

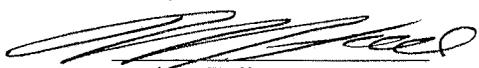
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Naghma Hall

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

|   |   |                            |
|---|---|----------------------------|
| Applicant: Zajac  | § | Group Art Unit: 2863       |
|   | § |                            |
| Serial No.: 09/882,952  | § |                            |
|   | § | Examiner: Victor Taylor    |
| Filed: June 15, 2001  | § |                            |
|   | § |                            |
| Title: Active Separation Tracking<br>And Positioning System for<br>Towed Seismic Arrays | § | Atty. Docket: 594-23539-US |
|   | § |                            |

Non Fee Amendment  
Commissioner for Patents  
P. O. Box 1450  
Alexandria, VA 22313-1450

**Response to Office Action Mailed March 31, 2003**

This paper is in response to the office action mailed on March 31, 2003. The Commissioner is authorized to charge any fees deemed necessary or credit any overpayment related to the filing of this Response to Deposit Account No. 50-1720 (594-23539-US) maintained by Western Geoco.

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In the Claims

Please amend the claims as follows:

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1. (currently amended) A seismic streamer array tracking and positioning system comprising:  
a towing vessel for towing a seismic array;  
an array comprising a plurality of seismic streamers;  
an active streamer positioning device (ASPD) attached to at least one seismic streamer for positioning the seismic streamer relative to other seismic streamers within the array; and  
a master controller for issuing positioning commands to each ASPD to adjust a vertical and horizontal position of a first streamer relative to a second streamer within the array for maintaining a specified array geometry.
  2. (original) The apparatus of claim 1 further comprising:  
an environmental sensor for sensing environmental factors which influence the path of the towed array.
  3. (original) The apparatus of claim 1 further comprising:  
a tracking system for tracking the streamer positions versus time during a seismic data acquisition run and storing the positions versus time in a legacy database for repeating the positions versus time in a subsequent data acquisition; and  
an array geometry tracking system for tracking the array geometry versus time during a seismic data acquisition run and storing the array geometry versus time in a legacy database for repeating the array geometry versus time in a subsequent data acquisition run.

4. (original) The apparatus of claim 3 wherein the master controller compares the positions of the streamers versus time and the array geometry versus time to a desired streamer position and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired streamer position and array geometry versus time.
5. (original) The apparatus of claim 4 wherein the master controller factors in environmental factors into the positioning commands to compensate for environmental influences on the positioning of the streamers and the array geometry.
6. (original) The apparatus of claim 4 wherein the master controller compensates for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry.
7. (original) The apparatus of claim 1 further comprising:  
a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to compensate for a failed streamer.
8. (original) The apparatus of claim 1 further comprising:  
a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to move a failed streamer out of the array.

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9. (original) The apparatus of claim 1 further comprising:  
a monitor for determining the status of each streamer, wherein the master controller detaches a failed streamer from the array.
10. (original) The apparatus of claim 1 wherein the array geometry comprises a plurality of streamers positioned at a uniform depth.
11. (original) The apparatus of claim 1 wherein the array geometry comprises a plurality of streamers positioned at a plurality of depths for varying temporal resolution of the array.
12. (original) The apparatus of claim 1 wherein the array geometry comprises a plurality of streamers positioned along a plane, wherein the plane is rotated at an angle  $\theta$  with respect to the longitudinal axis of the array.
13. (original) The apparatus of claim 4 wherein the array geometry is tracked via satellite and communicated to the master controller.
14. (currently amended) A seismic streamer array tracking and positioning system comprising:  
a towing vessel for towing a seismic array;  
a seismic streamer array comprising a plurality of seismic streamers;  
an active streamer positioning device (ASPD) attached to each seismic streamer for positioning each seismic streamer;

a master controller for issuing vertical and horizontal positioning commands to each ASPD for maintaining a specified array geometry;

an environmental sensor for sensing environmental factors which influence the towed path of the towed array;

a tracking system for tracking the streamer horizontal and vertical positions versus time during a seismic data acquisition run;

an array geometry tracking system for tracking the array geometry versus time during a seismic data acquisition run, wherein the master controller compares the vertical and horizontal positions of the streamers versus time and the array geometry versus time to desired streamer positions and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired streamer positions and array geometry versus time.

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15. (original) The apparatus of claim 14 wherein the master controller factors in environmental measurements into the positioning commands to compensate for environmental influences on the positions of the streamers and the array geometry.

