING

(54) Bezeichnung: ANORDNUNG ZUR ÜBERFÜLLSICHERUNG VON TREIBSTOFFTANKS



(57) Abstract: The invention relates to an arrangement for securing fuel tanks of a gasoline station from overflowing. Said arrangement is characterized in that the level indicators (3) of the fuel tanks (8) at the gasoline station are connected to a common interface (4) via one respective signal line (5, 25), said interface (4) encompassing a scanning circuit, especially a multiplex circuit. The signal transmitter (1) cooperates with the signal receiver (2) which is arranged on the tank truck (7) and is connected to a synchronized multiplex circuit or a circuit for receiving address-encoded signals of the signal transmitter (1). The circuit is connected to a controller for selectively shutting off the tank valves (23) on the tank truck (7).

(57) Zusammenfassung: Die Erfindung betrifft eine Anordnung zur Überfüllsicherung von Treibstofftanks einer Tankstelle, dadurch gekennzeichnet, dass die Füllstands-Grenzwertgeber (3) der Treibstofftanks (8) an der Tankstelle über jeweils eine Signalleitung (5, 25) mit einer gemeinsamen Schnittstelle (4) verbunden sind, die eine Abfrageschaltung, insbesondere eine Multiplexschaltung aufweist, welcher Signalegeber (1) mit dem am Tankfahrzeug (7) angeordneten Signalempfänger (2) zusammenwirkt, der mit einer synchronisierten Multiplexschaltung bzw einer Schaltung zum Empfang adresscodierter Signale des Signalegebers (1) verbunden ist, die an eine Steuerung zur selektiven Abschaltung der Tankventile (23) am Tankfahrzeug (7) angeschlossen ist.



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Erklärungen gemäß Regel 4.17:

- *hinsichtlich der Berechtigung des Anmelders, ein Patent zu beantragen und zu erhalten (Regel 4.17 Ziffer ii)*

- *Erfindererklärung (Regel 4.17 Ziffer iv)*

Veröffentlicht:

- *ohne internationalen Recherchenbericht und erneut zu veröffentlichen nach Erhalt des Berichts*

Anordnung zur Überfüllsicherung von Treibstofftanks

Die Erfindung bezieht sich auf eine Anordnung zur Überfüllsicherung, bevorzugt einer Mehrzahl von Treibstofftanks gemäß dem Oberbegriff des Anspruches 1. Durch die
5 DE 200 16 410 U1 wurde ein Tankfahrzeug bekannt, das mehrere Kammern aufweist, die mit je einem Auslassventil versehen sind, das zum Befüllen und Entleeren der entsprechenden Kammer dient. In diesen Kammern ist je ein Füllstandssensor angeordnet, wobei die Füllstandssensoren mit einem Rechner verbunden sind, der die Füll- und Abgabemengen der einzelnen Kammern berechnet. Dabei ist dieser
10 Rechner über eine drahtlose Übertragungsstrecke mit einer Bedieneinheit verbunden, die Anzeige- und Eingabeelemente zur Überwachung und Steuerung zum Befüllen oder Entleeren der Tanks einer Tankstelle aufweist und mit der die erforderlichen Operationen, wie das Ansteuern von Ventilen überwacht werden können. Bei dieser Lösung ergibt sich jedoch der Nachteil, dass eine Überwachung des Füllstandes nur indirekt erfolgen kann. Dabei hängt aber die Möglichkeit der Vermeidung
15 einer Überfüllung von dem Zusammenspiel der Füllstandsanzeiger mit dem Rechner ab, in dessen Speicher ein den jeweiligen Kammern bzw Tanks entsprechenden Algorithmen eingegeben sein müssen. Da die Kammern, bzw Tanks eines Tankfahrzeuges meist keine einfachen oder leicht berechenbaren Formen aufweisen ergeben
20 sich dabei meist entsprechende Ungenauigkeiten.

Beim Befüllen von Tanks und Tankstellen ergibt sich immer das Problem, dass ein Überfüllen der meist unterirdisch angelegten Tanks schon aus Umweltschutzgründen vermieden werden muß. Dazu sind meist optische oder Thermistor-Grenzwertgeber
25 oder sonstige Füllstandsmesssysteme vorgesehen, wobei diese beobachtet werden müssen, um dann die weitere Zufuhr von Kraftstoff in die Tanks der Tankstelle zu unterbinden. Dabei ergeben sich aber entsprechende Unsicherheiten.

Ziel der Erfindung ist es, diese Nachteile zu vermeiden und eine Einrichtung der eingangs erwähnten Art vorzuschlagen, bei der beim Befüllen von Tanks einer Tankstelle ein Überfüllen sicher vermieden ist und andererseits die Kapazität der Tanks weitgehend ausgenutzt werden kann. Erfindungsgemäß wird dies bei einer Anordnung der eingangs erwähnten Art durch die kennzeichnenden Merkmale des Anspruches 1 erreicht.

Durch die vorgeschlagenen Maßnahmen kann das Erreichen eines vorgegebenen
35 Füllstandes auf einfache Weise übertragen und ein automatisches Schliessen der

entsprechenden Zuflussventile eingeleitet werden. Dabei kann jedes Tankfahrzeug in einer ersten Ausführungsform einen entsprechenden Empfänger fest eingebaut haben und auch den Sender mitführen. Dieser kann einfach auf die Schnittstelle, eben den Stecker, aufgesteckt und nach Beendigung des Füllvorganges wieder
5 abgenommen werden. Dabei können aufgrund der Abfrageschaltung das Erreichen des jeweiligen vorgesehenen maximalen Füllstandes eines jeden einzelnen Tanks einer Tankstelle abgefragt werden.

Da der Sender mit einem bestimmten Tankfahrzeug stets mitgeführt werden kann, kann dieser exakt auf die Übertragungsfrequenz des Empfängers abgestimmt
10 werden und es erübrigt sich ein allfälliges Einstellen einer entsprechenden Übertragungsfrequenz auf einen Empfänger.

Durch weitere Merkmale der Erfindung ergibt sich der Vorteil, dass eine Überprüfung von Identifizierungscode auf einfache Weise durchgeführt werden kann. Weiters ergibt sich der Vorteil, dass das Füllen der Tanks einer Tankstelle praktisch weitge-
15 hend automatisiert werden kann. Es genügt dazu, die entsprechenden Schlauchverbindungen herzustellen und den Sender auf der Schnittstelle anzubringen. Nach der Aktivierung des Senders können die entsprechenden Ventile geöffnet werden und der Füllvorgang gestartet werden. Bei Erreichen des vorgesehenen maximalen Füllstandes bewirkt die Übertragung eines vom Füllstand-Grenzwertgeber erzeugten
20 Signals zum Empfänger ein Schliessen des entsprechenden Ventils.

In einer weiteren Ausführungsvariante der Erfindung wird statt der drahtlosen Datenübertragung eine Datenleitung von der Elektronik des Tankwagens zur Schnittstelle geführt. Die Schnittstelle befindet sich bevorzugt in oder nahe dem zentralen Füll-
25 schacht der Tankstelle, wo auch der vorgeschriebene Erdungsanschluss vorgesehen ist. Weitere Ausführungen zur Aufgabe und Lösung folgen weiter unten bei der Beschreibung der Ausführungsbeispiele.

Die Erfindung wird nun anhand der Zeichnungen näher erläutert, die schematisch
30 eine erfindungsgemäße Anordnung in zwei Ausführungsbeispielen zeigen. Fig. 1 zeigt schematisch eine erste Anwendung der Erfindung und Fig. 2 ein zweites Anwendungsbeispiel. Fig. 3 zeigt ein Detail aus Fig. 2.

Im Bereich einer nicht näher dargestellten Tankstelle sind in Fig. 1 mehrere Tanks,
35 bzw Treibstofftanks 8 angeordnet. In jedem dieser Tanks 8 ist ein Füllstand-

Grenzwertgeber 3 angeordnet, die bei Erreichen eines vorbestimmten Pegels zweckmäßigerweise dem Maximalpegel in den Tanks 8 ein Signal erzeugen.

Bei diesen Grenzwertgebern 3 kann es sich um bekannte optische Systeme handeln.

Bei diesen wird Licht ausgesandt und an einem Glasprisma an der Sonde definiert
5 gebrochen und auf ein lichtempfindliches Element zurückgeworfen. Wird das Prisma von der Flüssigkeit erreicht, so ändert sich der Brechungsindex und es kommt weniger oder gar kein Licht auf das lichtempfindliche Element zurück, wodurch ein Signal abgelöst wird.

Diese Füllstands-Grenzwertgeber 3 sind über elektrische Leitungen 5 mit einer
10 Schnittstelle 4 verbunden, die im einfachsten Fall durch einen Stecker gebildet sein kann.

Auf diese Schnittstelle 4 kann ein transportabler Sender 1 aufgesteckt werden, der vorzugsweise mit einer Abfrageschaltung, zB einen Multiplexer versehen sein kann.

Dieser Sender 1 wird zweckmäßigerweise mit einem Tankfahrzeug 7 mitgeführt, in
15 dem ein Empfänger 2 eingebaut ist, der mit dem Sender 1 kommunizieren kann.

Beim Befüllen der Tanks 8 werden Produktschläuche 6 vom Tankfahrzeug 7 zu den Tanks 8 verlegt und an die letzteren angeschlossen.

Nach dem Aktivieren des Senders 1 wird eine drahtlose Kommunikationsverbindung zwischen dem Sender 1 und dem Empfänger 2 aufgebaut. Vorteilhafterweise wird
20 dabei eine Funkverbindung aufgebaut, wobei der Sender 1 und der Empfänger 2, die vorzugsweise als Messumformer aufgebaut sind, aufeinander abgestimmt und kodiert sind. Auf diese Weise wird ausgeschlossen, dass ein anderes System, das sich in der Reichweite des Senders 1, bzw des Empfängers 2 befindet, Einfluss auf die Verbindung zwischen diesen nehmen kann. Dabei kann das Funkprotokoll digital
25 ausgeführt sein.

Während der Kommunikation zwischen dem Sender 1 und dem Empfänger 2 und einer dem Sender 1 zugeordneten Abfrageschaltung können die einzelnen Füllstands-Grenzwertgeber 3 in den einzelnen Tanks 8 in rascher Folge abgefragt und die Informationen an den Sender 1 übertragen werden. Damit es nicht möglich ist,
30 dass sich Sender 1 und/oder Empfänger 2 unterschiedlicher Anordnungen unbeabsichtigt beeinflussen, wird die Kommunikation zwischen Sender 1 und Empfänger 2 einer Anordnung kodiert.

Der Sender 1 ist zweckmäßigerweise mit einer Auswerteschaltung verbunden, die bei Eintreffen eines entsprechenden, das Erreichen des vorgesehenen maximalen

Pegelstandes anzeigenden Signals, ein den an den betreffenden Tank 8 angeschlossenen Schlauch 6 steuerndes Tankventil absperrt.

Dabei kann vorgesehen sein, dass alle Tankventile oder nur einzelne, in der Folge des Eintreffens entsprechender, dem maximalen Füllstand entsprechender Signale
5 gesperrt/verschlossen werden.

Die Funkverbindung zwischen dem auf der Schnittstelle 4 montierten Sender 1 und dem in dem Tankfahrzeug 7 mitgeführten Empfängers 2 kann auf einem geeigneten Frequenzband wie zB dem SRD-Band (Short Range Device – ehemals LPD, Low Power Device genannt) erfolgen.

10

Anhand der Fig. 2 wird nachstehend ein weiteres Ausführungsbeispiel dieser Erfindung anhand einer Tankstelle mit zentralem Füllschacht und Gaspendelanlage beschrieben. Die Datenübertragung zwischen den Füllstands-Grenzwertgebern und dem Tankwagen erfolgt hier nicht drahtlos, sondern über Datenleitungen.

15

Die dargestellte Tankstelle umfasst fünf Treibstofftanks 8 mit den zugehörigen Füllstands-Grenzwertgebern 3. Die Zuleitungsrohre 20 führen von einem zentralen Füllschacht 9 zu den einzelnen Tanks 8. Jeder Zuleitung ist im Füllschacht ein eigener Anschlussstutzen 27 zugeordnet. Demgemäß ist jedem Anschlussstutzen und dem
20 nachfolgenden Tank ein definiertes Abfüllprodukt zugeordnet wie zB Normalbenzin, Superbenzin, Diesel oder Heizöl.

Der Tankwagen TKW hat je nach ausgelieferten Produkten mehrere Tankabschnitte, aus denen über die TKW-Anschlusskupplungen 22 des Tankwagens und zugeordneten Tankventilen 23 über Produktschläuche 6, das jeweilige Produkt über die Anschlusskupplung und den Anschlussstutzen 27 an die zugehörigen Zuleitungsrohre
25 20 abgegeben werden kann.

Im Abfüllschacht 9 oder in dessen unmittelbarer Nähe befindet sich die Schnittstelle 4 mit dem Multiplexer 24, zu dem die Datenleitungen 25 der einzelnen Füllstands-Grenzwertgeber 3 geführt sind. An die Schnittstelle 4 ist auch die Datenleitung 26 des Tankwagens TKW anschliessbar.

Die Schnittstelle 4 ist bevorzugt ein mehrpoliger Erdungs- Versorgungs- und Kommunikationsstecker und verbindet die vom TKW führende mehrpolige Erdungs- und
35

Kommunikationsleitung für die auszutauschenden Grenzwertgeber-Informationen mit dem Multiplexer 24 und der Erdung 10. Die Datenleitung führt am Tankwagen TKW zur Auswert- und Steuerelektronik 15, die die Tankventile 23 steuert. Die von den Tanks 8 zum Multiplexer laufenden Datenleitungen umfassen die PID Leitungen 11, die zu den Produktanschlusskupplungen 21 führen, weiters die PID Leitungen 13, die zu den Gaspendelschlauchkupplungen 14 führen, und die Leitungen 25 zu den Grenzwertgebern 3. Weiters sind in Fig. 2 noch die Gaspendelrohrleitungen 17 eingezeichnet, die zu den Kupplungen 14 im Füllschacht 9 führen.

Zu den Datenleitungen ist zu sagen, dass diese entweder als eigenständige Datenleitungen ausgebildet, oder auch dadurch gebildet sein können, dass die Produktschläuche 6 und auch die Gaspendelschläuche 16 leitfähig und zur Datenübertragung befähigt sind. Gleiches gilt auch für die Datenleitung 26 des Tankwagens, wobei es bereits bekannt war, die Produktschläuche 6 leitend auszustatten, sodass die Produktinformation jedem Schlauch datenmäßig aufgeprägt wird. Damit ist es möglich, dass ein für das Abfüllprodukt charakteristisches Informationssignal jedem Schlauch 6 zugeordnet ist. Dieses PID Informationssignal (Multi-Product-Information-Device PID) wird von einer Steuerelektronik mit einem PID-Signal jedes der Tanks 8 verglichen. Nur dann, wenn die Signale bei der Auswertung ergeben, dass vom Tankwagen das richtige Produkt zum richtigen Tank geleitet wird, werden die Tankventile 23 des TKW freigegeben. Bisher war es allerdings bekannt, je ein PID als Signalgeber pro Tank 8 einzubauen und die Signale zu den Anschlusskupplungen 21 zu leiten. Dies hatte den Nachteil, dass immer dann neue PID's eingebaut werden mußten, wenn ein Tank für ein anderes Produkt verwendet werden sollte.

Bei der vorliegenden Erfindung sind die PID's softwaremäßig im Multiplexer 24 vorgesehen und der Signalvergleich erfolgt über Anschlüsse an den Anschlusskupplungen 21 mit den Signalen über die Schlauchleitungen 6. In gleicher Weise können die richtigen Anschlüsse der Gaspendelschläuche 16 überprüft werden.

Ein weiteres vorteilhaftes Merkmal der Erfindung gemäß Fig. 2 ist, dass die Datenleitung 26 des Tankwagens auch eine Überprüfung vornehmen kann, ob der Tankwagen vorschriftsmäßig geerdet ist. Die Erdung kann durch die Datenleitung 26 selbst erfolgen. Eine Freischaltung der Ventile 23 am TKW soll nur dann erfolgen können, wenn die Elektronik 15 die ordnungsgemäße Erdung feststellt. Weiters ist das

Freischalten der Tankventile 23 nur dann zugelassen, wenn die Grenzwertgeber 3 anzeigen, dass der Tank noch nicht voll ist. Sobald der Grenzwertgeber den Zustand "voll" einnimmt, muß das zugehörige Tankventil am TKW geschlossen werden oder bleiben.

5

Zufolge dieser erfindungsgemäßen Anordnung ist es möglich, den Füllvorgang vom Tankwagen zu den Produkttanks nach Anschluß der Schläuche 6, 16 und der Datenleitung 26 am zentralen Abfüllschacht 9 praktisch vollautomatisch ablaufen zu lassen. Dies bedeutet eine große Zeitersparnis, vermindert Fehlerquellen und bringt eine erhöhte Sicherheit mit sich.

10

Die Fig. 3 zeigt schematisch den Multiplexer 24, der in oder am Füllschacht 9 angeordnet ist und sowohl den Multiplexer für die Füllstands-Grenzwertgebersignale als auch die Schaltung für die PID's (Product Identification Devices) 28 aufweist. Zum Multiplexer führen die Leitungen 25, die den Zustand aller Füllstand-Grenzwertgeber 3 (voll oder nicht voll) übermitteln, und der Multiplexer verarbeitet die Signale, sodass sie über eine oder mehrere Kommunikationsleitungen 18 der Schnittstelle 4 übergeben werden können. Mit 19 ist eine Versorgungsleitung bezeichnet, über die die Elektronik wenigstens des Multiplexers mit Strom versorgt werden kann, unabhängig von der belieferten Tankstelle. Die Datenleitung 26 ist ein mehrpoliges Kabel als Verbindung zur Elektronik 15 des TKW und enthält auch dessen Erdungsleitung. Der Ausgang des Multiplexers über die Kommunikationsleitung 18 und die Schnittstelle 4 ergeben funktionsmäßig den Signalgeber 1 der Fig. 1 und die Elektronik 15 des Tankwagens 7 übernimmt die Funktion des Signalempfängers 2 in Fig. 1.

20

In den Multi-PID 28 führen die Produkt-PID-Leitungen 11, die von den isolierten Kupplungen 21 der Produktleitungen 20 kommen, und weiters die PID-Leitungen 13 von den Gaspedal-Schlauchkupplungen 14.

25

Die Produktidentifikation über isolierte Kupplungen und leitende Schläuche vom Füllschacht zum TKW ist Stand der Technik und in der Europeanorm EN 14116 festgehalten.

Das Multi-PID vereint mehrere PID-Code Generierungen in einem Gerät. Die Informationen sind von einem Installationsbetrieb frei programmierbar, sodass bei der Installation vor Ort die Produkte und ihre Tankzuordnung festgelegt werden kann. Die

30

35

einzelnen PID-Leitungen werden vom Gerät an die Befüll- und wenn vorhanden auch an die Gaspendelkupplungen angeschlossen. Wird ein Schlauch an die Produktkupplung (oder wenn vorhanden auch an die Gaspendelkupplung) angeschlossen, wird das Multi-PID über den leitenden Schlauch eigensicher versorgt. Es beginnt die

5 Tank-Daten auf die Versorgung aufzumodulieren (Stand der Technik). Die TKW-Elektronik überprüft die Daten und vergleicht diese mit dem Inhalt der Kammer im TKW, welche mit dem angeschlossenen Schlauch verbunden ist. Stimmen die Produkte überein und ist, falls vorhanden, auch der Gaspendelschlauch richtig angeschlossen, dann wird die Befüllung unter Berücksichtigung der GWG-Information für

10 diesen Tank freigegeben. Somit können viele Tanks gleichzeitig und unabhängig voneinander abgeladen werden.

Der Grenzwertgeber-Multiplexer kann auch unabhängig vom Multi-PID und umgekehrt eingesetzt werden.

15 Was zuvor für eine KFZ-Tankstelle beschrieben wurde gilt analog auch für alle anderen Tankstellen wie Abfüllanordnungen flüssiger Produkte wie zB Tankterminals für Schiffe, Heizöltankanlagen für Wohn- und Gewerbe Zwecke oder Abgabestationen von Raffinerien.

20 Die Tankventile 23 sind zumeist reine Auslassventile, durch die die Flüssigkeiten mittels Schwerkraft austreten. Es kann sich dabei aber auch um Förderpumpen handeln, die die Flüssigkeiten aktiv abgeben wenn sie eingeschaltet sind.

25 Die Anwendung der erfindungsgemäßen Überfüllsicherung kann auch dann vorteilhaft sein, wenn lediglich ein Tank gefüllt werden soll.

Patentansprüche:

1. Anordnung zur Überfüllsicherung, bevorzugt einer Mehrzahl von Treibstofftanks einer Tankstelle, die insbesondere gleichzeitig durch Mehrkammer-
5 Tankfahrzeuge befüllt werden und wobei die Treibstofftanks Füllstand-Grenzwertgeber wie zB optische oder Thermistor Sonden oder Füllstandsmesssysteme aufweisen, die mit einem Signalgeber zur Übertragung eines Signals bei Erreichen des Grenzwertes verbunden sind und wobei ein Signalempfänger am Tankfahrzeug zur Steuerung der Tankventile vorgesehen ist, dadurch gekennzeichnet,
10 dass die Füllstands-Grenzwertgeber (3) der Treibstofftanks (8) an der Tankstelle über jeweils eine Signalleitung (5, 25) mit einer gemeinsamen Schnittstelle (4) verbunden sind, die eine Abfrageschaltung, insbesondere eine Multiplexschaltung aufweist, welcher Signalgeber (1) mit dem am Tankfahrzeug (7) angeordneten Signalempfänger (2) zusammenwirkt, der mit einer synchronisierten Multiplexschaltung bzw einer Schaltung zum Empfang adresscodierter Signale
15 des Signalgebers (1) verbunden ist, die an eine Steuerung zur selektiven Abschaltung der Tankventile (23) am Tankfahrzeug (7) angeschlossen ist.
2. Anordnung nach Anspruch 1, dadurch gekennzeichnet, dass Signalgeber (1) und
20 Signalempfänger (2) zur drahtlosen Datenübermittlung ausgebildet sind und jeweils als Messumformer zur Abgabe, zum Empfang und zur Konkordanzüberprüfung von Identifizierungscode eingerichtet sind.
3. Anordnung nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass der an die
25 Schnittstelle (4) angeschlossene oder anschliessbare Signalgeber (1) bei Anschluss an diesen und bei Anliegen eines Bereitschaftssignals eines jeden Grenzwertgebers (3) selektive Einschaltsignale an den Empfänger am Tankfahrzeug (7), zur selektiven Freigabe des Öffnens der einzelnen Tankventile (23) der Kammern des Tankfahrzeuges (7) übermittelt.
30
4. Anordnung nach Anspruch 1, dadurch gekennzeichnet, dass die Schnittstelle (4) einen mehrpoligen Stecker zum Anschluss einer Datenleitung (26) aufweist, die mit einer Steuerelektronik (15) des Tankwagens verbunden ist.

5. Anordnung nach Anspruch 4, dadurch gekennzeichnet, dass die Datenleitung (26) zusätzlich zur Kommunikationsleitung (18) auch eine Erdungsleitung (19) zur Erdung des Tankwagens aufweist.
- 5 6. Anordnung nach Anspruch 5, dadurch gekennzeichnet, dass die Tankventile (23) nur bei Vorliegen eines Erdschlusses des Tankwagens freisaltbar sind.
7. Anordnung nach einem der Ansprüche 4 bis 6, dadurch gekennzeichnet, dass für
jeden Tank zumindest eine zugehörige Anschlusskupplung vorgesehen ist, der
10 ein für das Abfüllprodukt charakteristisches Informationssignal (PID-Signal) zuge-
ordnet ist und dass die Tankventile (23) des Tankwagens freisaltbar sind, wenn
das PID-Signal der vom Tankwagen kommenden Anschlusskupplung (21) mit
jenem des Anschlussstutzens (27) übereinstimmt.
- 15 8. Anordnung nach einem der Ansprüche 4 bis 7, dadurch gekennzeichnet, dass die
PID-Signale für die Anschlussstutzen (27) von einem programmierbaren Multi-
PID (28) bereitgestellt sind.
9. Anordnung nach einem der Ansprüche 4 bis 8, dadurch gekennzeichnet, dass die
20 Anschlussstutzen (27) für die Abfüllprodukte in einem Füllschacht (9) angeordnet
sind, und dass im Füllschacht oder in dessen Nähe die Schnittstelle (4) mit einem
Stecker, der Multiplexer (24) für die Füllstands-Grenzwertgeber und die PID (28)
sowie der Erdungsanschluss (10) vorgesehen sind.
- 25 10. Anordnung nach einem der Ansprüche 4 bis 9, dadurch gekennzeichnet, dass
jedem Tank (8) ein Füllprodukt-Anschlussstutzen (27) und ein Gaspendelan-
schlussstutzen (29) zugeordnet ist, und jeder Anschlussstutzen über ein PID-
Signal verfügt.