16. (original) The apparatus of claim 14 wherein the master controller compensates for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry.

17. (original) The apparatus of claim 14 further comprising:  
a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to compensate for a failed streamer.

18. (original) The apparatus of claim 14 further comprising:  
a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to move the failed streamer out of the array.
19. (currently amended) A seismic streamer array tracking and positioning system comprising:  
a towing vessel for towing a seismic array;  
a seismic streamer array comprising a plurality of seismic streamers;  
an active streamer positioning device (ASPD) attached to each seismic streamer for vertically and horizontally positioning each seismic streamer relative to the array;  
a master controller for issuing positioning commands to each ASPD for maintaining a specified array geometry;  
an environmental sensor for sensing environmental factors which influence the path of the towed array;  
a tracking system for tracking the streamer positions versus time during a seismic data acquisition run;  
an array geometry tracking system for tracking the array geometry versus time during a seismic data acquisition run, wherein the master controller compares the positions of the streamers versus time and the array geometry versus time to a desired position and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired position and array geometry versus time, wherein the master controller factors in environmental and maneuverability factors into the positioning commands to compensate

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for environmental and maneuverability influences on the position of the streamers and the array geometry; and

a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to compensate for a failed streamer and removes the failed streamer from the array.

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20. (currently amended) A seismic streamer array tracking and positioning system comprising:

a towing vessel for towing a seismic array;

a seismic streamer array comprising a plurality of seismic streamers;

an active streamer positioning device (ASPD) attached to each seismic streamer for vertically and horizontally positioning each seismic streamer relative to the array; and

a master controller for issuing positioning commands to each ASPD for maintaining a specified array path.

21. The apparatus of claim 20 wherein the master controller issues positioning commands to the towing vessel for maintaining a specified array path.

22. The apparatus of claim 20 further comprising:

a processor for calculating an optimal path for the seismic array for optimal coverage during seismic data acquisition over a seismic field;

a streamer behavior prediction processor which predicts array behavior; and

wherein the master controller compensates for predicted streamer behavior in issuing vertical and horizontal positioning commands to the towing vessel and the ASPDs for positioning the array along the optimal path.

23. The apparatus of claim 22 wherein the master controller compensates for environmental factors in the positioning commands.

24. The apparatus of claim 23 wherein the master controller compensates for maneuverability factors in the positioning commands.

25. (currently amended) A seismic streamer array tracking and positioning system comprising:  
a towing vessel for towing a seismic array;  
a seismic streamer array comprising a plurality of seismic streamers;  
an active streamer positioning device (ASPD) attached to each seismic streamer for vertically and horizontally positioning each seismic streamer relative to the array;  
a master controller for issuing positioning commands to each ASPD and to the towing vessel for maintaining an optimal path, wherein the master controller further comprises a processor for calculating an optimal path for the seismic array for optimal coverage during seismic data acquisition over a seismic field, and a streamer behavior prediction processor which predicts array behavior, wherein the master controller compensates for predicted streamer behavior in issuing positioning commands to the towing vessel and the ASPDs for positioning the array along the optimal path, wherein the master controller compensates for environmental and maneuverability factors in the positioning commands.

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26. (currently amended) A method for tracking and positioning a seismic streamer array comprising:

~~providing a towing vessel~~ for towing a seismic array;

~~providing an array~~ comprising a plurality of seismic streamers;

~~providing~~ attaching an active streamer positioning device (ASPD) ~~attached to at least one~~ each seismic streamer for positioning the seismic streamer relative to other seismic streamers within the array; and

~~providing a master controller for~~ issuing vertical and horizontal positioning commands to each ASPD for maintaining a specified array geometry.

27. The method of claim 26 further comprising:

providing an environmental sensor for sensing environmental factors which influence the path of the towed array.

28. The method of claim 26 further comprising:

providing a tracking system for tracking the streamer positions versus time during a seismic data acquisition run and storing the positions versus time in a legacy database for repeating the positions versus time in a subsequent data acquisition; and

providing an array geometry tracking system for tracking the array geometry versus time during a seismic data acquisition run and storing the array geometry versus time in a legacy database for repeating the array geometry versus time in a subsequent data acquisition run.