30

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Fig. 1

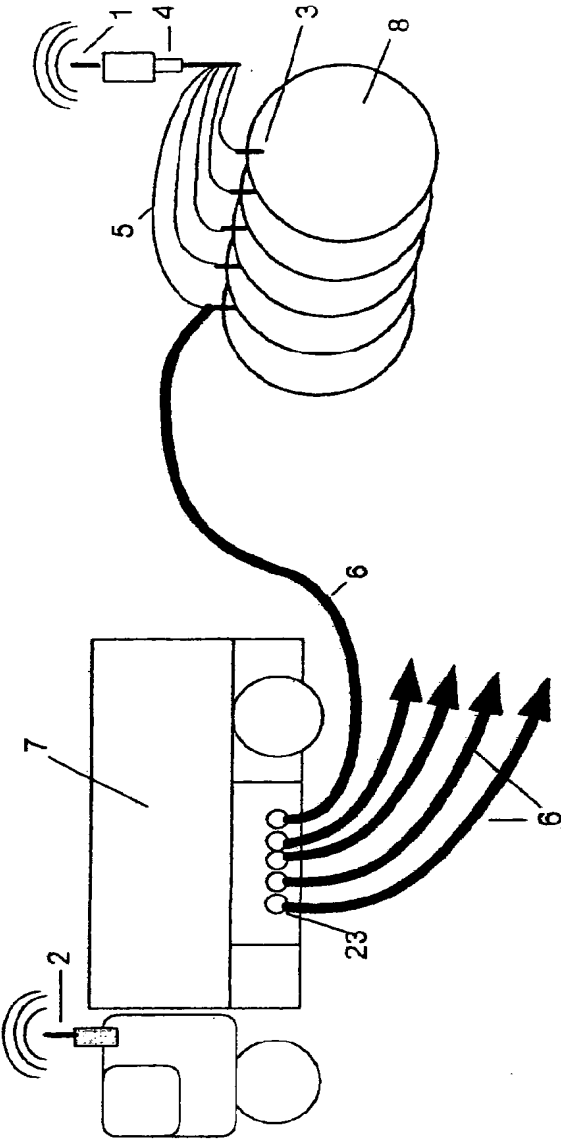


Fig. 2

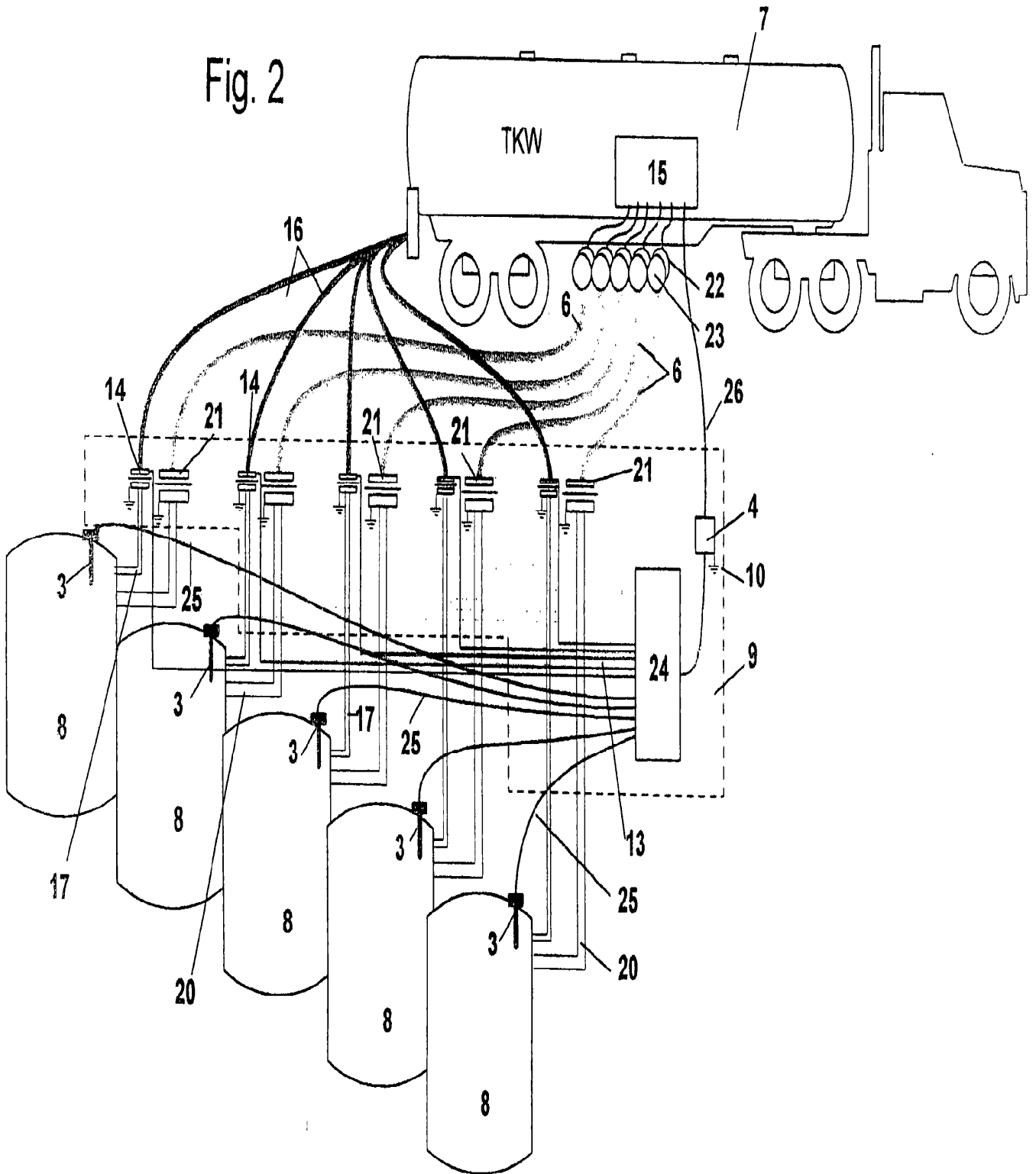
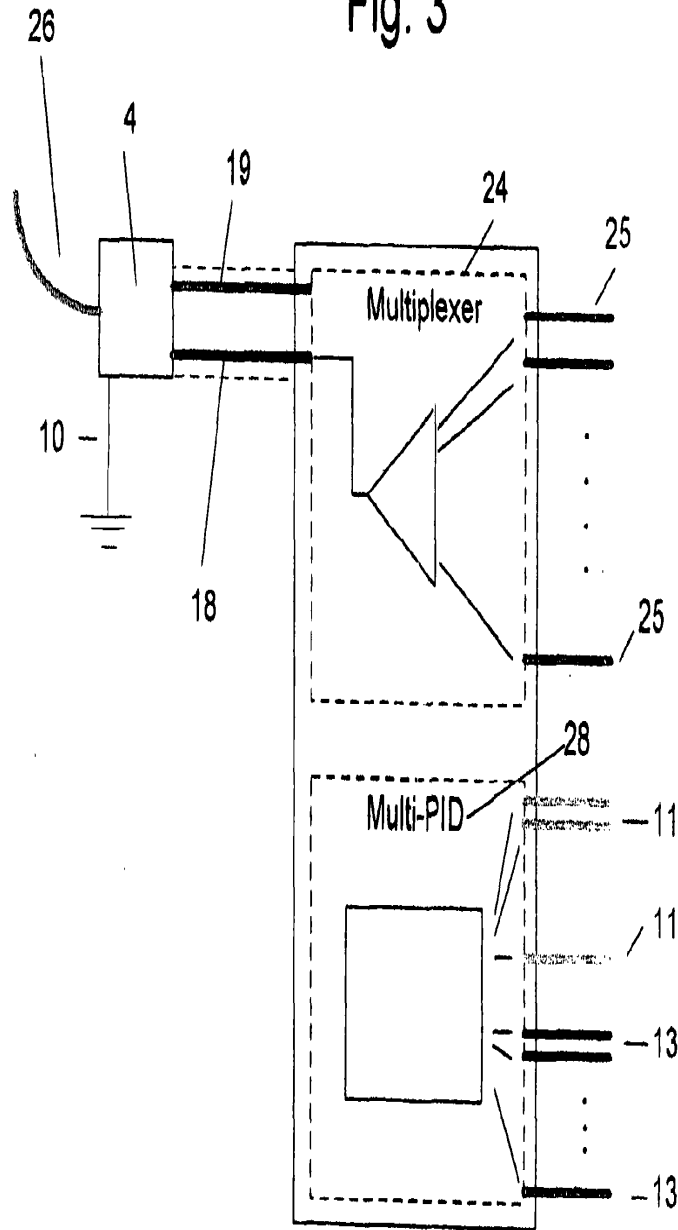


Fig. 3



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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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(54) Title: DRY-BREAK FUEL RECEIVER WITH INTEGRAL BACK-FLOW PREVENTION

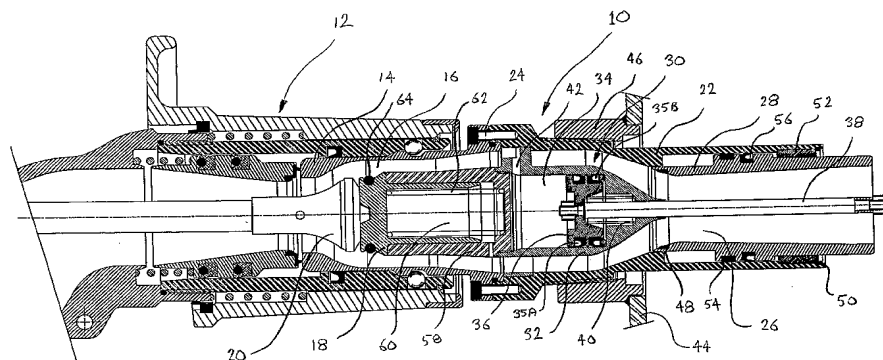


FIGURE 1

(57) Abstract: The present invention relates broadly to a valve assembly (10) being adapted to detachably receive a dry-break refuelling nozzle (12). The valve assembly comprises a receiver body (14) which defines a forward fuel passageway (16) in which a poppet valve member (18) is slidably mounted. The valve assembly (10) also comprises a tail body (22) secured coaxial with the receiver body (14) and defining a rearward fuel passageway (26). the tail body (22) slidably houses a check valve member or diffuser (28) which is driven by a hydraulic actuator or piston assembly (30).

1.

DRY-BREAK FUEL RECEIVER WITH INTEGRAL BACK-FLOW PREVENTION

FIELD OF THE INVENTION

5 The present invention relates broadly to a valve assembly such as that used in a dry-break refuelling receiver having integral back-flow prevention.

BACKGROUND OF THE INVENTION

10 The industry standard method of refuelling large diesel powered equipment in the mining, railway, and earthmoving industries has incorporated dry-break fluid couplings designed to transfer diesel fuel from dispensing point into the fuel tank onboard the equipment. This transfer is often done at relatively high flowrates and within a sealed fuel delivery system. The couplings used to engage the dispensing point with the equipment consist of a female coupling typically at the dispensing point – termed the nozzle – and a male coupling onboard the equipment – termed the receiver. The nozzle typically incorporates a manual operation handle (open/closed), and modern nozzles also incorporate an automatic shut-off mechanism.

15 This automatic mechanism is sensitive to fluid pressure passing through the mating nozzle and receiver, and activates at a preset pressure to automatically close the nozzle and hence terminate the transfer of fuel. This pressure generated in the fuel is typically from the pressurisation of the fuel tank, once it is filled.

20 Large equipment often incorporate fuel tanks of several thousand litre capacity, and are located on the equipment often several metres from ground level. To facilitate refuelling of the equipment from ground level, the fuel receiver is often situated in a position readily accessible to the refuelling operator and is linked to the fuel tank by a length of fixed pipe and/or flexible hose. Access from ground level has obvious occupational safety and time efficiency benefits.

25 The mechanical engagement of the nozzle and receiver creates wear between mating surfaces and sealing elements (fluid seals). Nozzles are often routinely removed from active use for the purpose of maintenance to replace damaged or otherwise faulty components. Replacing the

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receiver installed on equipment is often more difficult, and unless a separate fluid isolation valve exists between the receiver and the tank, the tank must be drained of fuel to a level below the receiver before the receiver can be replaced. This is costly and creates the risk of fuel spillage and subsequent environmental damage.

5 Drainage of fuel from the fuel tank via the receiver can typically occur in two ways:

- (i) The receiver seal is damaged, or the receiver itself suffers impact with another object causing the receiver to fracture; or
- (ii) Fuel is pilfered from the tank.

10 Many thousands of litres of fuel can be lost if no means of back-flow prevention exists between the receiver and the tank.

There are two (2) known fuel receiver products which have an integral back-flow prevention mechanism designed to prevent the drainage of fuel from the tank via the receiver. One such product employs a simple disc style check valve mechanism which is opened by fluid pressure acting directly onto the disc, and is closed by the action of a spring. The front receiver body of the product can be changed out without the need to drain the tank. Another such product is designed so that the second back-flow prevention valve is directly (mechanically) opened by the displacement of the first poppet valve. The principal role of the second valve in this product is to prevent the backflow of fuel during removal (changeout) of the receiver body.

20 SUMMARY OF THE INVENTION

According to the present invention there is provided a valve assembly comprising:

a poppet valve housing being adapted to provide releasable coupling for a refilling nozzle and including a forward elongated fluid passageway;

25 a poppet valve member slidably mounted within the poppet valve housing for opening and closure of the forward fluid passageway;

a check valve body connected to the poppet valve housing and including a rearward elongated fluid passageway;

3.

a check valve member movably coupled to the check valve body for opening and closure of the rearward fluid passageway;

5 a hydraulic actuator located within the check valve body and operatively coupled to the check valve member whereby in operation fluid pressure alone acting on the hydraulic actuator effects movement of the check valve member for the opening of the rearward fluid passageway.

Preferably the check valve member is coupled to the check valve body independent of the poppet valve member.

10 Preferably the hydraulic actuator comprises a piston assembly including a piston housing secured within the check valve body and having a piston chamber, and a piston head slidably mounted within the piston chamber and connected to the check valve member via a piston rod. More preferably the piston assembly also includes piston biasing means urging the check valve member into seated engagement with the piston housing. Even more preferably the piston housing includes a port into the piston chamber and arranged to provide hydraulic fluid
15 pressure against the piston head and the piston biasing means to force opening of the check valve member.

Preferably the valve assembly also comprises a poppet valve body mounted within the poppet valve housing and including a cylindrical bore for guided and sliding movement of the poppet valve member. More preferably the poppet valve body is secured to the piston housing at its
20 forward end. Even more preferably the valve assembly further comprises poppet valve biasing means housed within the cylindrical bore and arranged to urge the poppet valve member into seated engagement with the poppet valve housing for closure of the forward fluid passageway.

Preferably the check valve member is in the form of a generally cylindrical shaped diffuser.
25 More preferably the diffuser is retained for reciprocating movement within the rearward fluid passageway, via a retaining element. Even more preferably the diffuser is guided for reciprocating movement via an annular bearing and adjacent sealing arrangement.

Generally the valve assembly is adapted for use with a dry-break refuelling nozzle.

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BRIEF DESCRIPTION OF THE FIGURES

In order to achieve a better understanding of the nature of the present invention a preferred embodiment of a valve assembly will now be described, by way of example only, with reference to the accompanying drawings in which;

5 Figures 1 and 2 are cross-sectional views of an embodiment of the valve assembly according to the invention together with a refilling nozzle;

Figures 3 and 4 are cross-sectional views of the valve assembly of Figures 1 and 2 with and without a refilling nozzle respectively;

10 Figure 5 is a cross-sectional view of the preceding figures together with plan and elevational views.

DETAILED DESCRIPTION OF THE [INVENTION/PREFERRED EMBODIMENT]

As best shown in Figures 1 and 2 there is a valve assembly designated generally as 10 according to one embodiment of the invention and being adapted to receive a re-filling or in this example a refuelling nozzle 12. The refuelling nozzle 12 is of a dry-break configuration
15 such as that described in the applicant's US patent no. 4,919,174 the contents of which are included herein by way of reference.

The valve assembly 10 of this embodiment generally comprises the following components:

1. A poppet valve housing or in this example receiver body 14 which provides for latching of the dry-break refuelling nozzle 12 and defines a forward elongated fluid or
20 fuel passageway 16;
2. A poppet valve member 18 slidably mounted within the receiver body 14 and adapted to be urged open by a nozzle poppet 20 of the refuelling nozzle 12;
3. A check valve body or in this example tail body 22 secured coaxial with the receiver
25 body 14 via a series of screw fasteners such as 24 and defining a rearward elongated fuel passageway 26;

5.

4. A check valve member or in this example cylindrical shaped diffuser 28 slidably housed within the tail body 22;

5. A hydraulic actuator designated generally as 30 located within the tail body 22 and operatively coupled to the diffuser 28 for opening and closure of the rearward fuel passageway 26.

The hydraulic actuator of this embodiment is in the form of a piston assembly 30 including a piston housing 32 securely mounted at an upstream end of the rearward fuel passageway 26. The piston housing defines a piston chamber 34 within which a piston head 36 is slidably mounted. The piston head 36 is connected to the diffuser 28 via a piston connecting rod 38.

10 The piston assembly 30 of this embodiment includes a pair of piston seals 35A and 35B. The seals 35A and 35B each provide sealing by fluid pressure in both directions, that is the seals 35A and 35B provide a double-acting role. The forward seal 35A retains fluid pressure against the piston head 36 within the forward side of the chamber 34 whilst the rearward seal 35B provides a seal against fluid pressure entering into the forward side of the chamber 34, such as from the fuel tank. The pair of back to back seals 35A and 35B are in the form of U-seals designed to achieve low friction to achieve relatively free travel of the piston 36 within the chamber 34. The pair of seals 35A and 35B could be replaced by a single double-acting piston seal.

20 The piston assembly 30 also includes biasing means in the form of a compression spring 40 located within the piston chamber 34 about the piston connecting rod 38. The piston spring 40 urges the piston head 36 together with the piston connecting rod 38 and diffuser 28 in a forward direction. Importantly, the piston housing 32 includes a piston chamber port 42 to the piston chamber 34 and arranged to provide hydraulic fluid pressure against the piston head 36 and the biasing force of the spring 40 to force opening of the diffuser 28.

25 Figures 1 and 2 otherwise illustrate connection of the valve assembly 10 to a fuel tank such as 44 having a receiver socket 46 to which the valve assembly 10 or tail body 22 is screw threaded. The valve assembly 10 of these figures shows both the poppet valve member 18 and the check valve member or diffuser 28 in their open conditions. For ease of reference and

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in order to avoid repetition, like components of the assembly 10 of Figure 2 have been designated with the same reference numeral as the corresponding components of Figure 1.

Figures 3 and 4 illustrate the valve assembly 10 of the previous embodiment but with the check valve member or in this case diffuser 28 shown in its closed condition. The valve assembly 10 is otherwise identical in construction to the previous embodiment and corresponding components have been referenced with the same numeral.

The valve assembly 10 of Figures 3 and 4 shows the poppet valve member 18 in its open condition under the cooperating force of the nozzle poppet 20 or some other means.

However, in this case depressurisation of the fuel or diesel supply means the fluid pressure force acting within the piston chamber 34 is less than the counter-force of the piston spring 40 which urges the piston 36 together with the check valve member or diffuser 28 into its closed conditions. That is, despite the poppet valve 18 at the forward fluid passageway 16 being opened, the discharge of fuel from the tank 44 is prevented by the check valve member or diffuser 28 being closed.

As shown in Figures 3 and 4 the piston housing 32 is at a downstream end shaped conically and designed to engage or seat with the check valve member or diffuser 28. The diffuser 28 includes a tapered edge at its upstream end which is designed to house a face seal 48 which prevents fluid flow in a reverse direction. In an alternate embodiment the seal 48 may be affixed onto the conical surface of piston housing 32 where it engages the mating tapered face of the diffuser 28.

As best shown in Figure 5 the check valve member or diffuser 28 is arranged for reciprocating movement within the rearward fluid or fuel passageway 26. The diffuser 28 is retained within the check valve body or tail body 22 via a retaining ring 50 and diffuser sleeve 52. The diffuser 28 is guided for reciprocating movement via an annular bearing 54 together with an adjacent diffuser U-seal 56.

The valve assembly 10 of Figure 5 is shown with both the poppet valve member 18 and the check valve member 28 in their closed conditions. The poppet 18 is slidably housed within a poppet valve body 58 which in this example is connected to the piston housing 32. The

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poppet valve body 58 includes a cylindrical bore 60 which provides guided reciprocating movement of the poppet 18. The poppet 18 is urged into its closed condition via poppet biasing means in the form of a compression spring 62 located within the cylindrical bore 60. The poppet 18 includes an annular O-ring 64 which seats with an inner surface of the receiver body 14 on closure of the poppet 18.

The general steps involved in operation of the valve assembly 10 of this embodiment are as follows:

1. The refilling or dry-break refuelling nozzle 12 is detachably connected or latched onto the receiver body 14 of the valve assembly 10;
- 10 2. The refuelling nozzle 12 is manually opened forcing the nozzle poppet 20 into engagement with the poppet valve member 18 unseating it from the receiver body 14 against the biasing force of the poppet spring 62;
3. The poppet valve member 18 is thus opened allowing fluid to flow through the forward fuel passageway 16 and into the piston chamber 34 via the piston housing port 15 42;
4. The hydraulic fluid pressure of the fluid or fuel in the piston chamber 34 urges the piston head 36 in a rearward direction against the biasing force of the piston spring 40;
5. The piston head 36 drives the check valve member or diffuser 28 to a rearward position via the action of the piston rod 38;
- 20 6. The check valve member or diffuser 28 is thus opened allowing fuel to flow from the forward fluid passageway 16 to the rearward fluid passageway 26 to the fuel tank 44;
7. The refuelling nozzle 12 is either manually or automatically shut off allowing the poppet valve member 18 to return to its closed condition preventing the flow of fuel to the valve assembly 10;
- 25 8. The resultant pressure drop of fuel within the piston chamber 34 means that the piston head 36 (as urged by the spring 40) together with the associated diffuser 28 returns to

8.

a forward position for closure of the rearward fluid passageway 26, regardless of whether the front poppet 18 is opened by a nozzle or any other means.

Importantly, and as best shown in Figure 4, if the poppet valve member 18 is depressed open the check valve member 28 will not open unless sufficient fluid pressure is provided within the piston chamber 34. This means that fuel cannot be drained from the tank unless the check valve member 28 is hydraulically actuated. This will be the case whether or not the nozzle 12 is connected and turned ON. This particular design of the valve assembly 10 also prevents manual overriding of this hydraulic actuation insofar as the piston 36 itself and the check valve member or diffuser 28 are effectively inaccessible.

Now that a preferred embodiment of the present invention has been described in some detail it will be apparent to those skilled in the art that the valve assembly has the following advantages:

1. The valve assembly and in particular the check valve which is hydraulically actuated provides no real means of being overridden and thus protects against pilferage of fuel from a tank;
2. The check valve provides a minimal increase in pressure drop which means that the need or temptation for manual overriding of automatic shut-off is not increased where it could otherwise lead to overfilling and create environmental damage, wastage of fuel and possibly structural damage or rupturing of tanks;
3. The valve assembly cannot be forcibly overridden because there is no mechanical link between the poppet valve member and check valve member which is a feature of at least one example of the prior art;
4. The valve assembly has the check valve member "protected" and therefore cannot be overridden by forcing a stiff wire or other element through the open receiver poppet and against the disc style check valve of the prior art; and
5. The valve assembly provides both a poppet valve and check valve each being conveniently in a normally closed state.

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Those skilled in the art will appreciate that the invention described herein is susceptible to variations and modifications other than those specifically described. For example, the hydraulic actuator may vary from the piston assembly described provided it is effectively hydraulically operated and addresses the problems identified by the invention. The hydraulic
5 actuator and/or check valve could be mounted remote from or downstream of the poppet valve member. The check valve member need not be of the diffuser-type provided it effectively provides for opening and closure of the rearward fluid passageway. Although the embodiment described has been installed directly into a tank, the axial discharge of fuel from the check valve lends itself to mounting to a length of pipe or the like. All such variations and
10 modifications are to be considered within the scope of the present invention and nature of which is to be determined from the foregoing description.

10.

CLAIMS

1. A valve assembly comprising:

a poppet valve housing being adapted to provide releasable coupling for a refilling nozzle and including a forward elongated fluid passageway;

5 a poppet valve member slidably mounted within the poppet valve housing for opening and closure of the forward fluid passageway;

a check valve body connected to the poppet valve housing and including a rearward elongated fluid passageway;

10 a check valve member movably coupled to the check valve body for opening and closure of the rearward fluid passageway;

a hydraulic actuator located within the check valve body and operatively coupled to the check valve member whereby in operation fluid pressure alone acting on the hydraulic actuator effects movement of the check valve member for the opening of the rearward fluid passageway.

15 2. A valve assembly as defined in claim 1 wherein the check valve member is coupled to the check valve body independent of the poppet valve member.

3. A valve assembly as defined in either of claims 1 or 2 wherein the hydraulic actuator comprises a piston assembly including a piston housing secured within the check valve body and having a piston chamber, and a piston head slidably mounted within the piston chamber and connected to the check valve member via a piston rod.

20 4. A valve assembly as defined in claim 3 wherein the piston assembly also includes piston biasing means urging the check valve member into seated engagement with the piston housing.

25 5. A valve assembly as defined in claim 4 wherein the piston housing includes a port into the piston chamber and arranged to provide hydraulic fluid pressure against the piston head and the piston biasing means to force opening of the check valve member.

11.

6. A valve assembly as defined in any one of the preceding claims also comprising a poppet valve body mounted within the poppet valve housing and including a cylindrical bore for guided and sliding movement of the poppet valve member.
7. A valve assembly as defined in claim 6 wherein the poppet valve body is secured to the piston housing at its forward end.
8. A valve assembly as defined in either of claims 6 or 7 further comprising poppet valve biasing means housed within the cylindrical bore and arranged to urge the poppet valve member into seated engagement with the poppet valve housing for closure of the forward fluid passageway.
9. A valve assembly as defined in any one of the preceding claims wherein the check valve member is in the form of a generally cylindrical shaped diffuser.
10. A valve assembly as defined in claim 9 wherein the diffuser is retained for reciprocating movement within the rearward fluid passageway, via a retaining element.
11. A valve assembly as defined in either of claims 10 or 11 wherein the diffuser is guided for reciprocating movement via an annular bearing and adjacent sealing arrangement.
12. A valve assembly as defined in any one of the preceding claims wherein the valve assembly is adapted for use with a dry-break refuelling nozzle.

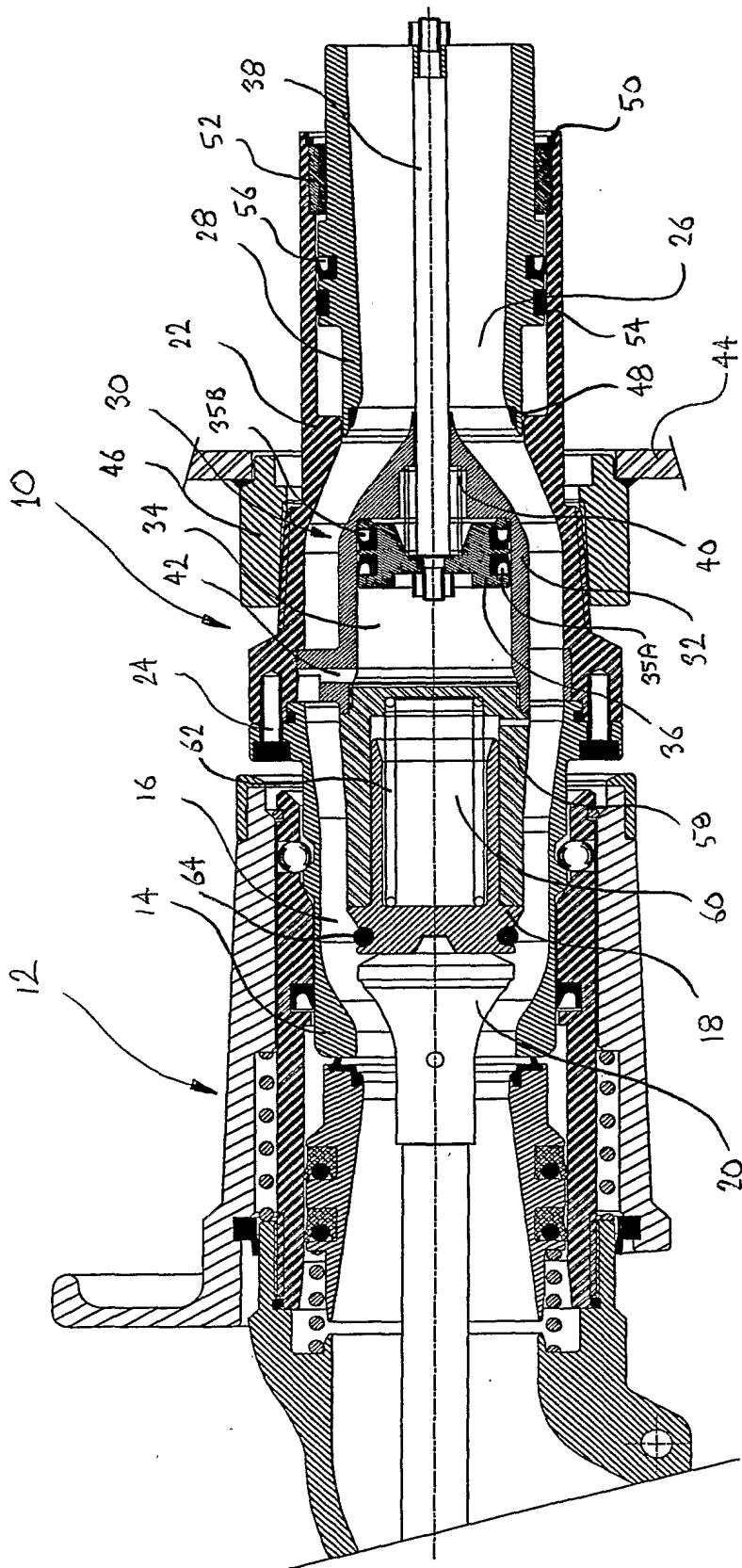


FIGURE 1

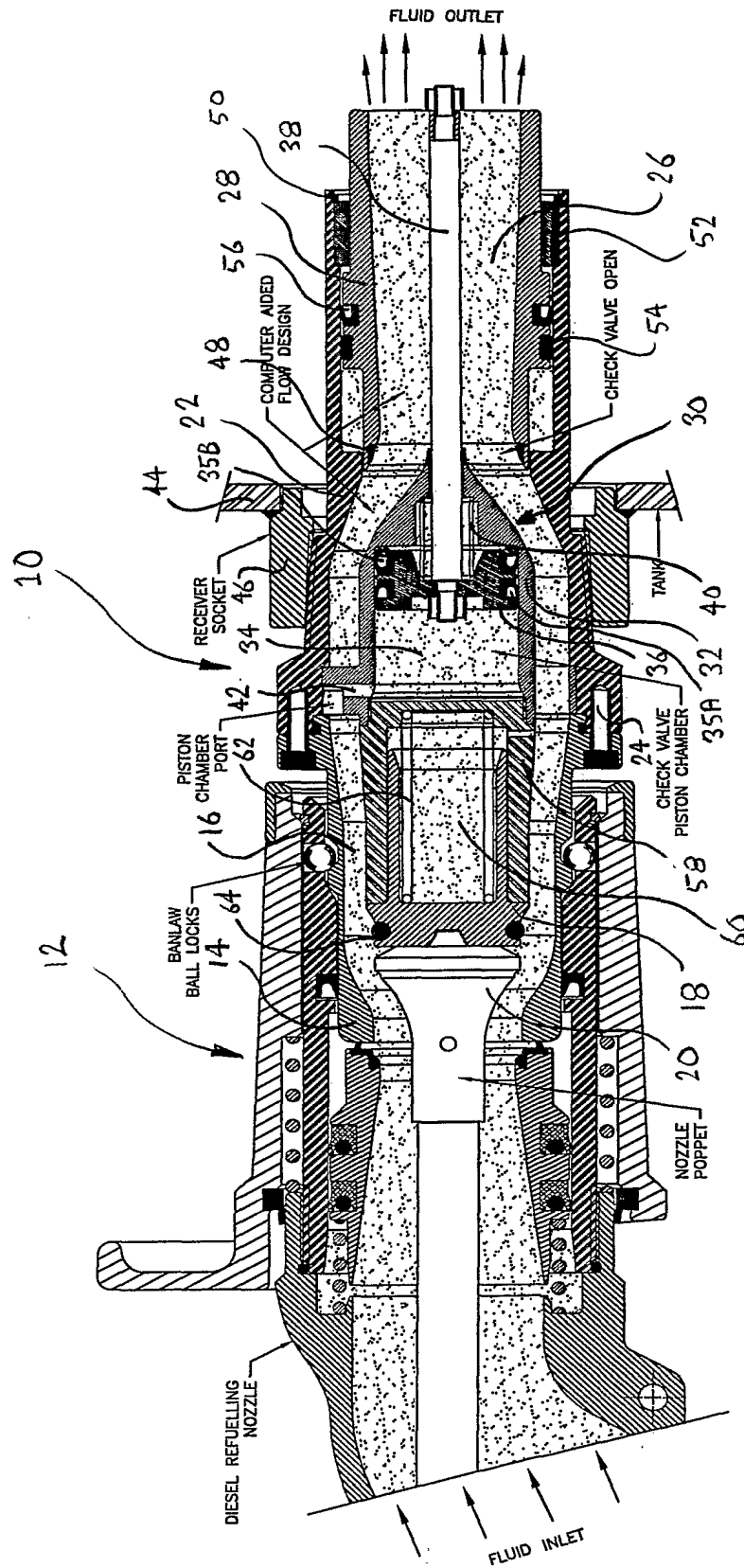


FIGURE 2

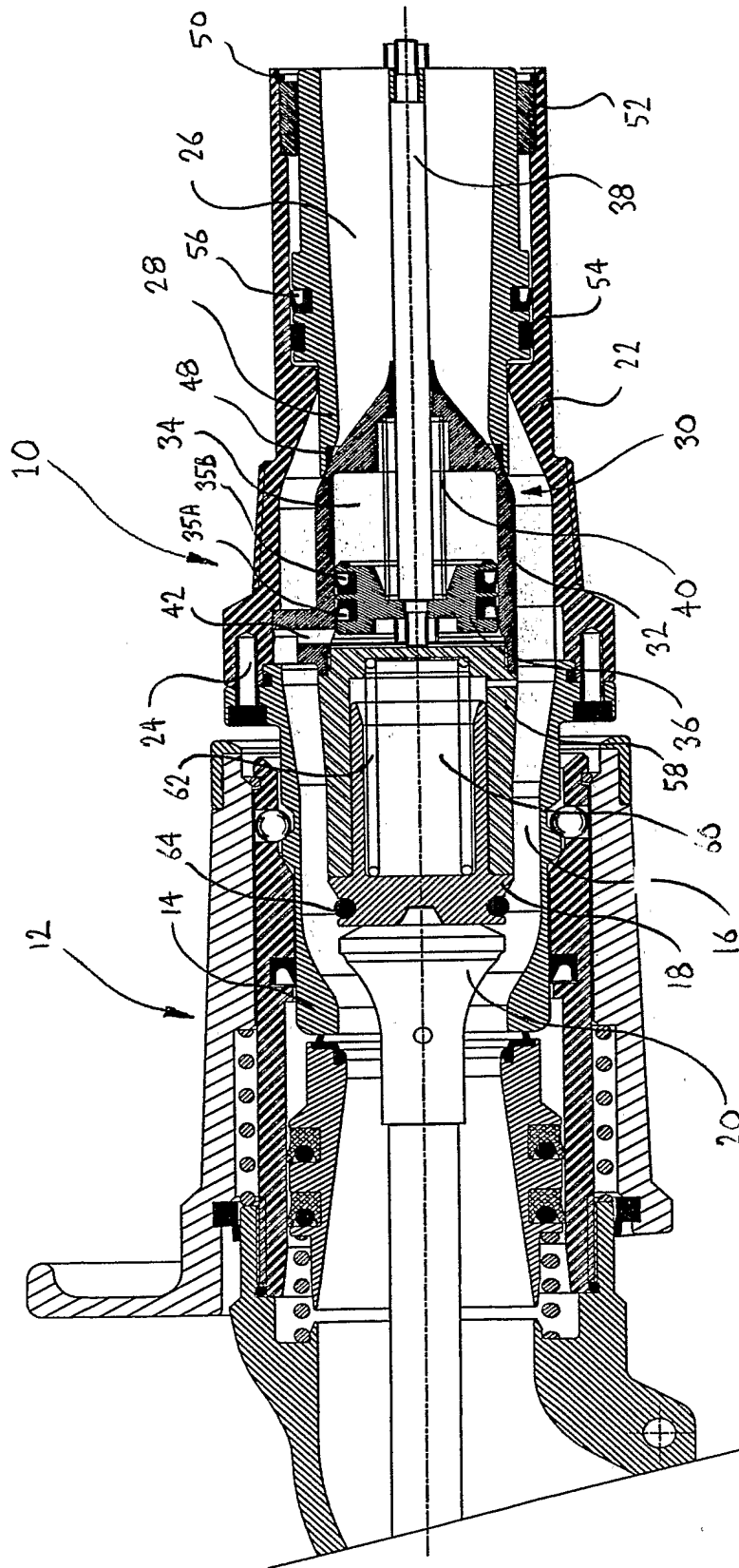


FIGURE 3

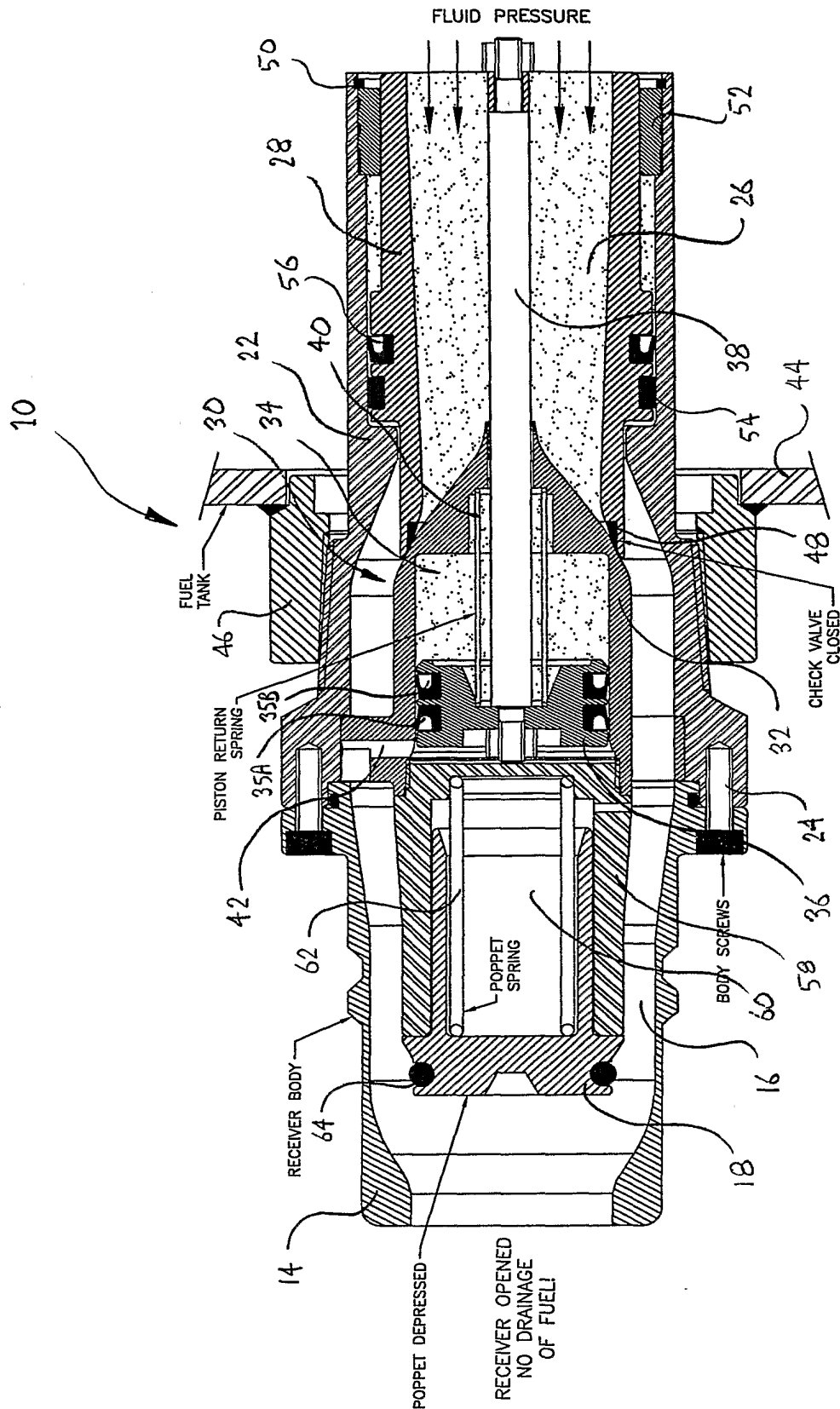
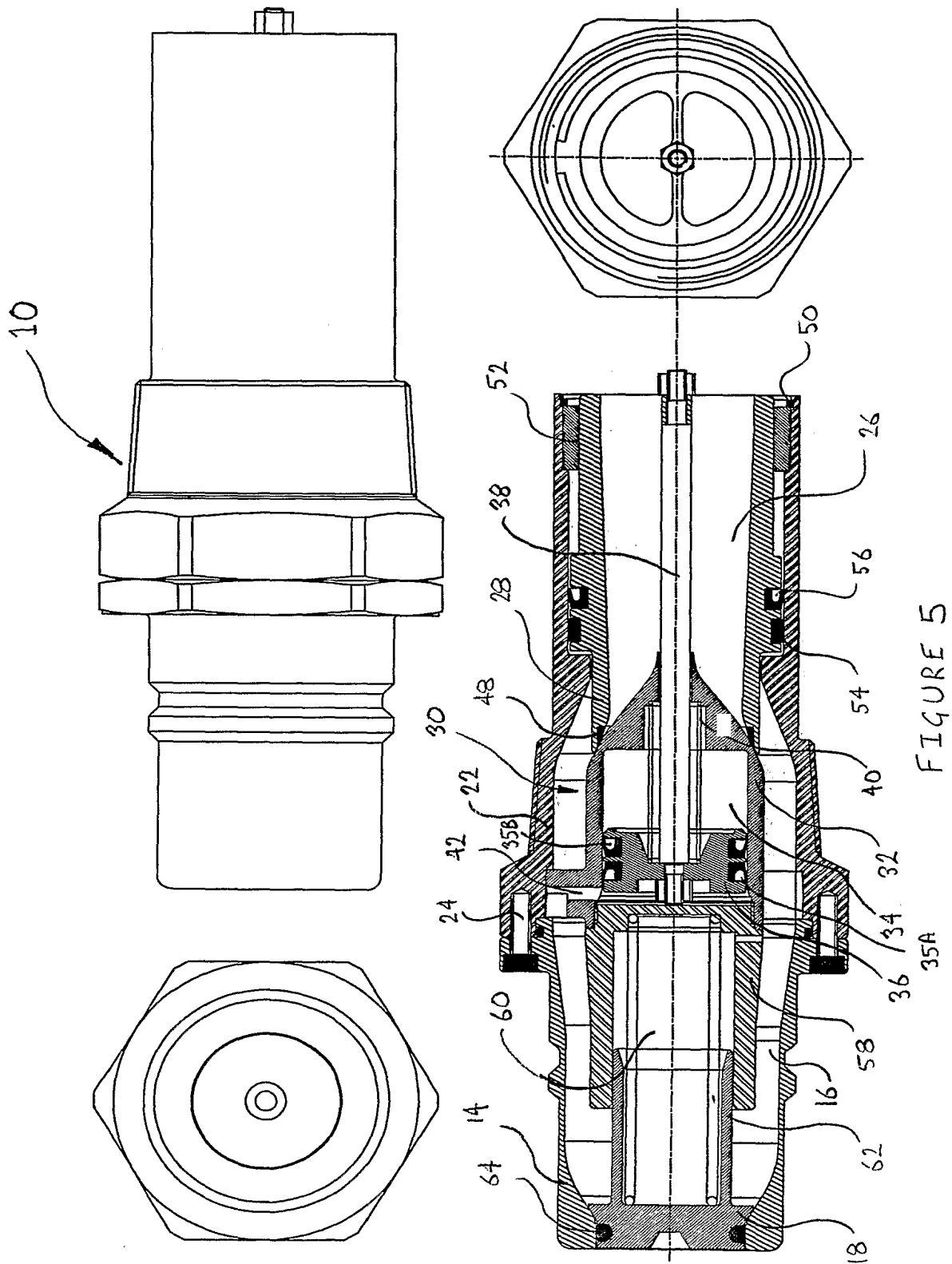


FIGURE 4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2007/001271

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

F16K 21/04 (2006.01) *F16K 15/18* (2006.01) *F16L 37/28* (2006.01)*B67D 5/377* (2006.01) *F16K 17/04* (2006.01)

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)

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)

DWPI - IPC F16K-, B67D- & keywords (valve, nozzle, poppet, plunger, check, return, fluid, fuel, actuator, control, piston, bias, urge, spring) and like terms; Esp@ce - IPC F16K 21/-, F16L 37/- & keywords (fuel, check, coupling, valve) & like terms; Google Patents & keywords (fuel, coupling, dry break) & like terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5813432 A (ELSDON et al) 29 September 1998 Whole of document	1,2,6,7,8,12
A	US 5078170 A (HENRY) 7 January 1992 Whole of document	1, 12
A	US 6672327 B1 (KRYWITSKY) 6 January 2004 Whole of document	1, 12



Further documents are listed in the continuation of Box C



See patent family annex

* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
12 October 2007Date of mailing of the international search report
19 OCT 2007Name and mailing address of the ISA/AU
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2007/001271

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
US	5813432	AU	81019/94	CA	2102569	CA	2175903
		EP	0728120	WO	9512545		
US	5078170	NONE					
US	6672327	CA	2354467	CA	2428072	CA	2431324
		US	6981513	US	7152630	US	2002170596
		US	2003000572	US	2006289062	US	2007039657
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.							
END OF ANNEX							

Electronic Patent Application Fee Transmittal

Application Number:				
Filing Date:				
Title of Invention:	MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY			
First Named Inventor/Applicant Name:	Ricky Dean Shock			
Filer:	Matthew L. Koziarz/Andrea DeHart			
Attorney Docket Number:	67846-008PUS1			
Filed as Large Entity				
Filing Fees for Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	280	280
UTILITY SEARCH FEE	1111	1	600	600
UTILITY EXAMINATION FEE	1311	1	720	720
REQUEST FOR PRIORITIZED EXAMINATION	1817	1	4000	4000
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	1202	2	80	160
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
PROCESSING FEE, EXCEPT PROV. APPLS.	1830	1	140	140
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				5900

Electronic Acknowledgement Receipt

EFS ID:	27178227
Application Number:	15290371
International Application Number:	
Confirmation Number:	3001
Title of Invention:	MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY
First Named Inventor/Applicant Name:	Ricky Dean Shock
Customer Number:	26096
Filer:	Matthew L. Koziarz/Andrea DeHart
Filer Authorized By:	Matthew L. Koziarz
Attorney Docket Number:	67846-008PUS1
Receipt Date:	11-OCT-2016
Filing Date:	
Time Stamp:	14:46:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$5900
RAM confirmation Number	101216INTEFSW00001315501482
Deposit Account	501482
Authorized User	Andrea DeHart

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and examination processing fees)

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	TrackOne Request	aia0424.pdf	129655	no	2
			7097b84c197d16fbc90dd9d4a6c74b22c2eb25e2		
Warnings:					
Information:					
2	Application Data Sheet	ADS.pdf	1793039	no	8
			9e0254be35e895904fcfced89a424eb3e4a2495e		
Warnings:					
Information:					
3		008PUS1_Application.pdf	154949	yes	24
			9b7dccdb2ee3de0eb2108c34e398187dbd6a123e		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	20	
	Claims		21	23	
	Abstract		24	24	
Warnings:					
Information:					
4	Drawings-only black and white line drawings	008PUS1_FormalDrawings.pdf	246220	no	19
			b7dccd8d30ff870d527ee46a9f974191cf424ce		
Warnings:					
Information:					
5	Information Disclosure Statement (IDS) Form (SB08)	US_IDS_Form_SB_08a_withapp.pdf	614066	no	9
			fcf5c93ac19744fc7289dfae25e4916ca33fbb9		