29. The method of claim 28 wherein the master controller compares the positions of the streamers versus time and the array geometry versus time to a desired streamer position and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired streamer position and array geometry versus time.
30. The method of claim 29 wherein the master controller factors in environmental factors into the positioning commands to compensate for environmental influences on the positioning of the streamers and the array geometry.
31. The method of claim 30 wherein the master controller compensates for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry.
32. The method of claim 26 further comprising:  
providing a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to compensate for a failed streamer.
33. The method of claim 26 further comprising:  
providing a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to move a failed streamer out of the array.
34. The method of claim 26 further comprising:

providing a monitor for determining the status of each streamer, wherein the master controller detaches a failed streamer from the array.

35. The method of claim 26 wherein the array geometry comprises a plurality of streamers positioned at a uniform depth.

36. The method of claim 26 wherein the array geometry comprises a plurality of streamers positioned at a plurality of depths for varying temporal resolution of the array.

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37. The method of claim 26 wherein the array geometry comprises a plurality of streamers positioned along a plane, wherein the plane is rotated at an angle  $\theta$  with respect to the longitudinal axis of the array.

38. The method of claim 29 wherein the array geometry is tracked via satellite and communicated to the master controller.

39. (currently amended) A method for tracking and positioning a seismic streamer array comprising:

~~providing a towing vessel for~~ towing a seismic array comprising a plurality of seismic streamers from a towing vessel;

~~providing a seismic streamer array comprising a plurality of seismic streamers;~~

~~providing~~ attaching an active streamer positioning device (ASPD) ~~attached~~ to each seismic streamer for positioning each seismic streamer;

~~providing a master controller for issuing positioning commands from a master controller to each ASPD to adjust vertical and horizontal position of a first streamer relative to a second streamer in the array for maintaining a specified array geometry;~~

~~providing an environmental sensor for sensing environmental factors which influence the towed path of the towed array;~~

~~providing a tracking system for tracking the streamer positions versus time during a seismic data acquisition run;~~

~~providing an array geometry tracking system for tracking the array geometry versus time during a seismic data acquisition run, wherein the master controller compares the positions of the streamers versus time and the array geometry versus time to desired streamer positions and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired streamer positions and array geometry versus time.~~

40. The method of claim 39 wherein the master controller factors in environmental measurements into the positioning commands to compensate for environmental influences on the positions of the streamers and the array geometry.

41. The method of claim 39 wherein the master controller compensates for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry.

42. (currently amended) The method of claim 39 further comprising:

~~providing a monitor for~~ determining the status of each streamer, wherein the master controller adjusts the array geometry to compensate for a failed streamer.

43. The method of claim 39 further comprising:

providing a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to move the failed streamer out of the array.

44. (currently amended) A method for tracking and positioning a seismic streamer array comprising:

~~providing a towing vessel for~~ towing a seismic array comprising a plurality of seismic streamers from a towing vessel;

~~providing a seismic streamer array comprising a plurality of seismic streamers;~~

~~providing an active streamer positioning device (ASPD) attached to each seismic streamer for positioning each seismic streamer;~~

~~providing a master controller for~~ issuing vertical and horizontal positioning commands to each ASPD for maintaining a specified array geometry;

~~providing an environmental sensor for~~ sensing environmental factors which influence the path of the towed array;

~~providing a tracking system for~~ tracking the streamer positions versus time during a seismic data acquisition run;

~~providing an array geometry tracking system for~~ tracking the array geometry versus time during a seismic data acquisition run, wherein the master controller compares the positions of the streamers versus time and the array geometry versus time to a desired position and

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array geometry versus time and issues positioning commands to the ASPDs to maintain the desired position and array geometry versus time, wherein the master controller factors in environmental and maneuverability factors into the positioning commands to compensate for environmental and maneuverability influences on the position of the streamers and the array geometry; and

~~providing a monitor for~~ determining the status of each streamer, wherein the master controller adjusts the array geometry to compensate for a failed streamer and removes the failed streamer from the array.

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45. (currently amended) A method for tracking and positioning seismic streamer array comprising:

~~providing a towing vessel for~~ towing a seismic array comprising a plurality of seismic streamers;

~~providing a seismic streamer array comprising a plurality of seismic streamers~~;

~~providing~~ attaching an active streamer positioning device (ASPD) attached to each seismic streamer for positioning each seismic streamer; and

~~providing a master controller for~~ issuing vertical and horizontal positioning commands to each ASPD for maintaining a specified array path.

46. (currently amended) The method of claim 45 wherein ~~the~~ a master controller issues positioning commands to the towing vessel for maintaining a specified array path.