PERMIAN GLOBAL, INC. AND MANTICORE FUELS, LLC EXHIBIT 1011. Page 200

Warnings:					
Information:					
6	Non Patent Literature	FrackShack_SeriesE.pdf	291115	no	2
			0904f27b422214c85368e41f230daa94136c ba4b		
Warnings:					
Information:					
7	Non Patent Literature	FrackShack_Service.pdf	295275	no	2
			3a539ad45909c50822c92a307400b00ebd1 2c058		
Warnings:					
Information:					
8	Non Patent Literature	FracShack_DesignBenefits.pdf	437528	no	3
			d497b3b224d34aeb01725af205d07409503 4dfcb		
Warnings:					
Information:					
9	Non Patent Literature	FracShack_Safety.pdf	603352	no	3
			de73ad3c804ba146f4e8b4cc5afb026bc53 dc8f9		
Warnings:					
Information:					
10	Non Patent Literature	FracShack_SeriesA.pdf	291214	no	2
			69299ddb4eac1ad43321b0f705da046058 bcfd4		
Warnings:					
Information:					
11	Non Patent Literature	FracShack_SeriesB.pdf	291575	no	2
			f232a411fa5cc2ea86bc6eb2b06b319345e0 634a		
Warnings:					
Information:					
12	Non Patent Literature	FracShack_SeriesC.pdf	287664	no	2
			0783bfbb92da6d3096b214d47245697d49 86cada		
Warnings:					
Information:					
PERMIAN GLOBAL, INC. AND MANTICORE FUELS, LLC EXHIBIT 1011, Page 201					

13	Non Patent Literature	FracShack_SeriesD.pdf	289022	no	2
			36f1fbdcdb185bfff626c61409d67fb5933bfb2f4		
Warnings:					
Information:					
14	Non Patent Literature	FracShack_SeriesEG.pdf	295519	no	2
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Information:					
15	Non Patent Literature	FracShack_Welcome.pdf	335305	no	2
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Information:					
16	Non Patent Literature	FracShak_Technology1.pdf	359723	no	3
			37107df2b9e7b16a6fe812af52379529d177193d		
Warnings:					
Information:					
17	Non Patent Literature	Mann_Teknik_AB_DD_Couplings.pdf	232151	no	4
			fadccl32f2c28032f551ba00687788113490014b9		
Warnings:					
Information:					
18	Non Patent Literature	Mann_Teknik_AB_Dry_Aviation_Couplings.pdf	208266	no	4
			5b690ddb16c524fa560e00520c6a25ef9d9affa5		
Warnings:					
Information:					
19	Non Patent Literature	TexasOil_2015.pdf	1661589	no	2
			fa7943b2477c7e12bb574edd867aa8ef3b1687bf		
Warnings:					
Information:					

20	Non Patent Literature	Waterman_2013.pdf	150176	no	3
			9724b72ce50a311c345633380bc0118555ad5a49		
Warnings:					
Information:					
21	Foreign Reference	GB2485832.pdf	1751108	no	50
			eda34a742ecebec72c433a0156a88a69dadf75e4		
Warnings:					
Information:					
22	Foreign Reference	WO0177006A1.pdf	1685588	no	48
			34e27c3142b24917cc5b8d74858ace79bfff008d0		
Warnings:					
Information:					
23	Foreign Reference	WO2006005686A1.pdf	518426	no	11
			64d31ba12374f19cc0a0f43056ff1fd83c4d4ada		
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Information:					
24	Foreign Reference	WO2008083830A2.pdf	590566	no	14
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Warnings:					
Information:					
25	Foreign Reference	WO2009026607.pdf	451842	no	19
			2cd2ef4a8735889bb97f3b09637a77bd83b8ba6d		
Warnings:					
Information:					
26	Fee Worksheet (SB06)	fee-info.pdf	40215	no	2
			781c51b8193a64840041a1ddfd4d0c69cc72d6ef2		
Warnings:					
Information:					
Total Files Size (in bytes):			14005148		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

**CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION
UNDER 37 CFR 1.102(e) (Page 1 of 1)**

First Named Inventor:	Ricky Dean Shock	Nonprovisional Application Number (if known):	
Title of Invention:	MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY		

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently \$0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.
2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.
3. The applicable box is checked below:

I. ☒ Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)

- i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.
---OR---
(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.
- ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, or the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

II. ☐ Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)

- i. A request for continued examination has been filed with, or prior to, this form.
- ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
- iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
- iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
- v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature <u>/Matthew L. Koziarz/</u>	Date <u>2016-10-11</u>
Name (Print/Typed) <u>Matthew L. Koziarz</u>	Practitioner Registration Number <u>53154</u>

Note: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.*

☒ *Total of 1 forms are submitted.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	67846-008PUS1
		Application Number	
Title of Invention	MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY		
<p>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.</p> <p>This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</p>			

Secrecy Order 37 CFR 5.2:

<input type="checkbox"/>	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
--------------------------	---

Inventor Information:

Inventor	1				Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Ricky	Dean	Shock			
Residence Information (Select One) • <input checked="" type="radio"/> US Residency <input type="radio"/> Non US Residency <input type="radio"/> Active US Military Service						
City	Victoria	State/Province	TX	Country of Residence	US	
Mailing Address of Inventor:						
Address 1	34 Hill Creek Lane					
Address 2						
City	Victoria	State/Province	TX			
Postal Code	77905	Country	US			
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button. Add						

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).	
<input type="checkbox"/> An Address is being provided for the correspondence information of this application.	
Customer Number	26096
Email Address	Add Email Remove Email

Application Information:

Title of the Invention	MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY		
Attorney Docket Number	67846-008PUS1	Small Entity Status Claimed	<input type="checkbox"/>
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	19	Suggested Figure for Publication (if any)	1

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	67846-008PUS1
		Application Number	
Title of Invention	MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY		

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not be** the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	<input checked="" type="radio"/> Customer Number	<input type="radio"/> US Patent Practitioner	<input type="radio"/> Limited Recognition (37 CFR 11.9)
Customer Number			

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	<input type="text"/>	<input type="button" value="Remove"/>
Application Number	Continuity Type	Prior Application Number
<input type="text"/>	<input type="text"/>	<input type="text"/>
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.		<input type="button" value="Add"/>

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	67846-008PUS1
		Application Number	
Title of Invention	MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY		

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	67846-008PUS1
	Application Number	
Title of Invention	MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	67846-008PUS1
		Application Number	
Title of Invention	MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant	1	Remove
<p>If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.</p> <p style="text-align: right;">Clear</p>		
<input checked="" type="radio"/> Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.		Person who shows sufficient proprietary interest
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:		
<div style="border: 1px solid black; height: 20px; width: 100%;"></div>		
Name of the Deceased or Legally Incapacitated Inventor: <div style="border: 1px solid black; height: 20px; width: 100%;"></div>		
If the Applicant is an Organization check here. <input checked="" type="checkbox"/>		
Organization Name	Fuel Automation Station, LLC	
Mailing Address Information For Applicant:		
Address 1	335 E. Maple	
Address 2		
City	Birmingham	State/Province MI
Country	US	Postal Code 48009
Phone Number		Fax Number
Email Address		
Additional Applicant Data may be generated within this form by selecting the Add button. Add		

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	67846-008PUS1
		Application Number	
Title of Invention	MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY		

Assignee	1			
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
				<input type="button" value="Remove"/>
If the Assignee or Non-Applicant Assignee is an Organization check here.				<input type="checkbox"/>
Prefix	Given Name	Middle Name	Family Name	Suffix
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1		<input type="text"/>		
Address 2		<input type="text"/>		
City	<input type="text"/>	State/Province	<input type="text"/>	
Country ⁱ	<input type="text"/>	Postal Code	<input type="text"/>	
Phone Number	<input type="text"/>	Fax Number	<input type="text"/>	
Email Address	<input type="text"/>			
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				<input type="button" value="Add"/>

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the **INITIAL** filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	67846-008PUS1
		Application Number	
Title of Invention	MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY		

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MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY

BACKGROUND

[0001] Hydraulic fracturing (also known as fracking) is a well-stimulation process that utilizes pressurized liquids to fracture rock formations. Pumps and other equipment used for hydraulic fracturing typically operate at the surface of the well site. The equipment may operate semi-continuously, until refueling is needed, at which time the equipment may be shut-down for refueling. Shut-downs are costly and reduce efficiency. More preferably, to avoid shut-downs fuel is replenished in a hot-refueling operation while the equipment continues to run. This permits fracking operations to proceed fully continuously; however, hot-refueling can be difficult to reliably sustain for the duration of the fracking operation.

SUMMARY

[0002] A distribution station according to an example of the present disclosure includes a mobile trailer, a pump on the mobile trailer, first and second manifolds on the mobile trailer and fluidly connected with the pump, a plurality of reels on the mobile trailer, a plurality of hoses connected, respectively, with the reels. A portion of the reels are connected with the first manifold and another portion of the reels are connected with the second manifold. Valves on the mobile trailer are each situated between one of the first or second manifolds and a respective different one of the hoses. Fluid level sensors are associated with respective different ones of the hoses. The reels are arranged on first and second opposed sides in the mobile trailer, with an aisle walkway down the middle of the mobile trailer.

[0003] In a further embodiment of any of the foregoing embodiments, the reels on each of the first and second opposed sides are arranged in upper and lower rows of reels.

[0004] A further embodiment of any of the foregoing embodiments includes first and second support racks on which the reels are supported. The first support rack is arranged on the first side and the second support rack arranged on the second side.

[0005] In a further embodiment of any of the foregoing embodiments, the aisle walkway has an aisle width and the reels have a reel diameter, and the aisle width is greater than the reel diameter by a factor of at least 1.3.

[0006] In a further embodiment of any of the foregoing embodiments, the trailer has a trailer width of no greater than about 96 inches.

[0007] In a further embodiment of any of the foregoing embodiments, a ratio of a number of reels in the upper row to a number of reels in the lower row is 1:1.

[0008] In a further embodiment of any of the foregoing embodiments, the mobile trailer includes a trailer end wall that has an outside door, and an inside wall that defines first and second compartments in the mobile trailer. The outside door opens into the first compartment, and at least the manifolds and the reels are in the first compartment.

[0009] In a further embodiment of any of the foregoing embodiments, the inside wall includes an inside door providing access between the first compartment and the second compartment. The aisle walkway extends from the outside door to the inside door.

[0010] A further embodiment of any of the foregoing embodiments includes a controller in the second compartment. The controller is configured to operate the valves.

[0011] In a further embodiment of any of the foregoing embodiments, the second compartment is insulated with a fire resistant or retardant material.

[0012] In a further embodiment of any of the foregoing embodiments, the aisle walkway has an aisle width and the reels have a reel diameter, and the aisle width is greater than the reel diameter by a factor of at least 1.3.

[0013] In a further embodiment of any of the foregoing embodiments, the aisle width is greater than the reel diameter by a factor of at least 1.5.

[0014] In a further embodiment of any of the foregoing embodiments, the aisle walkway has an aisle width and the mobile trailer has a trailer width, and a ratio of the trailer width to the aisle width is no greater than 5.

[0015] In a further embodiment of any of the foregoing embodiments, the ratio of the trailer width to the aisle width is greater than 2.

[0016] In a further embodiment of any of the foregoing embodiments, the ratio of the trailer width to the aisle width is equal to or less than 4.

[0017] A further embodiment of any of the foregoing embodiments includes a floor pan in the mobile trailer.

[0018] A distribution station according to an example of the present disclosure includes a mobile trailer, a pump on the mobile trailer, first and second manifolds on the mobile trailer and fluidly connected with the pump, and a plurality of reels on the mobile trailer. A plurality of hoses are connected, respectively, with the reels. A portion of the reels are connected with the first manifold and another portion of the reels are connected with the second manifold. Valves on the mobile trailer are situated between one of the first or second manifolds and respective different ones of the hoses. A plurality of fluid level sensors are associated with respective different ones of the hoses. The mobile trailer includes first and second opposed

trailer side walls. A first group of the hoses are deployable from the first trailer side wall and a second group of the hoses are deployable from the second trailer side wall.

[0019] In a further embodiment of any of the foregoing embodiments, the reels are arranged on first and second opposed sides in the mobile trailer such that there is an aisle walkway down the middle of the mobile trailer.

[0020] In a further embodiment of any of the foregoing embodiments, the reels on each of the first and second opposed sides are arranged in upper and lower rows of reels.

[0021] In a further embodiment of any of the foregoing embodiments, the aisle walkway has an aisle width and the reels have a reel diameter, and the aisle width is greater than the reel diameter by a factor of at least 1.3.

[0022] In a further embodiment of any of the foregoing embodiments, the mobile trailer has a trailer width of no greater than about 96 inches.

[0023] A further embodiment of any of the foregoing embodiments includes a floor pan in the mobile trailer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The various features and advantages of the present disclosure will become apparent to those skilled in the art from the following detailed description. The drawings that accompany the detailed description can be briefly described as follows.

[0025] Figure 1 illustrates an example mobile distribution station.

[0026] Figure 2 illustrates an internal layout of a mobile distribution station.

[0027] Figure 3 illustrates an isolated view of hose reels on a support rack used in a mobile distribution station.

[0028] Figure 4 illustrates an example of a connection between a manifold, a control valve, and a reel.

[0029] Figure 5 illustrates a sectioned view of an example hose for a mobile distribution station.

[0030] Figure 6 illustrates an example of an integrated fuel cap sensor for a mobile distribution station.

[0031] Figure 7 illustrates an example of the routing of a sensor communication line through a reel in a mobile distribution station.

[0032] Figure 8 illustrates an example of a mobile distribution station with an integrated floor pan.

[0033] Figure 9 illustrates a system that can be used to remotely monitor and manage one or more mobile distribution stations.

[0034] Figure 10 illustrates a workflow logic diagram that represents an example of a method for managing one or more mobile distribution stations.

[0035] Figure 11 illustrates another workflow logic diagram that represents an example of a method for managing one or more mobile distribution stations.

DETAILED DESCRIPTION

[0036] Figure 1 illustrates a mobile distribution station 20 and Figure 2 illustrates an internal layout of the station 20. As will be described, the station 20 may serve in a “hot-refueling” capacity to distribute fuel to multiple pieces of equipment while the equipment is running, such as fracking equipment at a well site. As will be appreciated, the station 20 is not limited to applications for fracking or for delivering fuel. The examples herein may be presented with respect to fuel delivery, but the station 20 may be used in mobile delivery of other fluids, in other gas/petroleum recovery operations, or in other operations where mobile refueling or fluid delivery will be of benefit.

[0037] In this example, the station 20 includes a mobile trailer 22. Generally, the mobile trailer 22 is elongated and has first and second opposed trailer side walls W1 and W2 that join first and second opposed trailer end walls E1 and E2. Most typically, the trailer 22 will also have a closed top (not shown). The trailer side walls W1/W2 define a trailer width, TW. The mobile trailer 22 may have wheels that permit the mobile trailer 22 to be moved by a vehicle from site to site to service different hot-refueling operations.

[0038] In this example, the mobile trailer 22 has two compartments. A first compartment 24 includes the physical components for distributing fuel, such as diesel fuel, and a second compartment 26 serves as an isolated control room for managing and monitoring fuel distribution. The compartments 24/26 are separated by an inside wall 28a that has an inside door 28b. The second compartment 26 may be insulated with a fire resistant or retardant material 26a. In the event of a fire threat, a worker may take cover in the second compartment 26. The fire resistant or retardant material 26a may shield the second compartment and thus temporarily protect the worker under such circumstances. The second compartment 26 may include an auxiliary escape door to provide external egress from the trailer 22. Thus, if needed, a worker may exit the trailer 22 other than by the first compartment 24.

[0039] The first compartment 24 includes one or more pumps 30. Fuel may be provided to the one or more pumps 30 from an external fuel source, such as a tanker truck on

the site. On the trailer 22, the one or more pumps 30 are fluidly connected via a fuel line 32 with a high precision register 34 for metering fuel. The fuel line 32 may include, but is not limited to, hard piping. In this example, the fuel line 32 includes a filtration and air eliminator system 36a and one or more sensors 36b. Although optional, the system 36a is beneficial in many implementations, to remove foreign particles and air from the fuel prior to delivery to the equipment. The one or more sensors 36b may include a temperature sensor, a pressure sensor, or a combination thereof, which assist in fuel distribution management.

[0040] The fuel line 32 is connected with one or more manifolds 38. In the illustrated example, the station 20 includes two manifolds 38 that arranged on opposed sides of the compartment 24. As an example, the manifolds 38 are elongated tubes that are generally larger in diameter than the fuel line 32 and that have at least one inlet and multiple outlets. Each hose 40 is wound, at least initially, on a reel 42 that is rotatable to extend or retract the hose 40 externally through one or more windows of the trailer 22. Each reel 42 has a reel diameter RD, which is the outside diameter or dimension of the reel 42. Most typically, all or substantially all of the reels 42 will be the same size and thus have a common reel diameter RD. Each reel 42 may have an associated motor to mechanically extend and retract the hose 40.

[0041] As shown in an isolated view in Figure 3, the reels 42 are mounted on a support rack 42a. In this example, the support rack 42a is configured with upper and lower rows of reels 42. For instance, a ratio of the number of reels 42 in the upper row to a number of reels in the lower row on the support rack 42a is 1:1. As an example, each row has five reels 42 such that each support rack 42a provides ten reels 42 and thus ten hoses 40. There are two support racks 42a (Figure2) arranged on opposed sides of the first compartment 24. The reels 42 are thus likewise arranged on opposed sides of the first compartment 24 in the trailer 22. The station 20 therefore can provide twenty hoses 40 in the illustrated arrangement, with ten hoses 40 deployable on each side of the station 20. For instance, the first group of ten hoses 40 on one side of the compartment 24 are deployable from the first trailer side wall W1 and the second group of ten hoses 40 are deployable from the second trailer side wall W2. As will be appreciated, fewer or additional reels and hoses may be used in alternative examples.

[0042] An aisle walkway (A) runs down the middle of the trailer 22. In this example, the aisle walkway A runs between the support racks 42a from an outside door E to the inside door 28b. Most typically, the aisle walkway A will include the space or volume through which workers walk to operate the station 20. The aisle walkway A has an aisle width A1. As an example, the aisle width A1 is the largest constant width walkway down the trailer

22 adjacent at least the reels 42 that is not intruded upon by affixed equipment in the trailer 22, such as the reels 42, support racks 42a, other support structures, etc.

[0043] The size of the aisle width A can contribute to reducing the potential for undesired incidents. For instance, there may be two or three or more workers that walk up and down the aisle walkway A in connection with their job duties. The workers need space to potentially pass by each other in the aisle walkway A and carry equipment through the aisle walkway A without bumping into each other or into equipment affixed in the trailer 22.

[0044] The aisle width A1, however, is not unlimited and is subject to space availability and other factors relating to the performance of the station 20. For instance, the reel diameter RD relates to the lengths of hoses that can be stored on the reels 42. A relatively large reel diameter RD can accommodate a long hose winding, while a relatively smaller reel diameter RD would only accommodate a shorter hose winding. Longer hoses potentially provide greater access to equipment on a site that is located farther from the station, but longer hoses require more space in a station than shorter hoses due to the size of the reel needed to wind the longer hose. There is thus a multi-faceted interplay between the size and number of reels, arrangement of reels, and size/location of an aisle.

[0045] In a middle aisle arrangement as with the aisle walkway A, the aisle width A1 is greater than the reel diameter RD by a factor of at least 1.3. In a further example, the aisle width A1 is greater than the reel diameter RD by a factor of at least 1.5, and the trailer width TW is no greater than about 96 inches.

[0046] Additionally or alternatively, in a further example, a ratio of the trailer width TW to the aisle width A1 is no greater than 5. In a further example, the ratio of the trailer width TW to the aisle width A1 is also greater than 2. In a further example, the ratio of the trailer width TW to the aisle width A1 is also equal to or less than 4. In a further example, the trailer width TW is no greater than about 96 inches and the ratio of the trailer width TW to the aisle width A1 is greater than 2 and no greater than 5. In a further example of any of the examples herein, the aisle width A1 is between about 30 inches and about 38 inches. The parameters above provide good station performance in combination with good packaging in the trailer 22 and good aisle size for worker movement.

[0047] As shown in a representative example in Figure 4, each hose 40 is connected to a respective one of the reels 42 and a respective one of a plurality of control valves 44. For example, a secondary fuel line 46 leads from the manifold 38 to the reel 42. The control valve 44 is in the secondary fuel line 46. The control valve 44 is moveable between open and closed

positions to selectively permit fuel flow from the manifold 38 to the reel 42 and the hose 40. For example, the control valve 44 is a powered valve, such as a solenoid valve.

[0048] In the illustrated example, the first compartment 24 also includes a sensor support rack 48. The sensor support rack 48 holds integrated fuel cap sensors 50 (when not in use), or at least portions thereof. When in use, each integrated fuel cap sensor 50 is temporarily affixed to a piece of equipment (i.e., the fuel tank of the equipment) that is subject to the hot-refueling operation. Each hose 40 may include a connector end 40a and each integrated fuel cap sensor 50 may have a corresponding mating connector to facilitate rapid connection and disconnection of the hose 40 with the integrated fuel cap sensor 50. For example, the connector end 40a and mating connector on the integrated fuel cap sensor 50 form a hydraulic quick-connect.

[0049] At least the control valves 44, pump or pumps 30, sensor or sensors 36b, and register 34 are in communication with a controller 52 located in the second compartment 26. As an example, the controller 52 includes software, hardware, or both that is configured to carry out any of the functions described herein. In one further example, the controller 52 includes a programmable logic controller with a touch-screen for user input and display of status data. For example, the screen may simultaneously show multiple fluid levels of the equipment that is being serviced.

[0050] When in operation, the integrated fuel cap sensors 50 are mounted on respective fuel tanks of the pieces of equipment that are subject to the hot-refueling operation. The hoses 40 are connected to the respective integrated fuel cap sensors 50. Each integrated fuel cap sensor 50 generates signals that are indicative of the fuel level in the fuel tank of the piece of equipment on which the integrated fuel cap sensor 50 is mounted. The signals are communicated to the controller 52.

[0051] The controller 52 interprets the signals and determines the fuel level for each fuel tank of each piece of equipment. In response to a fuel level that falls below a lower threshold, the controller 52 opens the control valve 44 associated with the hose 40 to that fuel tank and activates the pump or pumps 30. The pump or pumps 30 provide fuel flow into the manifolds 38 and through the open control valve 44 and reel 42 such that fuel is provided through the respective hose 40 and integrated fuel cap sensor 50 into the fuel tank. The lower threshold may correspond to an empty fuel level of the fuel tank, but more typically the lower threshold will be a level above the empty level to reduce the potential that the equipment completely runs out of fuel and shuts down. The controller 52 can also be programmed with a failsafe measure related to the operation of the fuel cap sensors 50. As an example, once a

control valve 44 is open, if the controller 52 does not detect a change in fuel level from the fuel cap sensor 50 associated with the control valve 44 within a preset time period, the controller 52 shuts the pump 30 off and closes the control valve 44. Thus, if a hose 40 were to rupture, spillage of fuel is limited to the volume of fuel in the hose 40. For instance, the preset time period may be three seconds, six seconds, ten seconds, or fifteen seconds, which may limit spillage to approximately fifteen gallons for a given size of hose.

[0052] The controller 52 also determines when the fuel level in the fuel tank reaches an upper threshold. The upper threshold may correspond to a full fuel level of the fuel tank, but more typically the upper threshold will be a level below the full level to reduce the potential for overflow. In response to reaching the upper threshold, the controller 52 closes the respective control valve 44 and ceases the pump or pumps 30. If other control valves 44 are open or are to be opened, the pump or pumps 30 may remain on. The controller 52 can also be programmed with an electronic stop failsafe measure to prevent over-filling. As an example, once an upper threshold is reached on a first tank and the control valve 44 is closed, but the pump 30 is otherwise to remain on to fill other tanks, if the fuel level continues to rise in the first tank, the controller 52 shuts the pump 30 off.

[0053] Multiple control valves 44 may be open at one time, to provide fuel to multiple fuel tanks at one time. Alternatively, if there is demand for fuel from two or more fuel tanks, the controller 52 may sequentially open the control valves 44 such that the tanks are refueled sequentially. For instance, upon completion of refueling of one fuel tank, the controller 52 closes the control valve 44 of the hose 40 associated with that tank and then opens the next control valve 44 to begin refueling the next fuel tank. Sequential refueling may facilitate maintaining internal pressure in the manifold and fuel line 32 above a desired or preset pressure threshold to more rapidly deliver fuel. Similarly, the controller 52 may limit the number of control valves 44 that are open at any one instance in order to maintain the internal pressure in the manifold and fuel line 32 above a desired or preset threshold. The controller 52 may perform the functions above while in an automated operating mode. Additionally, the controller 52 may have a manual mode in which a user can control at least some functions through the PLC, such as starting and stopped the pump 30 and opening and closing control valves 44. For example, manual mode may be used at the beginning of a job when initially filling tanks to levels at which the fuel cap sensors 50 can detect fuel and/or during a job if a fuel cap sensor 50 becomes inoperable. Of course, operating in manual mode may deactivate some automated functions, such as filling at the low threshold or stopping at the high threshold.

[0054] In addition to the use of the sensor signals to determine fuel level, or even as an alternative to use of the sensor signals, the refueling may be time-based. For instance, the fuel consumption of a given piece of equipment may be known such that the fuel tank reaches the lower threshold at known time intervals. The controller 52 is operable to refuel the fuel tank at the time intervals rather than on the basis of the sensor signals, although sensor signals may also be used to verify fuel level.

[0055] The controller 52 also tracks the amount of fuel provided to the fuel tanks. For instance, the register 34 precisely measures the amount of fuel provided from the pump or pumps 30. As an example, the register 34 is an electronic register and has a resolution of about 0.1 gallons. The register 34 communicates measurement data to the controller 52. The controller 52 can thus determine the total amount of fuel used to very precise levels. The controller 52 may also be configured to provide outputs of the total amount of fuel consumed. For instance, a user may program the controller 52 to provide outputs at desired intervals, such as by worker shifts or daily, weekly, or monthly periods. The outputs may also be used to generate invoices for the amount of fuel used. As an example, the controller 52 may provide a daily output of fuel use and trigger the generation of an invoice that corresponds to the daily fuel use, thereby enabling almost instantaneous invoicing.

[0056] In a further example, the integrated fuel cap sensors 50 are each hard-wired to the controller 52. The term “hard-wired” or variations thereof refers to a wired connection between two components that serves for electronic communication there between, which here a sensor and a controller. The hard-wiring may facilitate providing more reliable signals from the integrated fuel cap sensors 50. For instance, the many pieces of equipment, vehicles, workers, etc. at a site may communicate using wireless devices. The wireless signals may interfere with each other and, therefore, degrade communication reliability. Hard-wiring the integrated fuel cap sensors 50 to the controller 52 facilitates reduction in interference and thus enhances reliability.

[0057] In general, hard-wiring in a hot-refueling environment presents several challenges. For example, a site has many workers walking about and typically is located on rough terrain. Thus, as will be described below, each integrated fuel cap sensor 50 is hard-wired through the associated hose 40 to the controller 52.

[0058] Figure 5 illustrates a representative portion of one of the hoses 40 and, specifically, the end of the hose 40 that will be located at the fuel tank of the equipment being refueled. In this example, the hose 40 includes a connector 60 at the end for detachably connecting the hose 40 to the integrated fuel cap sensors 50. The hose 40 is formed of a tube

62 and a sleeve 64 that circumscribes the tube 62. As an example, the tube 62 may be a flexible elastomeric tube and the sleeve 64 may be a flexible fabric sleeve. The sleeve 64 is generally loosely arranged around the tube 62, although the sleeve 64 may closely fit on the tube 62 to prevent substantial slipping of the sleeve 64 relative to the tube 62 during use and handling. Optionally, to further prevent slipping and/or to secure the sleeve 64, bands may be tightened around the hose 40. As an example, one or more steel or stainless steel bands can be provided at least near the ends of the hose 40.

[0059] A plurality of sensor communication lines 66 (one shown) are routed with or in the respective hoses 40. For instance, each line 66 may include a wire, a wire bundle, and/or multiple wires or wire bundles. In one further example, the line 66 is a low milli-amp intrinsic safety wiring, which serves as a protection feature for reducing the concern for operating electrical equipment in the presence of fuel by limiting the amount of thermal and electrical energy available for ignition. In this example, the line 66 is routed through the hose 40 between (radially) the tube 62 and the sleeve 64. The sleeve 64 thus serves to secure and protect the line 66, and the sleeve 64 may limit spill and spewing if there is a hose 40 rupture. In particular, since the line 66 is secured in the hose 40, the line 66 does not present a tripping concern for workers. Moreover, in rough terrain environments where there are stones, sand, and other objects that could damage the line 66 if it were free, the sleeve 64 shields the line 66 from direct contact with such objects. In further examples, the line 66 may be embedded or partially embedded in the tube 62 or the sleeve 64.

[0060] In this example, the line 66 extends out from the end of the hose 40 and includes a connector 68 that is detachably connectable with a respective one of the integrated fuel cap sensors 50. For example, Figure 6 illustrates a representative example of one of the integrated fuel cap sensors 50. The integrated fuel cap sensor 50 includes a cap portion 50a and a fluid level sensor portion 50b. The cap portion 50a is detachably connectable with a port of a fuel tank. The cap portion 50a includes a connector port 50c, which is detachably connectable with the connector 60 of the hose 40. The sensor portion 50b includes a sensor 50d and a sensor port 50e that is detachably connectable with the connector 68 of the line 66. The fuel cap sensor 50 may also include a vent port that attaches to a drain hose, to drain any overflow into a containment bucket and/or reduce air pressure build-up in a fuel tank. Thus, a user may first mount the cap portion 50a on the fuel tank of the equipment, followed by connecting the hose 40 to the port 50c and connecting the line 66 to the port 50e.

[0061] The sensor 50d may be any type of sensor that is capable of detecting fluid or fuel level in a tank. In one example, the sensor 50d is a guided wave radar sensor. A guided

wave radar sensor may include a transmitter/sensor that emits radar waves, most typically radio frequency waves, down a probe. A sheath may be provided around the probe. For example, the sheath may be a metal alloy (e.g., stainless steel or aluminum) or polymer tube that surrounds the probe. One or more bushings may be provided between the probe and the sheath, to separate the probe from the sheath. The sheath shields the probe from contact by external objects, the walls of a fuel tank, or other components in a fuel tank, which might otherwise increase the potential for faulty sensor readings. The probe serves as a guide for the radar waves. The radar waves reflect off of the surface of the fuel and the reflected radar waves are received into the transmitter/sensor. A sensor controller determines the “time of flight” of the radar waves, i.e., how long it takes from emission of the radar waves for the radar waves to reflect back to the transmitter/sensor. Based on the time, the sensor controller, or the controller 52 if the sensor controller does not have the capability, determines the distance that the radar waves travel. A longer distance thus indicates a lower fuel level (farther away) and a shorter distance indicates a higher fuel level (closer).

[0062] The line 66 routes through the hose 40 and back to the reel 42 in the trailer 22. For example, the line 66 is also routed or hard-wired through the reel 42 to the controller 52. Figure 7 illustrates a representative example of the routing in the reel 42. In this example, the reel 42 includes a spindle 42b about which the reel is rotatable. The spindle 42b may be hollow, and the line 66 may be routed through the spindle 42b. The reel 42 may also include a connector 42c mounted thereon. The connector 42c receives the line 66 and serves as a port for connection with another line 66a to the controller 52.

[0063] The lines 66a may converge to one or more communication junction blocks or “bricks” prior to the controller 52. The communication junction blocks may serve to facilitate the relay of the signals back to the controller 52. The communication junction blocks may alternatively or additionally serve to facilitate identification of the lines 66, and thus the signals, with respect to which of the hoses a particular line 66 is associated with. For instance, a group of communication junction blocks may have unique identifiers and the lines 66 into a particular communication junction block may be associated with identifiers. A signal relayed into the controller 52 may thus be associated with the identifier of the communication junction blocks and a particular line 66 of that communication junction block in order to identify which hose the signal is to be associated with. The valves 44 may also communicate with the controller 52 in a similar manner through the communication junction blocks.

[0064] As illustrated in a further example in Figure 8, the station 20 may be further enhanced to reduce the potential for fluid or fuel escape. The trailer 22, depicted here in

phantom, includes a floor pan 80. The floor pan 80 may be formed of metal, polymer, or combinations thereof and serves to reduce or prevent the escape of fluid or fuel from inside the trailer 22. In comparison to a temporary, moveable catch basin, the floor pan 80 is a permanent fixture in the trailer 22, and may be structurally affixed in the trailer 22 by fasteners, adhesive, or the like.

[0065] As an example, the floor pan 80 includes a bottom 80a that joins sides 80b to define a container cavity 80c. For instance, the floor pan 80 lines the bottom portion of the trailer 22. The bottom 80a and sides 80b seal the container cavity 80c such that any fluid or fuel that leaks in the trailer 22 is caught and contained in the floor pan 80, to reduce the potential of spilling or leaking out from the trailer 22. The floor pan 80 may line only the first compartment 24 or may line both the first and second compartments 24/26. In alternative examples, the floor pan 80 may line only a portion of the trailer 22 where there is potential for leak or spill. Most typically, the floor pan 80 will cover a majority of the floor area of the trailer 22 or at least a majority of the first compartment 24. In further examples, a ratio of the width of the floor pan 80 to the minimum height of the sides 80b is no less than 16 and may be up to about 50. In yet a further example, the cavity 80c of the floor pan 80 has a volume of approximately two-hundred gallons and the minimum height of the sides 80b is no less than two inches.

[0066] Optionally, the floor pan 80 may include one or more drain ports in the bottom 80a, sides 80b, or both, to permit controlled drainage of spilled fluid or fuel from the floor pan 80 into a catch container.

[0067] As can be appreciated from the examples herein, the station 20 permits continuous hot-refueling with enhanced reliability. While there might generally be a tendency to choose wireless sensor communication for convenience, a hard-wired approach mitigates the potential for signal interference that can arise with wireless. Moreover, by hard-wiring the sensors through the hoses to the controller, wired communication lines are protected from exposure and do not pose additional concerns for workers on a site. Additionally, the spatial layout of the station 20 permits enhanced station performance in combination with good packaging and aisle size for worker movement.

[0068] Figure 9 illustrates a system 69 for remotely monitoring and/or managing at least one mobile distribution station 20 (A). It is to be appreciated that the system 69 may include additional mobile distribution stations, shown in phantom at 20 (B), 20 (C), and 20 (D) (collectively mobile distribution stations 20), for example. The mobile distribution stations 20 may be located at a single work site or located across several different work sites S1 and S2.

Each mobile distribution station 20 is in communication with one or more servers 71 that are remotely located from the mobile distribution stations 20 and work sites S1/S2. In most implementations, the communication will be wireless.

[0069] The server 71 may include hardware, software, or both that is configured to perform the functions described herein. The server 71 may also be in communication with one or more electronic devices 73. The electronic device 73 is external of or remote from the mobile fuel distribution stations 20. For example, the electronic device 73 may be, but is not limited to, a computer, such as a desktop or laptop computer, a cellular device, or tablet device. The electronic device 73 may communicate and interact in the system 69 via data connectivity, which may involve internet connectivity, cellular connectivity, software, mobile application, or combinations of these.

[0070] The electronic device 73 may include a display 73a, such as an electronic screen, that is configured to display the fuel operating parameter data of each of the mobile distribution stations 20. As an example, the electronic device 73 may display in real-time the operating parameter data of each of the mobile distribution stations 20 in the system 69 to permit remote monitoring and management control of the mobile distribution stations 20. For instance, the operating parameter data may include fuel temperature, fuel pressure, fuel flow, total amount of fuel distributed, operational settings (e.g., low and high fuel level thresholds), or other parameters.

[0071] The server 71 may also be in communication with one or more cloud-based devices 75. The cloud-based device 75 may include one or more servers and a memory for communicating with and storing information from the server 71.

[0072] The server 71 is configured to communicate with the mobile distribution stations 20. Most typically, the server 71 will communicate with the controller 52 of the mobile distribution station 20. In this regard, the controller 52 of each mobile distribution station 20 may be include hardware, software, or both that is configured for external communication with the server 71. For example, each controller 52 may communicate and interact in the system 69 via data connectivity, which may involve internet connectivity, cellular connectivity, software, mobile application, or combinations of these.

[0073] The server 71 is configured to receive operating parameter data from the mobile distribution stations 20. The operating parameter data may include or represent physical measurements of operating conditions of the mobile distribution station 20, status information of the mobile distribution station 20, setting information of the mobile distribution station 20,

or other information associated with control or management of the operation of the mobile distribution station 20.

[0074] For example, the server 71 utilizes the information to monitor and auto-manage the mobile distribution station 20. The monitoring and auto-management may be for purposes of identifying potential risk conditions that may require shutdown or alert, purposes of intelligently enhancing operation, or purposes of reading fuel or fluid levels in real-time via the sensors 50. As an example, the server 71 may utilize the information to monitor or display fuel or fluid levels, or determine whether the fuel operating parameter data is within a preset limit and send a control action in response to the operating parameter data being outside the preset limit. As will be described in further detail below, the control action may be a shutdown instruction to the mobile fuel distribution stations 20, an adjustment instruction to the mobile fuel distribution stations 20, or an alert to the electronic device 73.

[0075] Figure 10 illustrates a workflow logic diagram of an example control method 77 which can be implemented with the system 69 or with other configurations of one or more mobile distribution stations 20 and one or more servers. In general, the illustrated method 77 can be used to provide a shutdown instruction or an alert if operating parameter data of one or more mobile distribution stations 20 is outside of a preset limit. For instance, if fuel pressure or fuel temperature in one of the mobile distribution stations 20 exceeds one or more limits, the method 77 shuts down the mobile distribution station 20 and/or sends an alert so that appropriate action can, if needed, be taken in response to the situation. In particular, in hot-refueling implementations, the ability to automatically shut down or to provide a remote alert may facilitate enhancement of reliable and safe operation.

[0076] Referring to Figure 10, one or more current or instantaneous operating parameters are read (i.e., by the controller 52). An operating parameter may include, but is not limited to, fuel temperature and fuel pressure. Other parameters may additionally or alternatively be used, such as pump speed or power and fuel flow. Parameters may be first order parameters based on first order readings from sensor signals, or second order parameters that are derived or calculated from first order parameters or first order sensor signals. For instance, temperature is a first order parameter and direct detection of temperature to produce signals representative of temperature constitute first order sensor signals. The product of temperature and pressure, for example, is a second order parameter that is based on first order sensor signals of each of temperature and pressure. As will be appreciated, there may be additional types of second order parameters based on temperature, pressure, power, flow, etc., which may or may not be weighted in a calculation of a second order parameter.

[0077] In this example, the current operating parameter is compared with a prior operating parameter stored in memory in the controller 52. A difference in the current operating parameter and the prior operating parameter is calculated to produce a change (delta) value in the operating parameter. The change value is used as the operating parameter data for control purposes in the method 77. The operating parameter data thus represents the change in the operating parameter from the prior reading to the current reading. Use of the change value as the operating parameter data serves to reduce the amount of data that is to be sent in connection with the method 77. For example, the actual operating parameter values may be larger than the change values and may thus require more memory and bandwidth to send than the change values. The change values are sampled and calculated at a predesignated interval rate. In this example, the interval rate is once per second. Each operating parameter is stored in memory for use as the next “prior” operating parameter for comparison with a subsequent “new” operating parameter reading. The controller 52 may be programmed to perform the above steps. As will be appreciated, the steps above achieve data efficiency, and actual values could alternatively or additionally be used if memory and bandwidth permit.

[0078] Each operating parameter data reading (i.e., change value) is published or sent via IoT (Internet of Things) Gateway to an IoT Platform, which may be implemented fully or partially on the server 71 and cloud device 75. The operating parameter data may also contain additional information, such as but not limited to, metadata with time stamp information and identification of the individual mobile distribution station 20. In this example, the operating parameter data of interest is associated with fuel pressure and fuel temperature. In the method 77, the operating parameter data for fuel temperature and fuel pressure are compared to, respectively, a preset fuel temperature shutdown limit and a preset fuel pressure shutdown limit. The shutdown limits may be temperature and pressure limits corresponding to rated limits of the pump 30, fuel line 32, and manifold 38, for example.

[0079] If the temperature or pressure are outside of the preset fuel temperature or pressure shutdown limits, the method 77 initiates a shutdown event. In this example, the shutdown event includes identifying the particular mobile distribution station 20 associated with the temperature or pressure that is outside of the preset limit, forming a shutdown instruction message, and publishing or sending the shutdown instruction message via the IoT Gateway to the corresponding identified mobile distribution station 20.

[0080] Upon receiving the shutdown instruction message, the controller 52 of the identified mobile distribution station 20 validates and executes the shutdown instruction. For instance, shutdown may include shutting off the pump 30 and closing all of the control valves

44. In this example, the method 77 includes a timing feature that waits for confirmation of shutdown. Confirmation may be generated by the controller 52 performing an electronic check of whether the pump 30 is off and the control valves 44 are closed. Confirmation may additionally or alternatively involve manual feedback via input into the controller 52 by a worker at the identified mobile distribution station 20.

[0081] Once shutdown is confirmed by the controller 52, confirmation of shutdown is published or sent via the Iot Gateway to the IoT Platform for subsequent issuance of an alert. If there is no confirmation of shutdown by a maximum preset time threshold, a non-confirmation of shutdown is published or sent for subsequent issuance of an alert.

[0082] If the temperature and/or pressure is not outside of the preset fuel temperature or pressure shutdown limits, the method 77 in this example continues to determine whether the fuel temperature and fuel pressure with are, respectively, outside of a preset fuel temperature threshold limit and a preset fuel pressure threshold limit. The threshold limits will typically be preset at levels which indicate a potential for shutdown conditions. For example, the threshold limits may be intermediate temperature or pressure levels which, if exceeded, may indicate an upward trend in temperature or pressure toward the shutdown limits. In one example, the threshold limits are rate of change thresholds. For instance, a change value in temperature and/or pressure that exceeds a corresponding threshold change limit may be indicative that temperature and/or pressure is rapidly elevating toward the shutdown condition.

[0083] In response to the temperature and/or pressure being outside of the preset fuel temperature or pressure threshold limits, the method 77 initiates an alert event. In this example, the alert event includes initiating an event notification. In the event notification, the method 77 conducts a lookup of notification channels and then issues an alert via one or more selected notification channels, such as an alert on the display 73a. As an example, the notification channels may be selected by user preferences and may include alerts by email, SMS (short message service), and/or mobile device app notification (e.g., banners, badges, home screen alerts, etc.). The event notification is also used for alerts of confirmation and non-confirmation of shutdown. The method 77 thus provides capability to nearly instantaneously issue an alert that can be immediately and readily viewed in real-time on the electronic device 73 so that appropriate action, if needed, can be taken. In one example, such actions may include adjustment of operation settings of the mobile distribution station 20, which may be communicated and implemented via the system 69 from the electronic device 73 to the mobile distribution station 20.

[0084] Figure 11 illustrates a workflow logic diagram of an example control management method 79 which can be implemented with the method 77 and with the system 69 or with other configurations of one or more mobile distribution stations 20 and one or more servers. For example, the method 79 is used to identify shutdown conditions and/or remotely intelligently auto-manage operation of one or more mobile distribution stations 20. The initial portion of the method 79 with respect to generating operating parameters data may be similar to the method 77; however, the method 79 uses the operating parameter data to calculate an efficiency score and identify shutdown conditions or other actions to be taken in response to the efficiency score. For example, the efficiency score is a second order parameter and is a calculation based on multiple fuel operating parameters selected from fuel temperature, fuel pressure, fuel flow, and time. The efficiency score is then compared to an efficiency score shutdown limit. If the calculated efficiency score exceeds the limit, the method 79 initiates the shutdown event as described above. As an example, the efficiency score is the product of a safety score multiplied by one or more of a temperature score, a pressure score, a flow rate score, a tank level score, or the sum of two or more of these scores. For instance, the efficiency score is as shown in Equation I below.

[0085] Equation I:

[0086] Efficiency Score = Safety Score x (Temperature Score + Pressure Score + Flow Rate Score + Tank Level Score).

[0087] In one example, the safety score is a product of a safety factor and logic values of one or zero for each of the temperature score, the pressure score, the flow rate score, and the tank level score. Thus, if any of the temperature score, the pressure score, the flow rate score, or the tank level score fails, resulting in a logic value of zero, the efficiency score will be zero. In response to an efficiency score of zero, the method 79 initiates the shutdown event as described above. The logic values are assigned according to whether the given parameter is within a predetermined minimum/maximum range. If the parameter is within the range, the logic value is one and if the parameter is outside of the range, the value is zero. As an example, the safety score may be determined by:

[0088] Safety Score = (Safety Check Positive Response/Total Safety Checks) * (IF (Temperature Reading between MIN LIMIT and MAX LIMIT) THEN 1 ELSE 0)) * (IF (Pressure Reading between MIN LIMIT and MAX LIMIT) THEN 1 ELSE 0)) * (IF (Flow Rate Reading between MIN LIMIT and MAX LIMIT) THEN 1 ELSE 0)) * (IF (Tank Inventory Reading between MIN LIMIT and MAX LIMIT) THEN 1 ELSE 0)),

[0089] wherein

[0090] Temperature Score = (((Temperature Reading – Min Limit)/ Temperature Reading) + ((Max Limit + Temperature Reading)/ Temperature Reading))/2,

[0091] Pressure Score = (((Pressure Reading – Min Limit)/ Pressure Reading) + ((Max Limit + Pressure Reading)/ Pressure Reading))/2,

[0092] Flow Rate Score = (((Flow Rate Reading – Min Limit)/ Flow Rate Reading) + ((Max Limit + Flow Rate Reading)/ Flow Rate Reading))/2, and

[0093] Tank Level Score = (((Tank Level Reading – Min Limit)/ Tank Level Reading) + ((Max Limit + Tank Level Reading)/ Tank Level Reading))/2.

[0094] In one example, the safety factor includes a calculation based on safety checks of a mobile distribution station 20. For instance, the safety factor is the quotient of positive or passing safety checks divided by the total number of safety check made. A safety check may involve periodic validation of multiple parameters or conditions on the site of a station 20 and/or in the station 20. As examples, the safety check may include validation that electrical power supply is fully functional (e.g., a generator), validation of oil levels (e.g., in a generator), validation of whether there are any work obstructions at the site, etc. Thus, each safety check may involve validation of a set of parameters and conditions. If validation passes, the safety check is positive and if validation does not pass the safety check is negative. As an example, if 5 safety checks are conducted for a station 20 and four of the checks pass and one does not pass, the safety factor is equal to four divided by five, or 0.8.

[0095] The method 79 also uses the efficiency score to actively intelligently auto-manage operation of one or more of the mobile distribution stations 20. For example, the efficiency score is compared in the method 79 with an efficiency score threshold limit or efficiency score range. If the efficiency score is outside of the limit or range, the method 79 initiates an adjustment event to adjust settings of the operating parameters of the mobile distribution station 20. For example, pumping rate or power may be changed to increase or decrease fuel pressure. In further examples in the table below, preset actions are taken in response to efficiency scores within preset ranges.

Efficiency Score	Action
<= 1	SHUTDOWN
>1 AND <= 2	ALERT
>2 AND <= 3	ADJUST SETTINGS
>3 AND <= 4	NO ACTION

[0096] The adjustment event may include forming an adjustment instruction message and publishing or sending the adjustment instruction message to the mobile

distribution station 20 via the IoT Gateway. Upon receiving the adjustment instruction message the controller 52 of the mobile distribution station 20 validates and executes the message. The message constitutes a control action to change one or more of the operating parameters to move the efficiency score within the limit or range. As an example, pumping rate is changed to change fuel pressure. Other parameters may additionally or alternatively be adjusted to change the fuel efficiency score, such as but not limited to, fuel tank upper and lower thresholds, sequence of opening/closing control valves 44, and number of control valves 44 that may be open at one time. Thus, once implemented, the method 79 can serve to auto-adjust operation of one or more of the mobile distribution stations 20, without human intervention, to achieve enhanced or optimize fuel distribution.

[0097] In one example, a rate of fuel consumption of one or more pieces of the equipment may be calculated, and the upper and/or lower fuel level threshold settings are changed in response to the calculated rate of fuel consumption. For instance, if consumption is lower or higher than a given fuel level threshold setting warrants, the fuel level threshold setting is responsively auto-adjusted up or down for more efficient operation. For a low consumption rate, there may be a downward adjustment of the lower fuel level threshold, since there is lower likelihood that the low consumption rate will lead to a fully empty condition in the equipment. Similarly, for a high consumption rate, there may be an upward adjustment of the lower fuel level threshold, since there is higher likelihood that the high consumption rate will lead to a fully empty condition in the equipment. Thus, the mobile distribution station 20 can be operated more efficiently and safely by distributing fuel at proper times to ensure filling the equipment with desired safety margins.

[0098] Similar to the shutdown instruction message described above, the method 79 may include a timing feature that waits for confirmation of adjustment. Once adjustment is confirmed by the controller 52, confirmation of adjustment is published or sent via the Iot Gateway to the IoT Platform for subsequent issuance of an alert. If there is no confirmation of adjustment by a maximum preset time threshold, a non-confirmation of adjustment is published or sent for subsequent issuance of an alert. In further examples, the method 79 may exclude use of the efficiency score for purposes of shutdown or for purposes of intelligent auto-management. That is, the method 79 may employ the efficiency score for only one or the other of shutdown or intelligent auto-management.

[0099] Additionally or alternatively, the system 69 with one or more mobile distribution stations 20 and one or more servers may be used for centralized, intelligent auto-filling. For example, fuel levels may be tracked in real-time or near real-time. When a fuel level

associated with one of the stations 20 reaches the lower threshold, described above, an instruction may be sent via the system 69 to active the pump 30 and open the appropriate control valve 44. Moreover, the system 69 can ensure that there is minimal or zero delay time from the time of identifying the low threshold to the time that filling begins. Thus, at least a portion of the functionality of the controllers 52 may be remotely and centrally based in the server of the system 69.

[00100] Although a combination of features is shown in the illustrated examples, not all of them need to be combined to realize the benefits of various embodiments of this disclosure. In other words, a system designed according to an embodiment of this disclosure will not necessarily include all of the features shown in any one of the Figures or all of the portions schematically shown in the Figures. Moreover, selected features of one example embodiment may be combined with selected features of other example embodiments.

[00101] The preceding description is exemplary rather than limiting in nature. Variations and modifications to the disclosed examples may become apparent to those skilled in the art that do not necessarily depart from this disclosure. The scope of legal protection given to this disclosure can only be determined by studying the following claims.

CLAIMS

What is claimed is:

1. A distribution station comprising:
 - a mobile trailer;
 - a pump on the mobile trailer;
 - first and second manifolds on the mobile trailer and fluidly connected with the pump;
 - a plurality of reels on the mobile trailer;
 - a plurality of hoses connected, respectively, with the reels, wherein a portion of the reels are connected with the first manifold and another portion of the reels are connected with the second manifold;
 - a plurality of valves on the mobile trailer, each of the valves situated between one of the first or second manifolds and a respective different one of the hoses; and
 - a plurality of fluid level sensors, each of the fluid level sensors being associated a respective different one of the hoses,
 - wherein the reels are arranged on first and second opposed sides in the mobile trailer, with an aisle walkway down the middle of the mobile trailer.
2. The distribution station as recited in claim 1, wherein the reels on each of the first and second opposed sides are arranged in upper and lower rows of reels.
3. The distribution station as recited in claim 2, further comprising first and second support racks on which the reels are supported, the first support rack arranged on the first side and the second support rack arranged on the second side.
4. The distribution station as recited in claim 3, wherein the aisle walkway has an aisle width and the reels have a reel diameter, and the aisle width is greater than the reel diameter by a factor of at least 1.3.
5. The distribution station as recited in claim 4, wherein the trailer has a trailer width of no greater than about 96 inches.
6. The distribution station as recited in claim 2, wherein a ratio of a number of reels in the upper row to a number of reels in the lower row is 1:1.

7. The distribution station as recited in claim 1, wherein the mobile trailer includes trailer end wall that has an outside door, an inside wall that defines first and second compartments in the mobile trailer, the outside door opening into the first compartment, and at least the manifolds and the reels are in the first compartment.
8. The distribution station as recited in claim 7, wherein the inside wall includes an inside door providing access between the first compartment and the second compartment, the aisle walkway extending from the outside door to the inside door.
9. The distribution station as recited in claim 7, further comprising a controller in the second compartment, the controller configured to operate the valves.
10. The distribution station as recited in claim 9, wherein the second compartment is insulated with a fire resistant or retardant material.
11. The distribution station as recited in claim 1, wherein the aisle walkway has an aisle width and the reels have a reel diameter, and the aisle width is greater than the reel diameter by a factor of at least 1.3.
12. The distribution station as recited in claim 11, wherein the aisle width is greater than the reel diameter by a factor of at least 1.5.
13. The distribution station as recited in claim 1, wherein the aisle walkway has an aisle width and the mobile trailer has a trailer width, and a ratio of the trailer width to the aisle width is no greater than 5.
14. The distribution station as recited in claim 13, wherein the ratio of the trailer width to the aisle width is greater than 2.
15. The distribution station as recited in claim 14, wherein the ratio of the trailer width to the aisle width is equal to or less than 4.
16. The distribution station as recited in claim 1, further comprising a floor pan in the mobile trailer.

17. A distribution station comprising:
- a mobile trailer;
 - a pump on the mobile trailer;
 - first and second manifolds on the mobile trailer and fluidly connected with the pump;
 - a plurality of reels on the mobile trailer;
 - a plurality of hoses connected, respectively, with the reels, wherein a portion of the reels are connected with the first manifold and another portion of the reels are connected with the second manifold;
 - a plurality of valves on the mobile trailer, each of the valves situated between one of the first or second manifolds and a respective different one of the hoses; and
 - a plurality of fluid level sensors, each of the fluid level sensors being associated a respective different one of the hoses,
- wherein the mobile trailer includes first and second opposed trailer side walls, and a first group of the hoses are deployable from the first trailer side wall and a second group of the hoses are deployable from the second trailer side wall.
18. The distribution station as recited in claim 17, wherein the reels are arranged on first and second opposed sides in the mobile trailer such that there is an aisle walkway down the middle of the mobile trailer.
19. The distribution station as recited in claim 18, wherein the reels on each of the first and second opposed sides are arranged in upper and lower rows of reels.
20. The distribution station as recited in claim 19, wherein the aisle walkway has an aisle width and the reels have a reel diameter, and the aisle width is greater than the reel diameter by a factor of at least 1.3.
21. The distribution station as recited in claim 20, wherein the mobile trailer has a trailer width of no greater than about 96 inches.
22. The distribution station as recited in claim 17, further comprising a floor pan in the mobile trailer.

MOBILE DISTRIBUTION STATION WITH AISLE WALKWAY

ABSTRACT

A distribution station includes a mobile trailer, a pump on the mobile trailer, first and second manifolds on the mobile trailer and fluidly connected with the pump, a plurality of hoses, a plurality of reels, a plurality of valves, and a plurality of fluid level sensors. The hoses are connected with the reels. A portion of the reels are connected with the first manifold and another portion of the reels are connected with the second manifold. Each of the valves is situated between one of the first or second manifolds and a respective different one of the hoses. Each of the fluid level sensors is associated with a respective different one of the hoses. The reels are arranged on first and second opposed sides in the mobile trailer, with an aisle walkway down the middle of the mobile trailer.

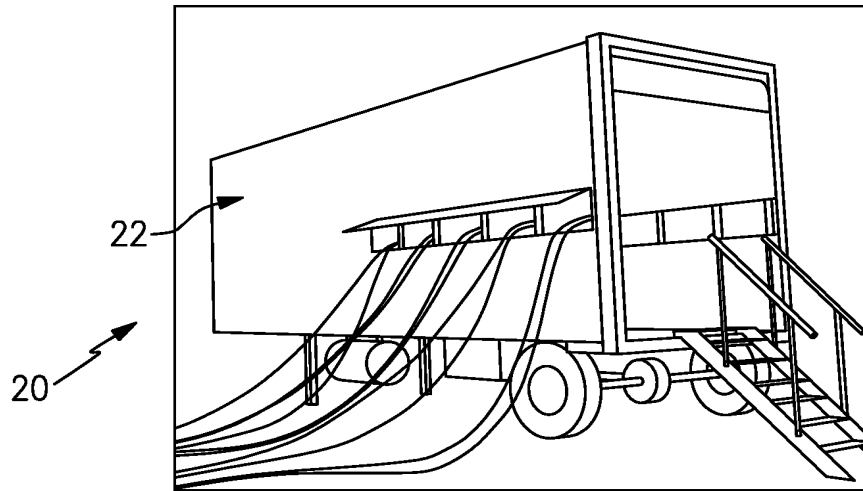


FIG. 1

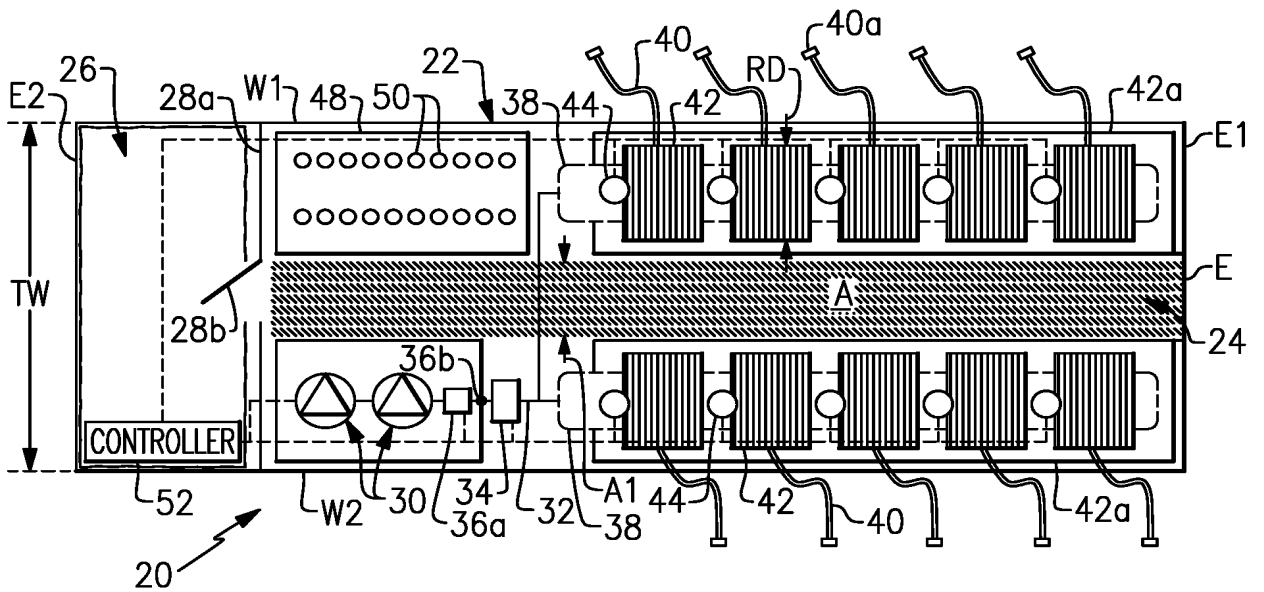


FIG. 2

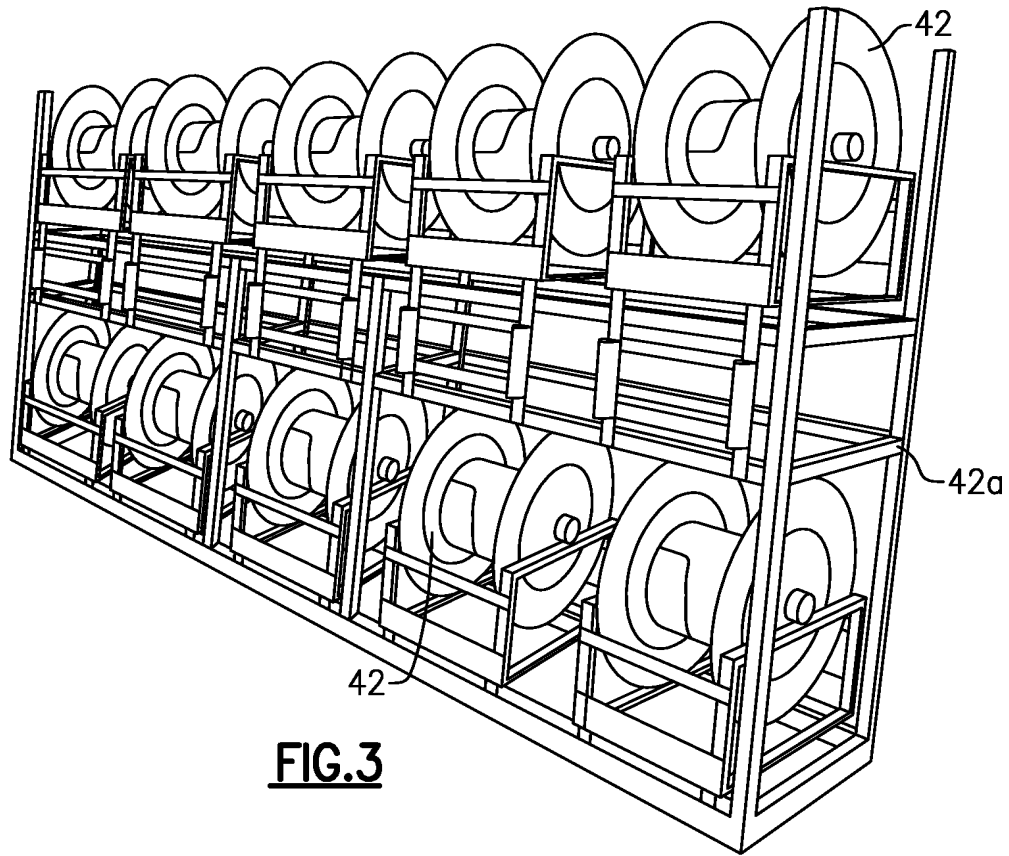


FIG. 3

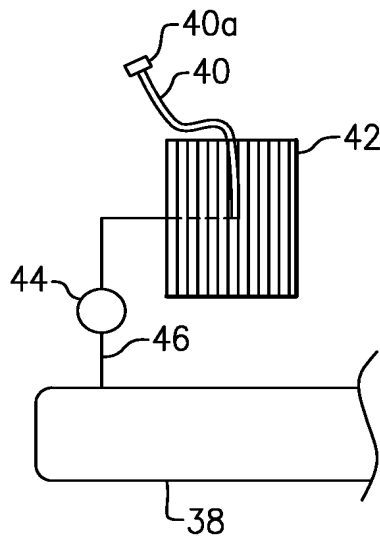
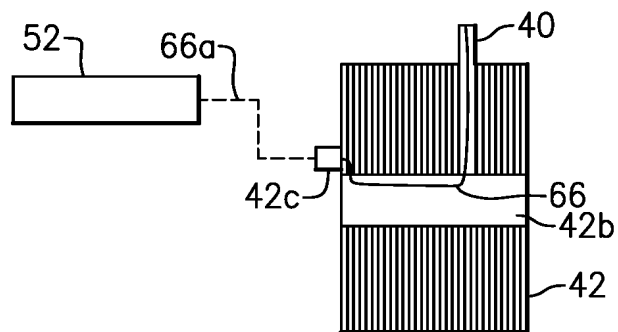
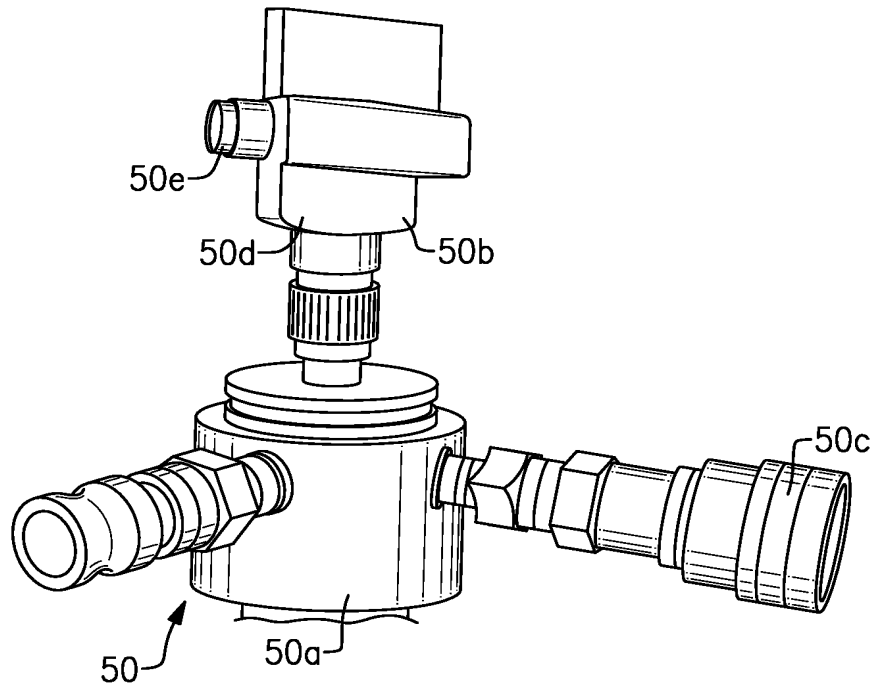
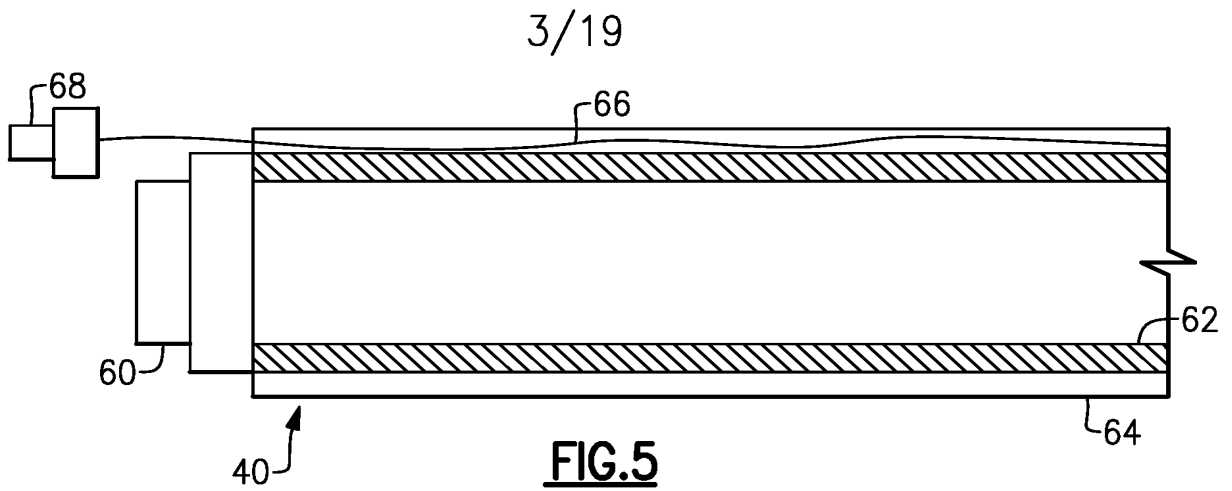


FIG. 4



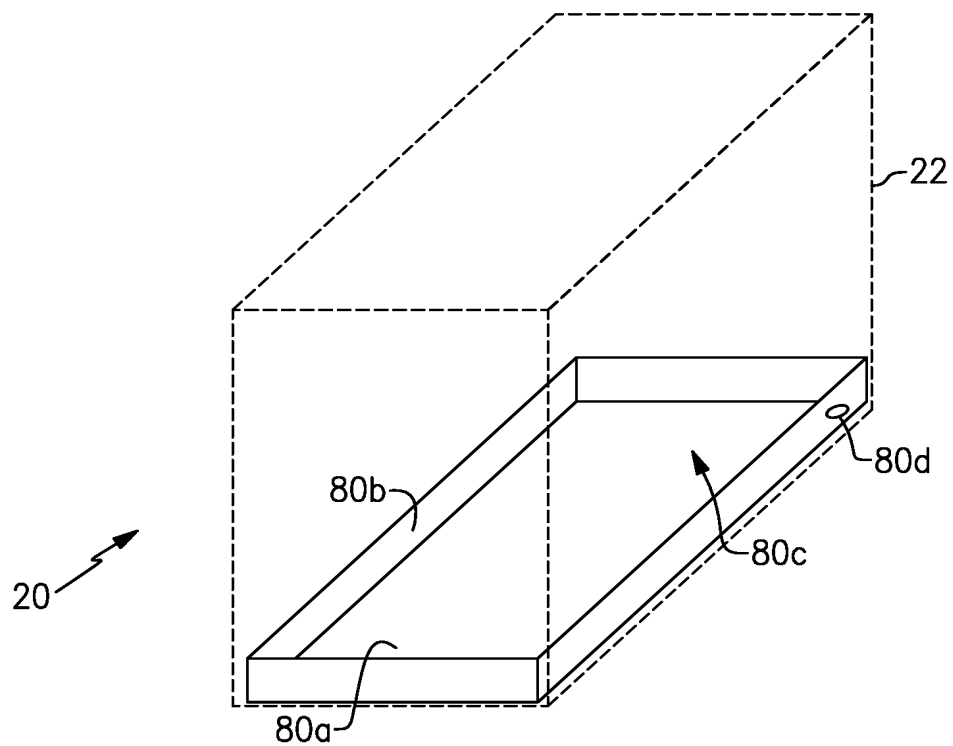
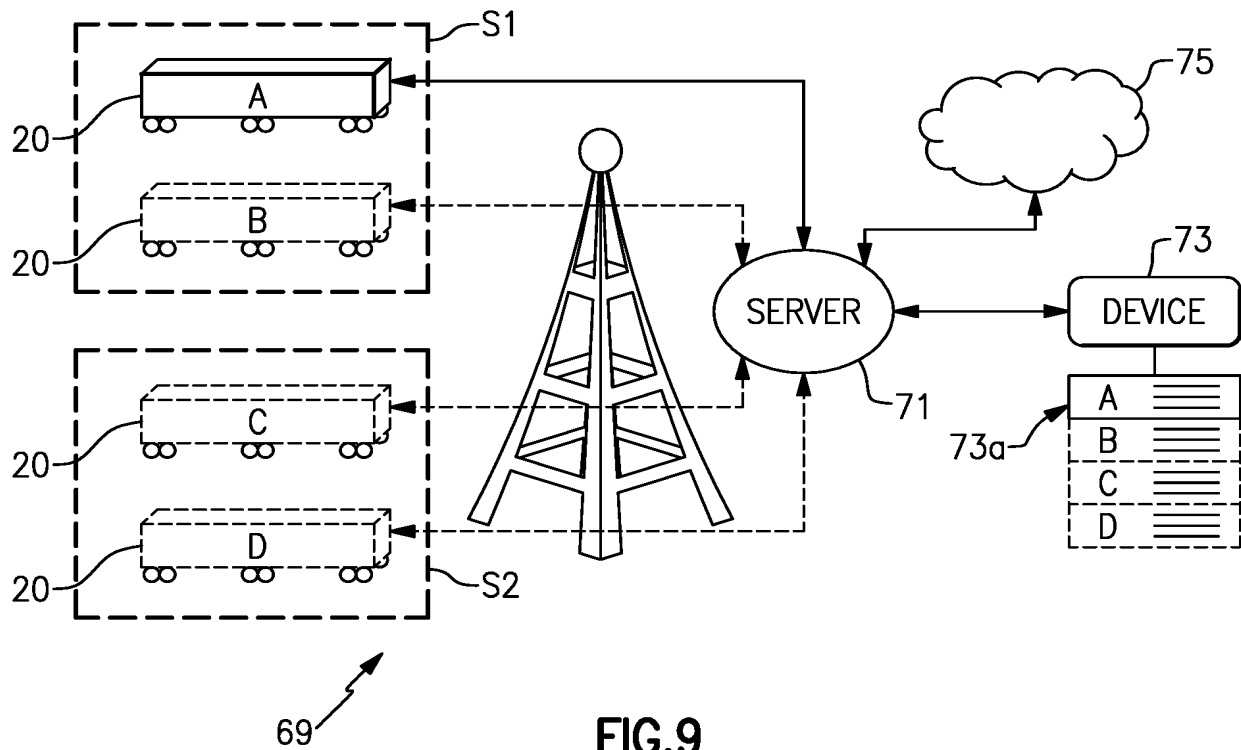


FIG. 8



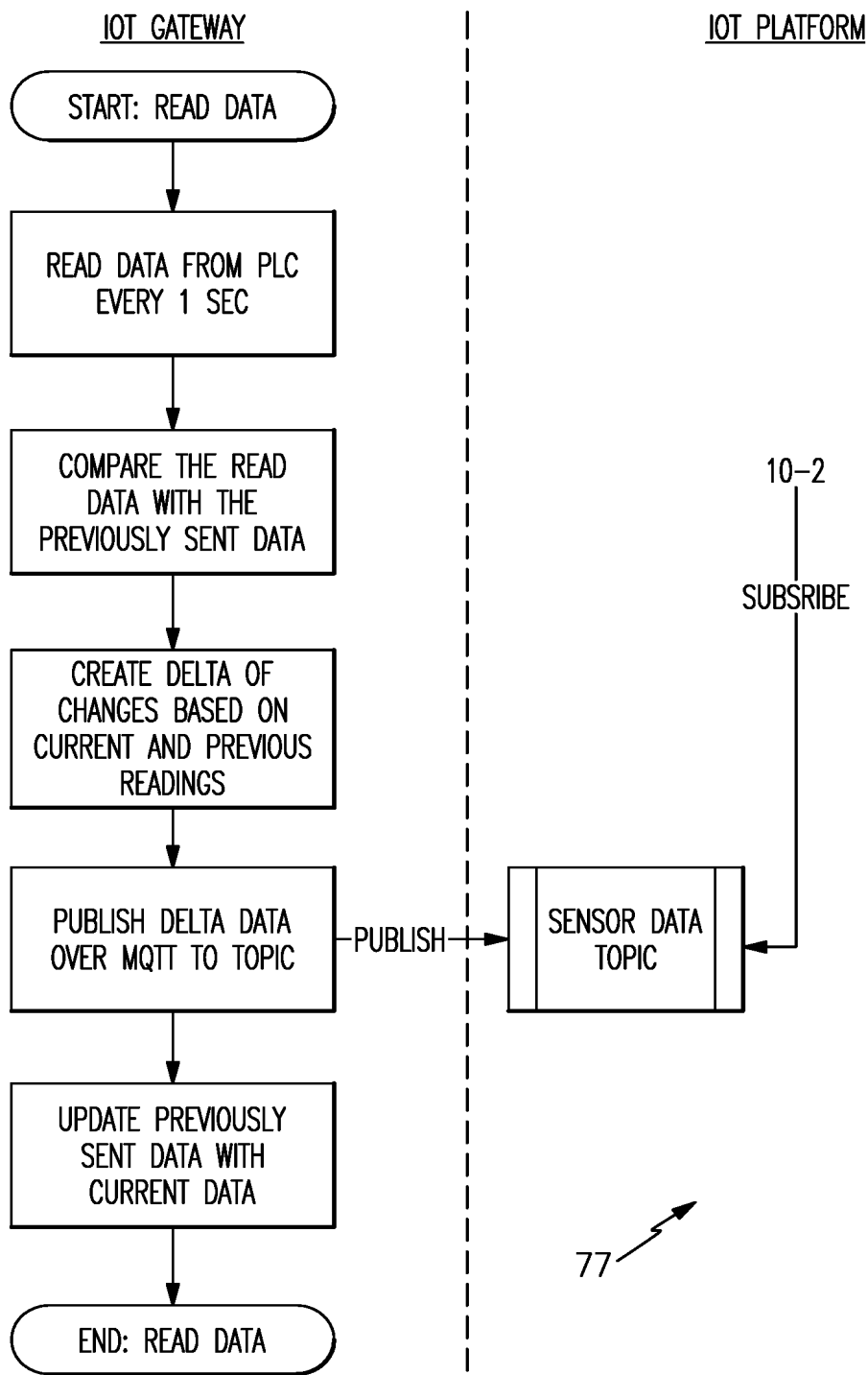
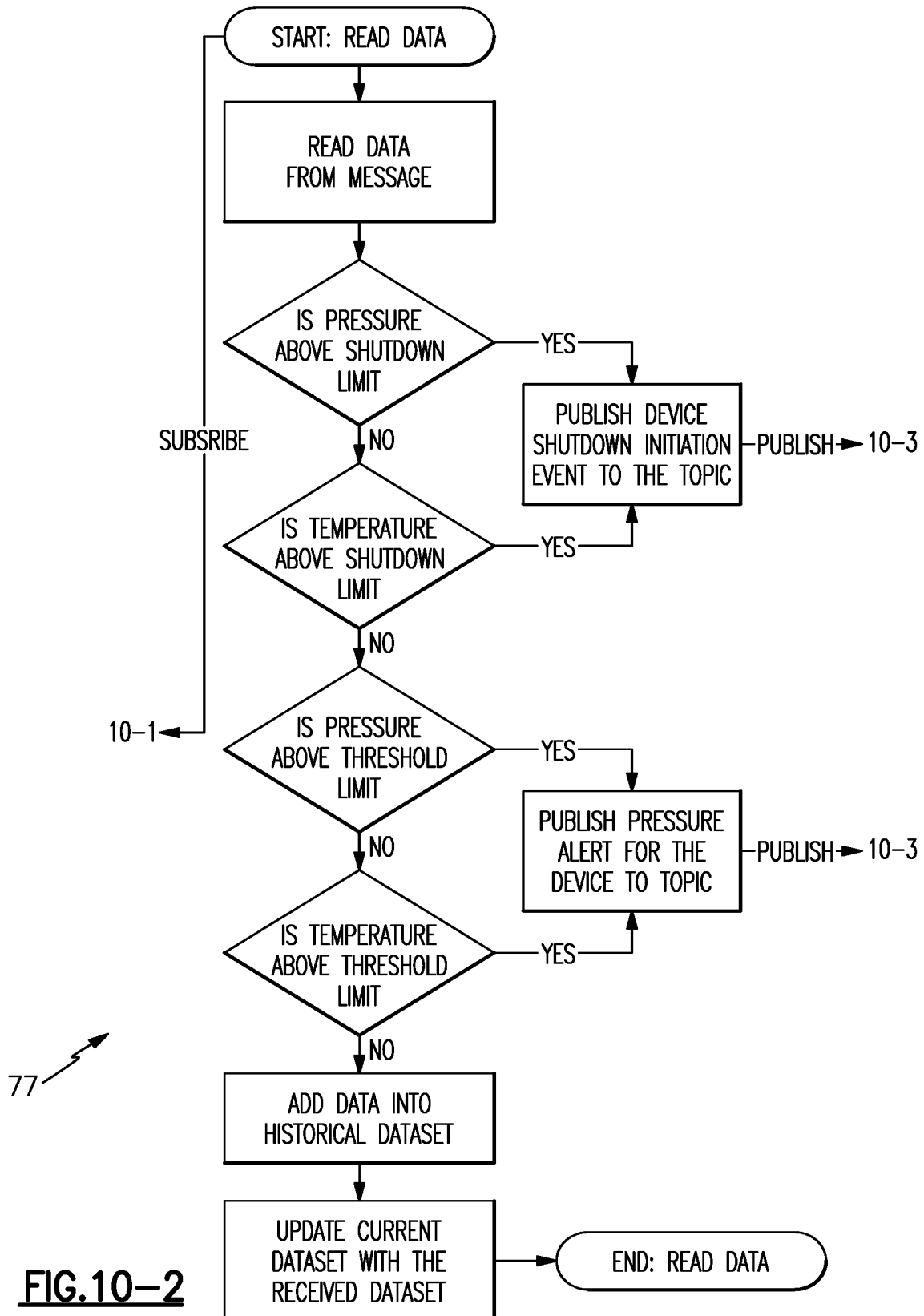
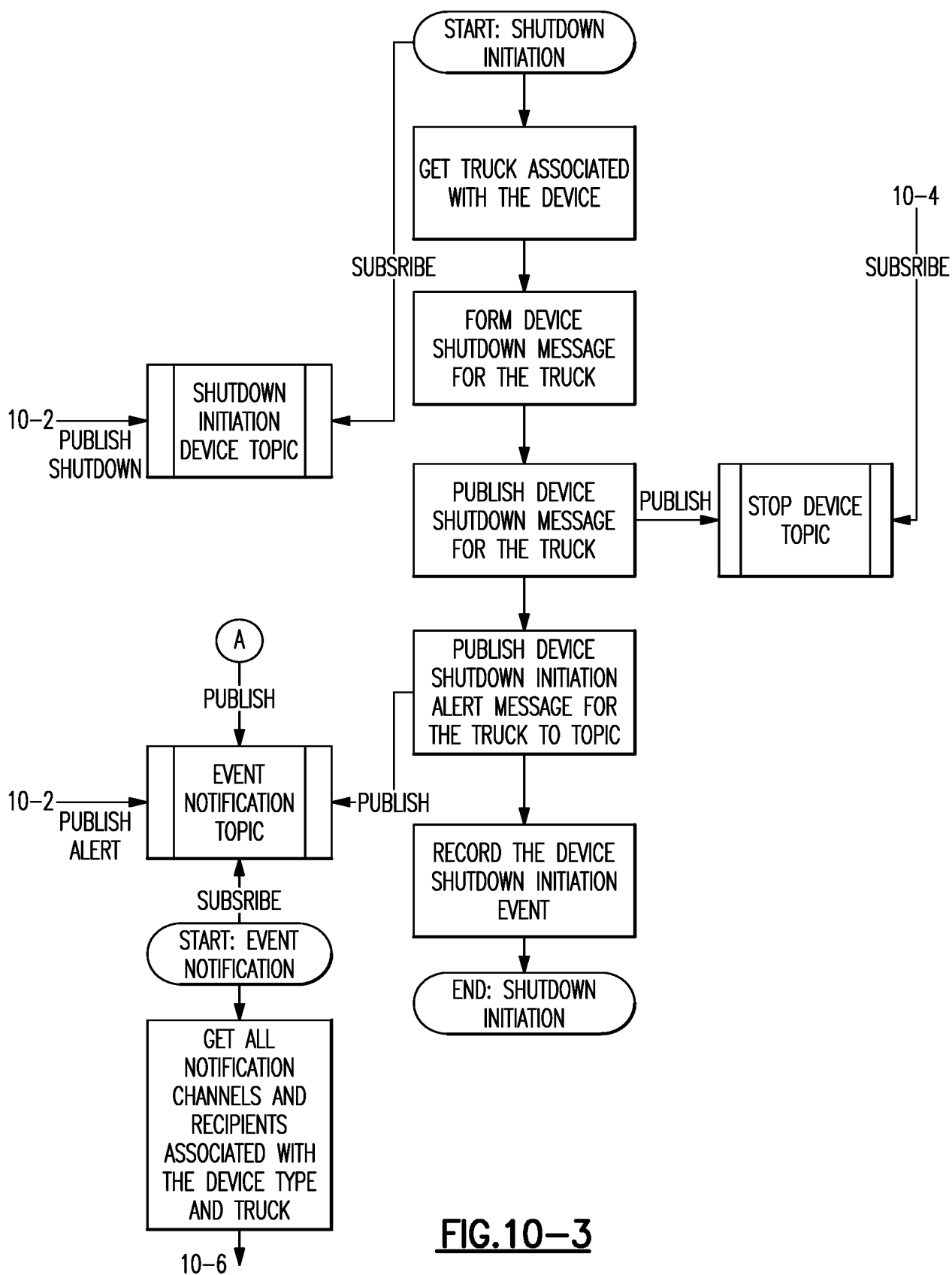


FIG.10-1

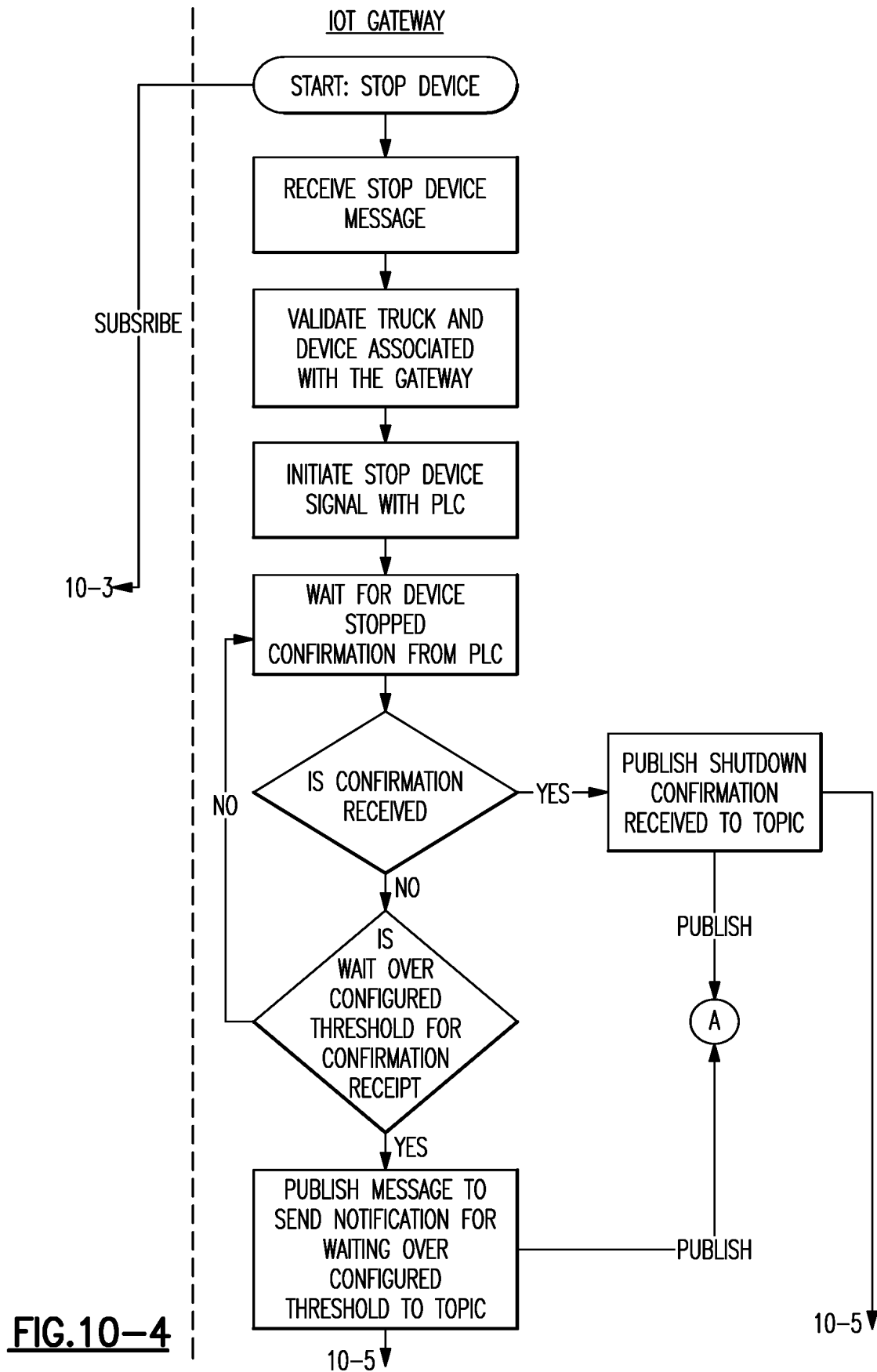
<u>FIG.10-1</u>	<u>FIG.10-2</u>	<u>FIG.10-3</u>	<u>FIG.10-4</u>
		<u>FIG.10-6</u>	<u>FIG.10-5</u>

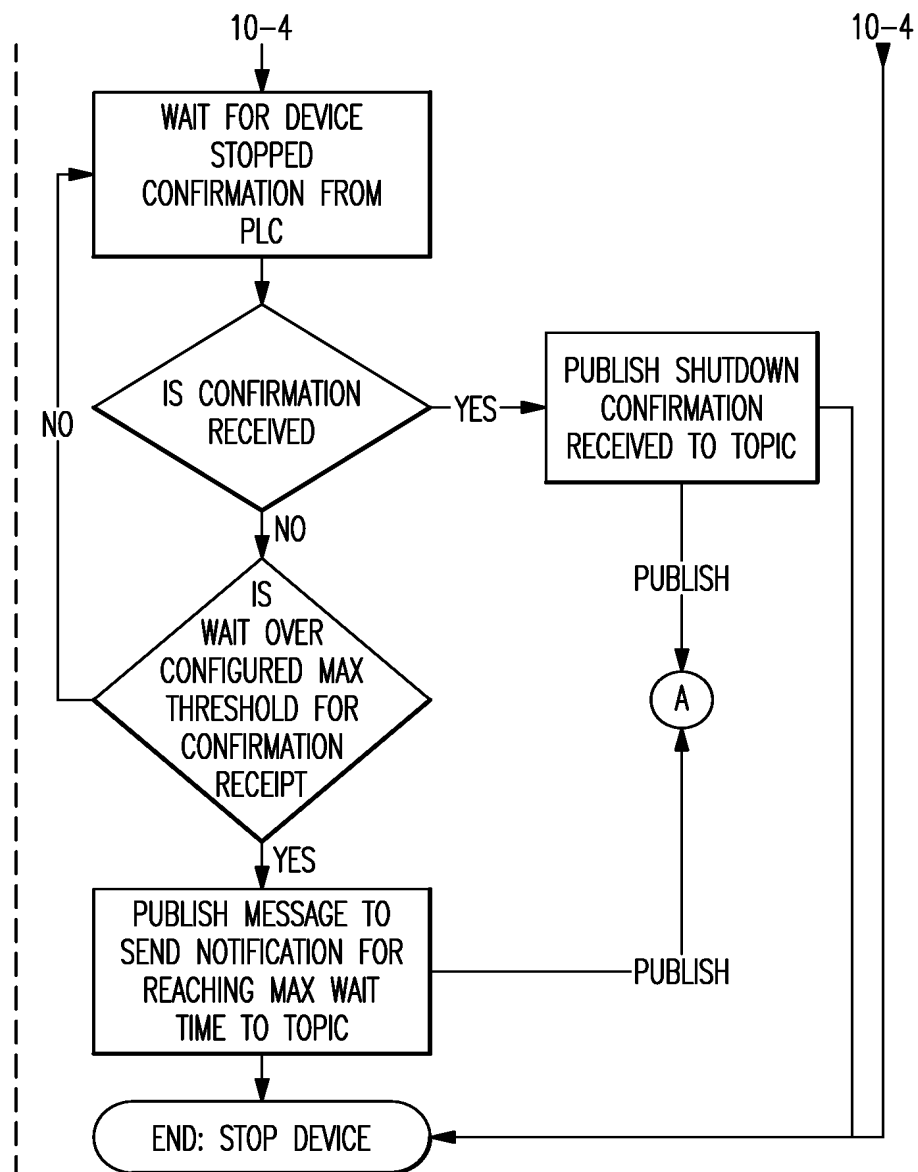
FIG.10

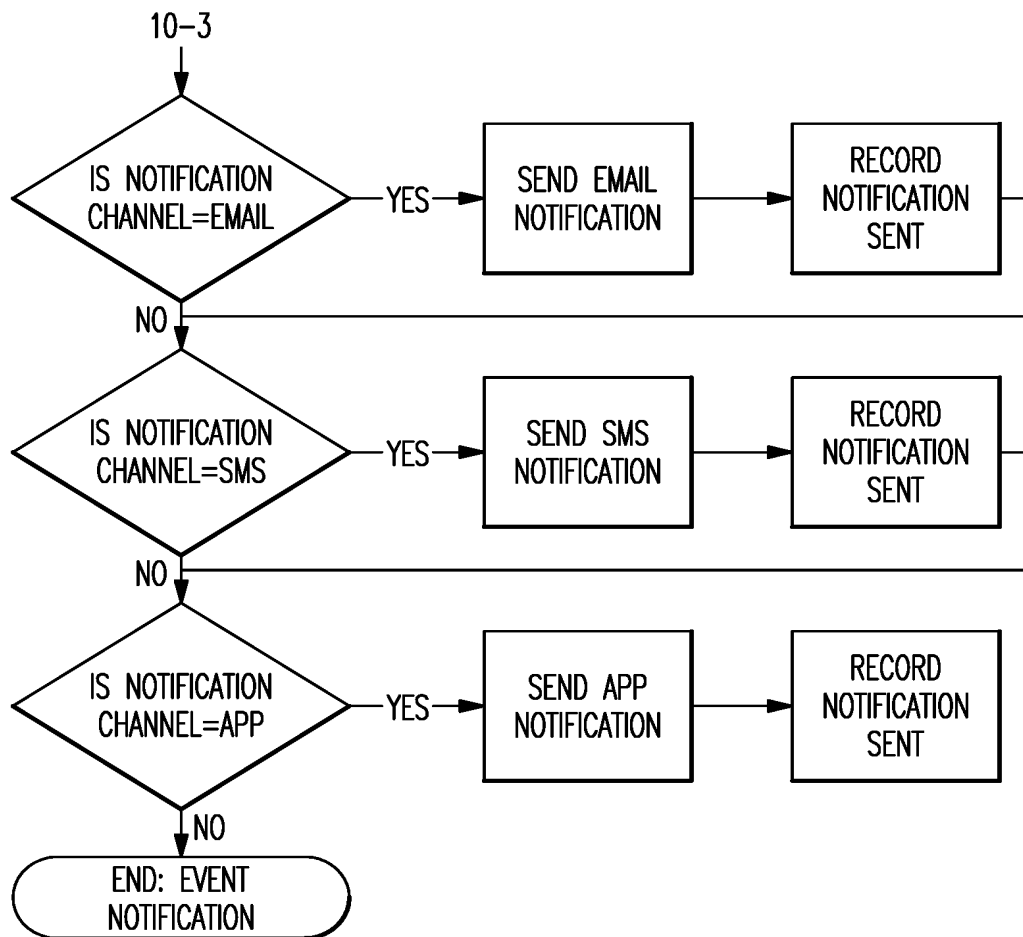




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**FIG.10-5**

**FIG.10-6**

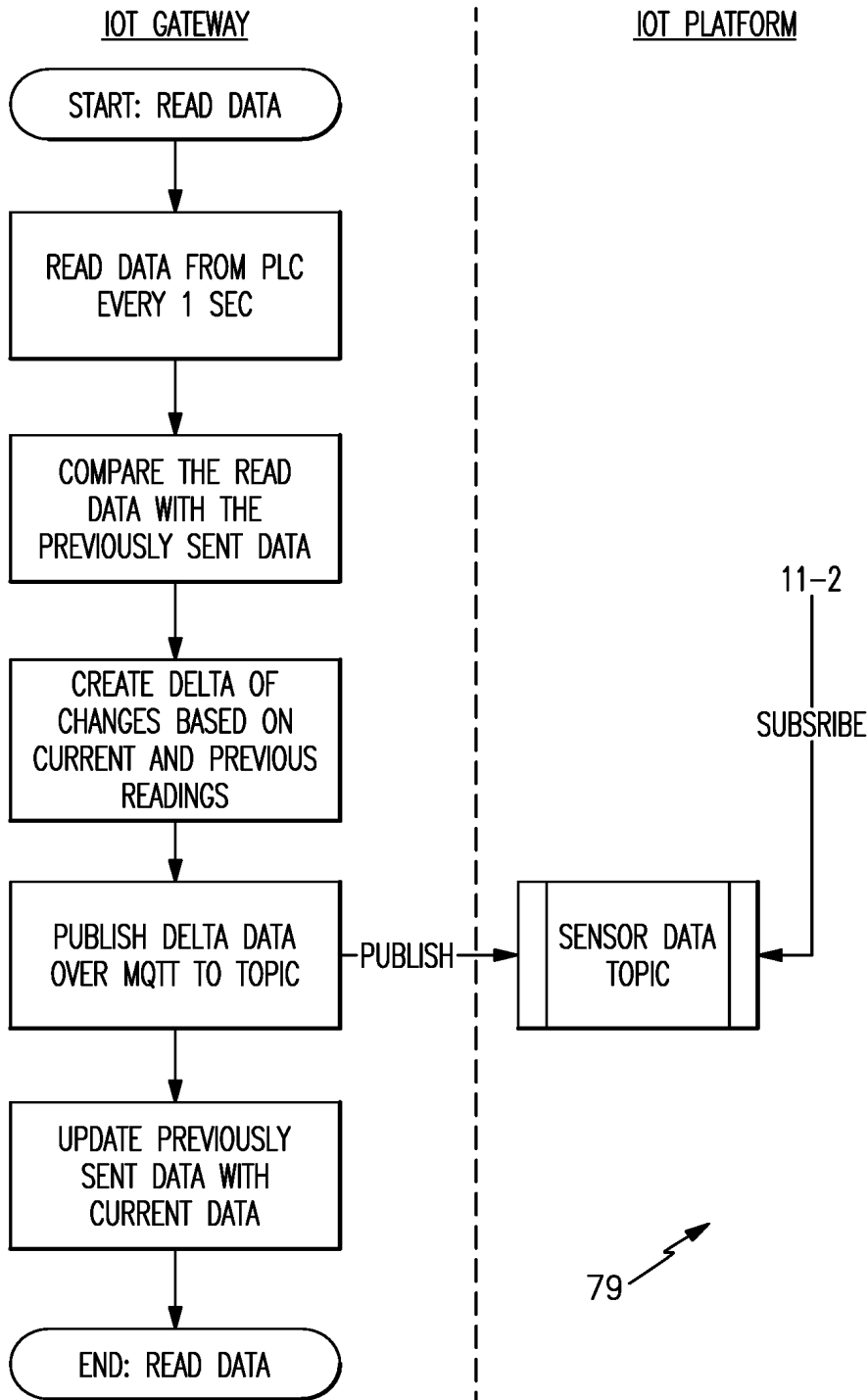
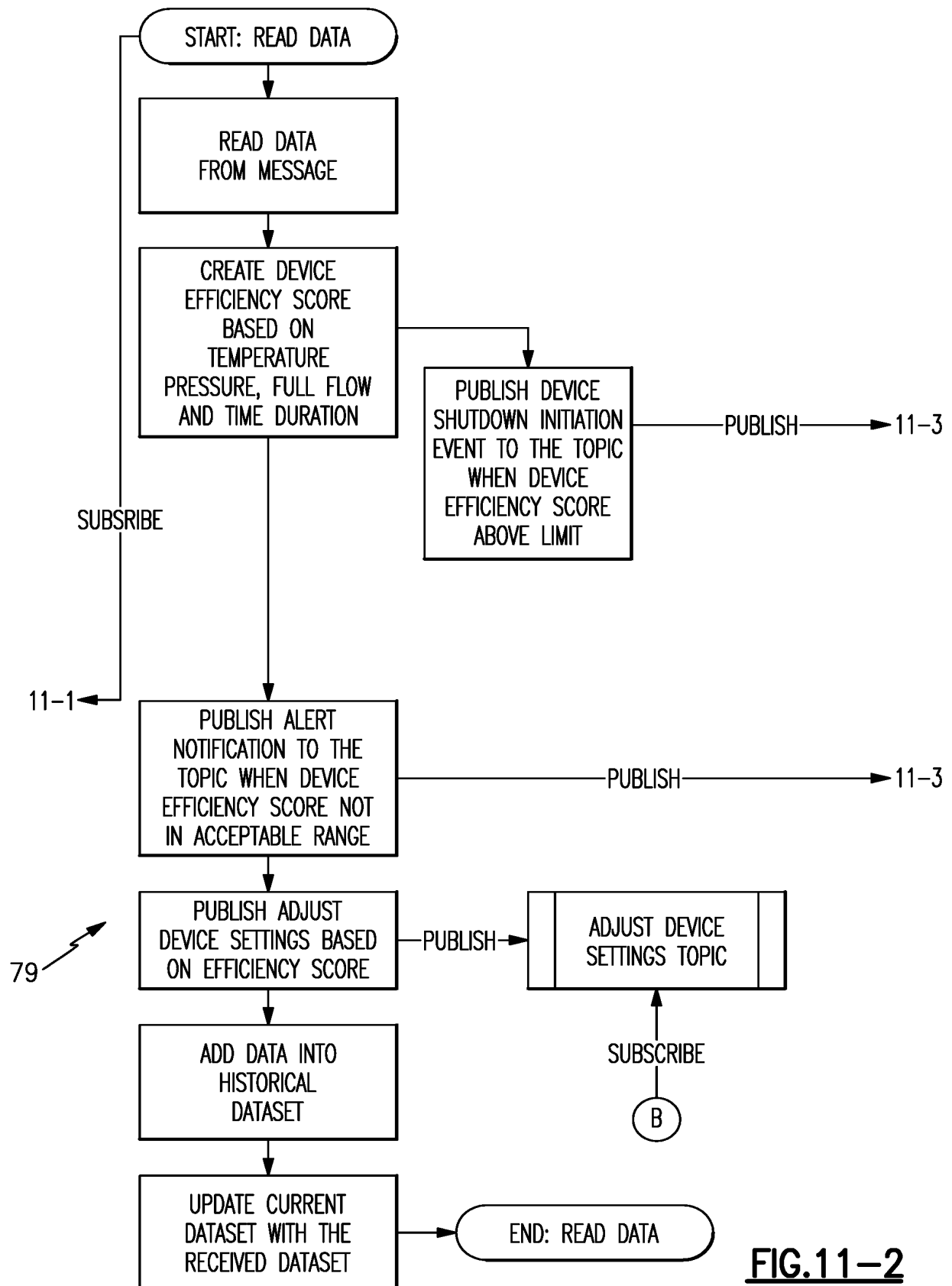
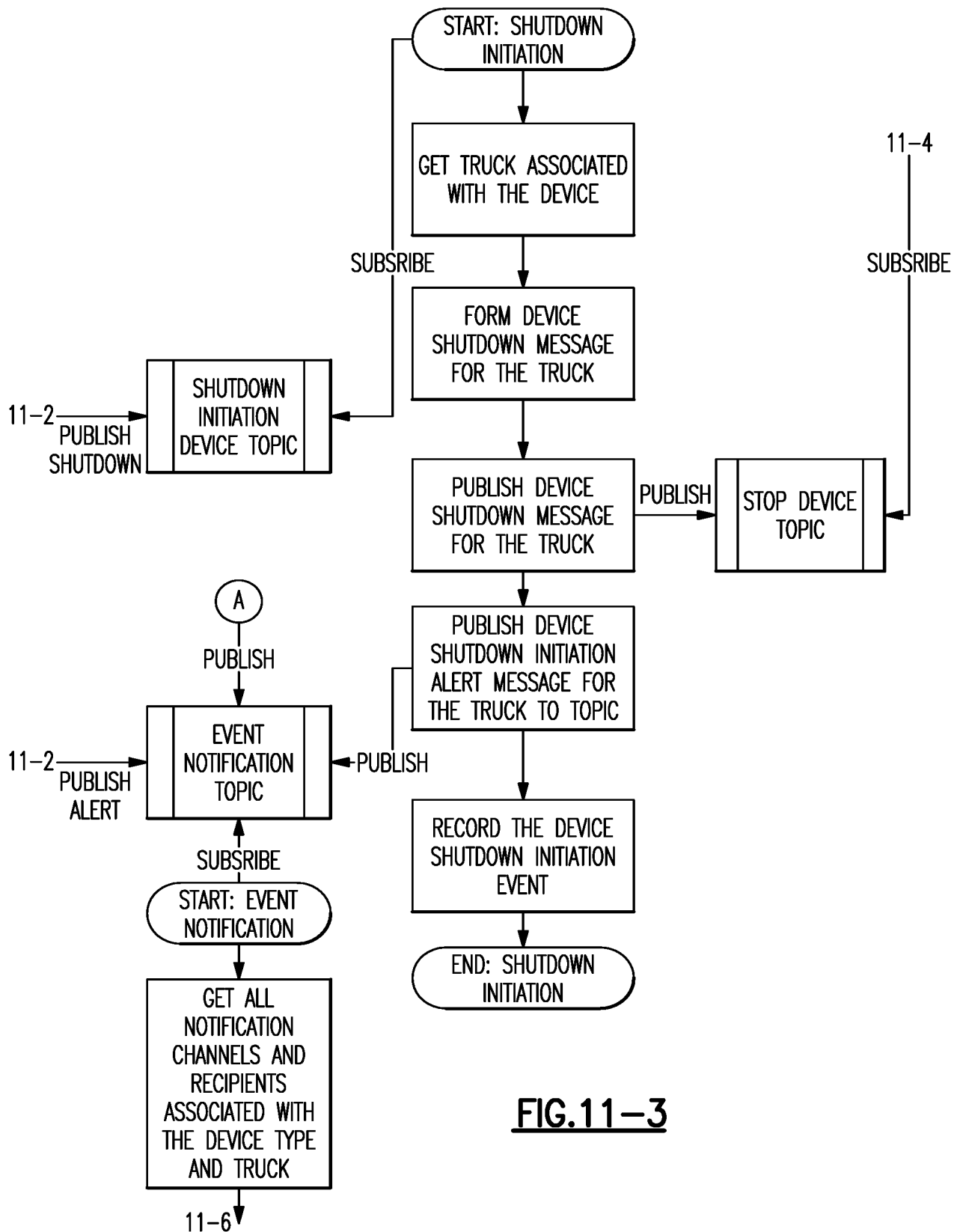


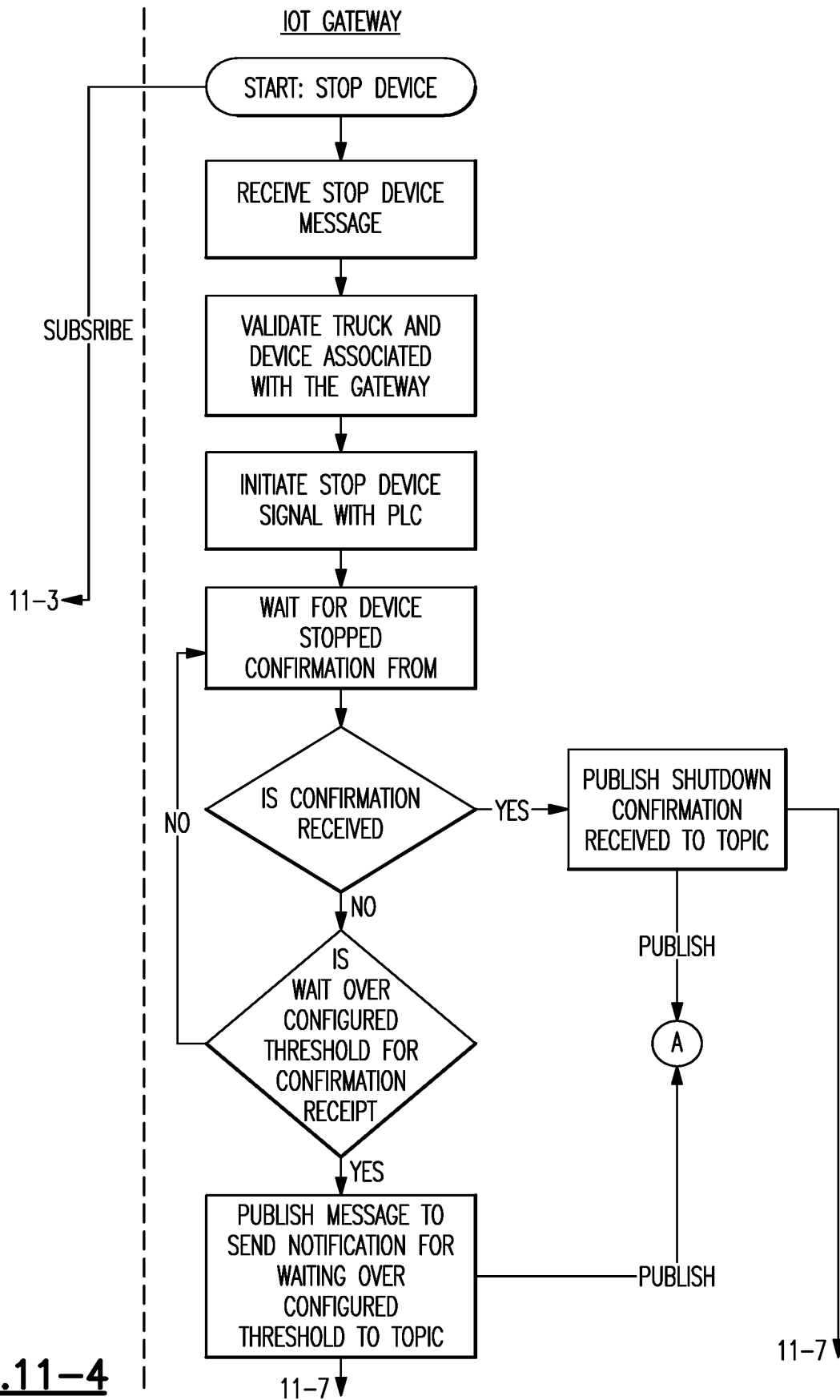
FIG.11-1

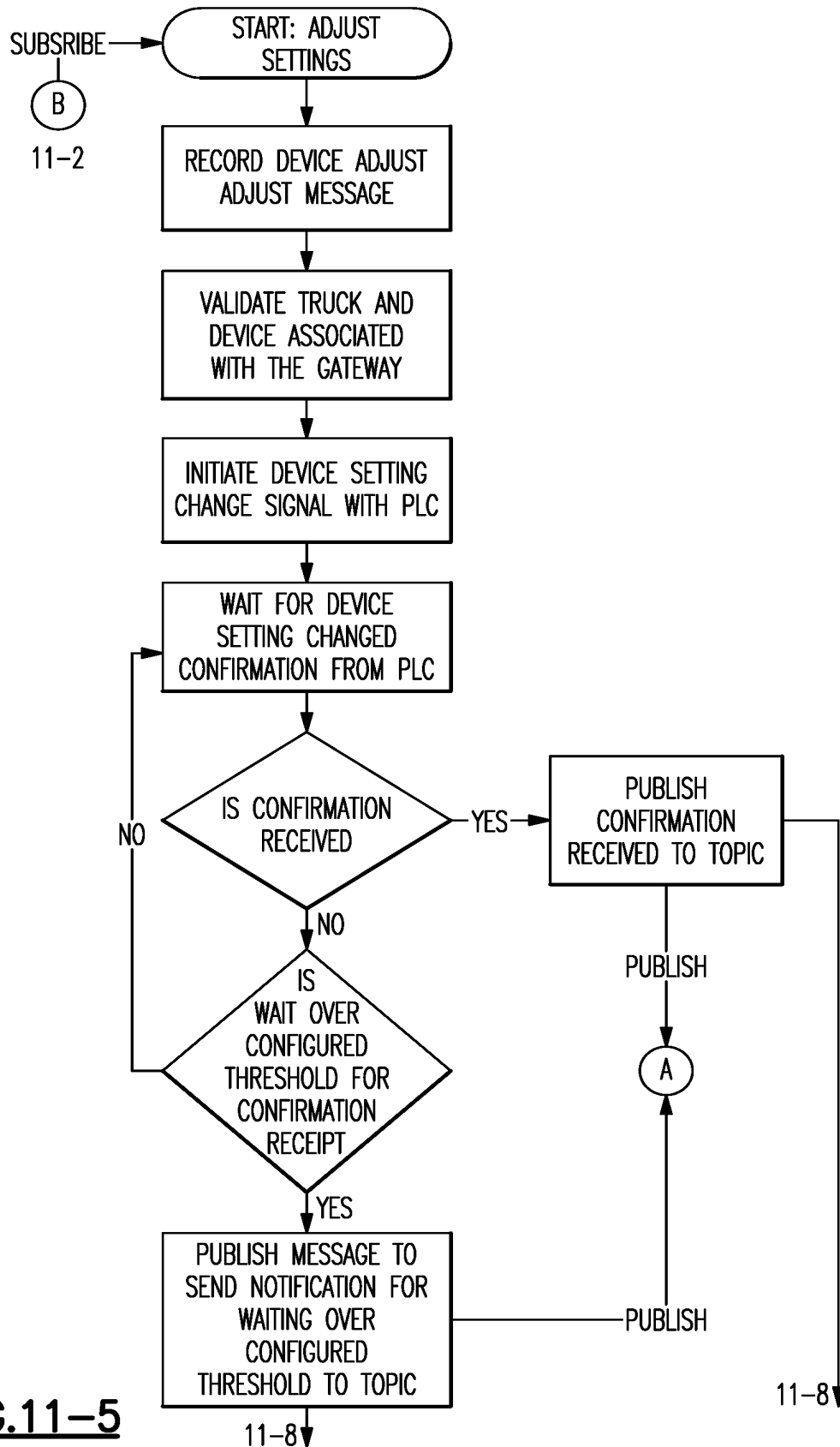
<u>FIG.11-1</u>	<u>FIG.11-2</u>	<u>FIG.11-3</u>	<u>FIG.11-4</u>	<u>FIG.11-5</u>
		<u>FIG.11-6</u>	<u>FIG.11-7</u>	<u>FIG.11-8</u>

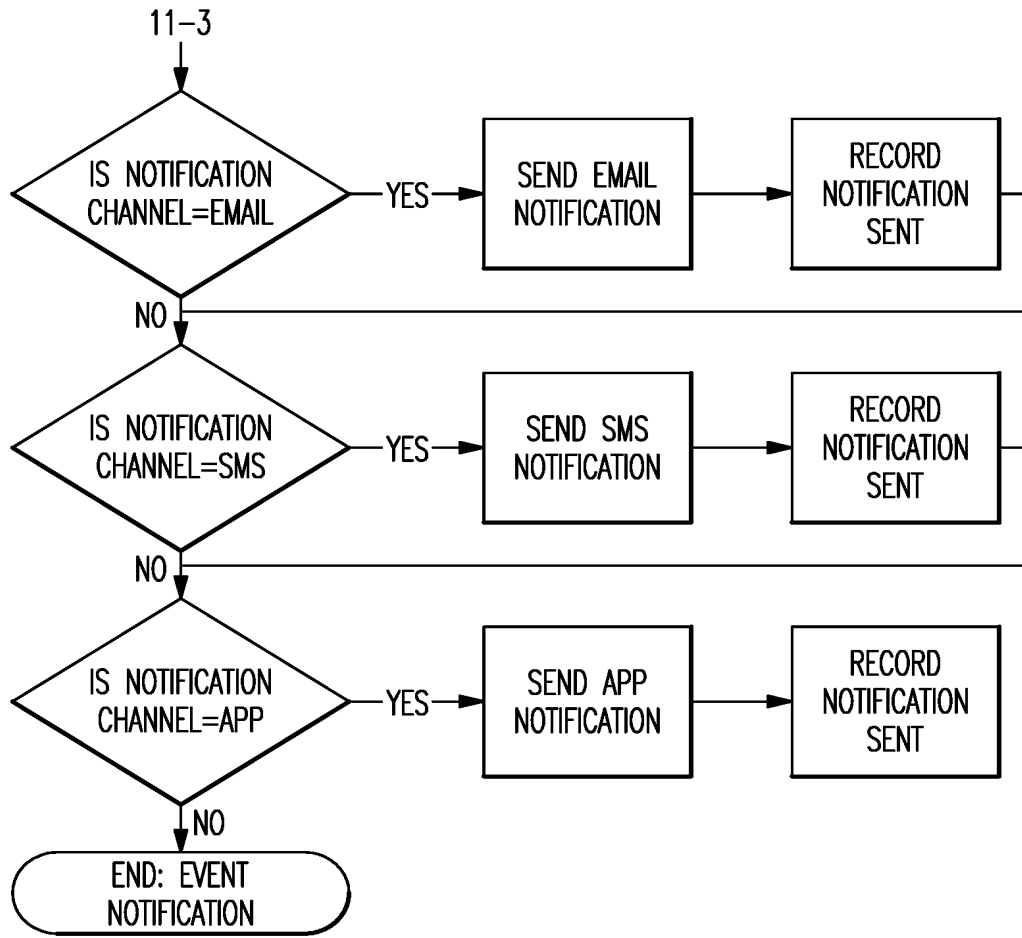
FIG.11

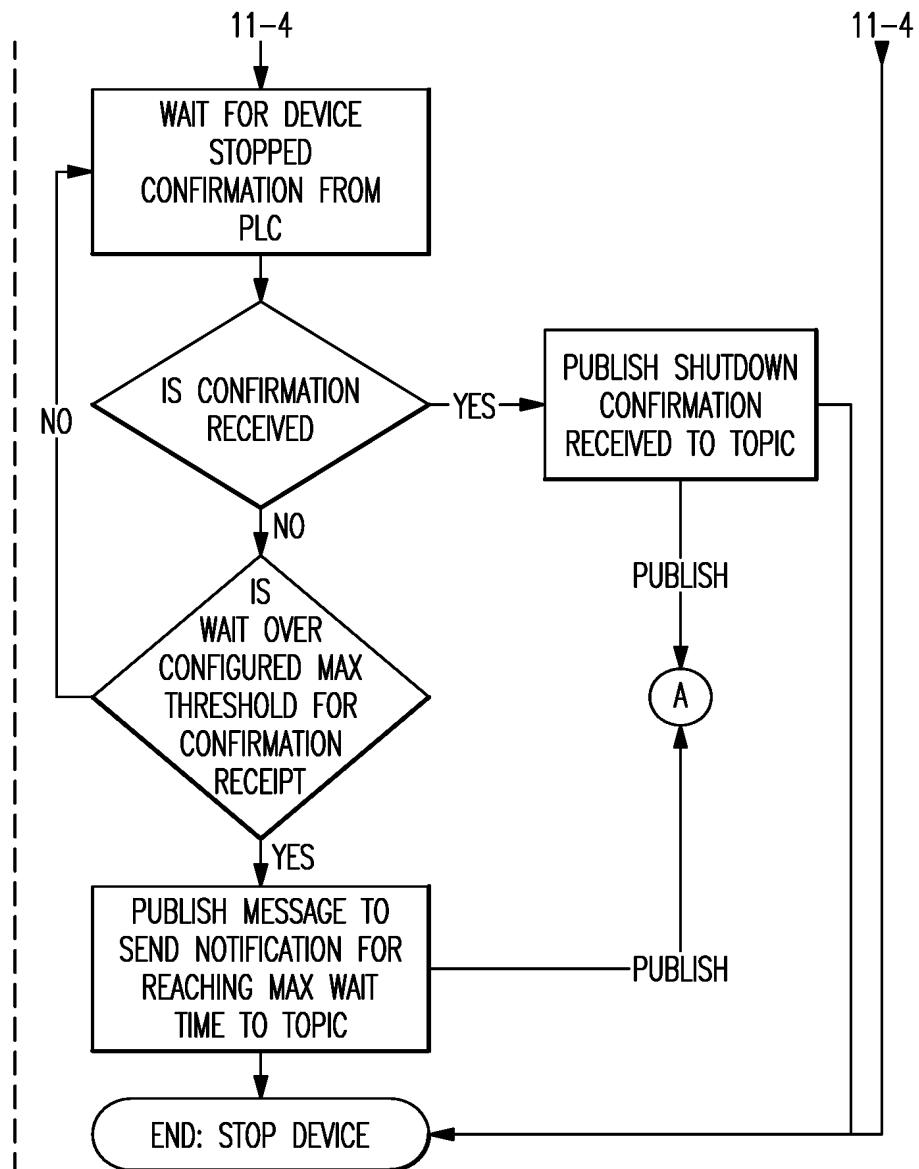
**FIG.11-2**

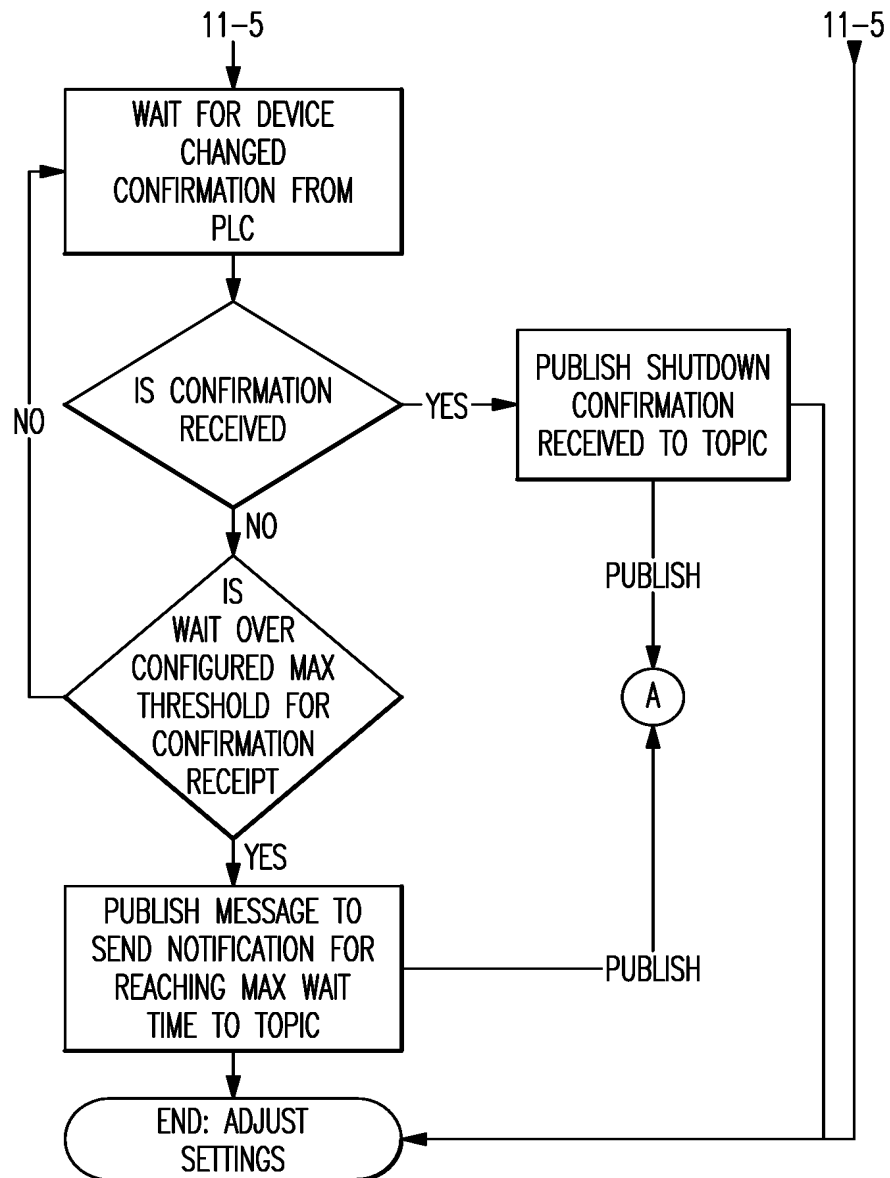
**FIG. 11-3**

**FIG.11-4**

**FIG.11-5**

**FIG.11-6**

**FIG.11-7**

**FIG.11-8**