47. (currently amended) The method of claim 45 further comprising:

~~providing a processor for calculating an optimal path for the seismic array for optimal coverage during seismic data acquisition over a seismic field;~~  
~~providing a streamer behavior prediction processor which predicts array behavior;~~  
~~predicting array behavior;~~ and ~~wherein the master controller compensates~~ compensating for predicted streamer behavior in issuing positioning commands to the towing vessel and the ASPDs for positioning the array along the optimal path.

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05/11* 48. The method of claim 47 wherein the master controller compensates for environmental factors in the positioning commands.

49. The method of claim 48 wherein the master controller compensates for maneuverability factors in the positioning commands.

50. (currently amended) A method for tracking and positioning a seismic streamer array comprising:

~~providing a towing vessel for towing a seismic array~~ comprising a plurality of seismic streamers;

~~providing a seismic streamer array comprising a plurality of seismic streamers;~~

~~providing~~ attaching an active streamer positioning device (ASPD) attached to each seismic streamer for positioning each seismic streamer;

~~providing a master controller for issuing~~ horizontal and vertical positioning commands to each ASPD and to the towing vessel for maintaining an optimal path, ~~wherein the master controller further comprises a processor for calculating an optimal path for the seismic array for optimal coverage during seismic data acquisition over a seismic field, and a streamer~~

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behavior prediction processor which ~~predicts~~ predicting array behavior, wherein the master controller compensates for predicted streamer behavior in issuing positioning commands to the towing vessel and the ASPDs for positioning the array along the optimal path, wherein the master controller compensates for environmental and maneuverability factors in the positioning commands.

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In the Abstract

Please amend the abstract as follows:

A method and apparatus comprising an active control system for a towed seismic streamer array that enables any relative positional control of any number of towed seismic streamers. The streamer positions are controlled horizontally and vertically using active control units positioned within the seismic array. The three component (x, y, z) position of each streamer element, relative to the vessel and relative to each other is controlled, tracked and stored during a seismic data acquisition run. ~~The active control elements can be located at diverter position, streamer head, along the length of the streamer or on the tail of the streamer. The apparatus and method of the~~ The present invention enables a seismic array to be maneuvered as the towing vessel maintains course, ~~or the vessel itself maneuvers to assist in the repositioning of the array. The system enables~~ maintenance of specific array position and geometry in the presence of variable environmental factors. ~~The present invention~~ and facilitates four-dimensional seismic data acquisition by sensing and storing the position of the array and each array element with respect to time. ~~Ancillary configurations such as collapsing an array or one section one streamer of an array for maintenance, handling or retrieval are enabled.~~

REMARKS

An amended set of Figures 1-6 are submitted herewith with added alphabetic listing and title for each element clearly detailed in the drawing.

A copy of the two previously filed Information Disclosure Statements are included herewith. All non-cumulative prior art references known to the applicant have been disclosed to the USPTO in these two previously filed Information Disclosure statements. U.S. Patent 4,992,990 is mentioned in the specification and in WO 00/20895 cited by the Examiner. Applicant considers 4,992,990US cumulative to other patents already disclosed to the USPTO. An amended abstract is enclosed having a word count less than 150 words. A supplemental declaration will be submitted correcting the deficiencies pointed out by the Examiner.

The Examiner objected to the incorporation by reference. Applicant respectfully submits that incorporation of related co-pending applications is proper, even when the present application is not a continuation application.

The Examiner rejected claims 1-50 as anticipated by Hillesund et al., in WO 2000/20895. Applicant respectfully traverses the Examiner's rejections as follows:

With regard to claim 1, Hillesund does not disclose positioning a streamer vertically and horizontally relative to a second streamer in the array, as claimed. Hillesund teaches only horizontal steering (p.6, line 20) of the streamers. Vertical position is monitored but not steered as described in Hillesund on p.8, ll. 6-10, "the global control system 22 will typically acquire the



following...the location of the birds in the horizontal plane..." Thus Hillesund does not anticipate claim 1.

With regard to claim 2, Hillesund teaches depth sensors but not environmental sensors that influence the path of the towed array as claimed. Thus, Hillesund does not anticipate claim 2.

With regard to claim 3, Hillesund does not teach repeating the array geometry versus time in a subsequent data acquisition run as claimed. Thus Hillesund does not anticipate claim 3.

With regard to claim 4, Hillesund does not teach comparing the positions of the streamers versus time and the array geometry versus time to a desired streamer position and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired streamer position and array geometry versus time as claimed. Thus Hillesund does not anticipate claim 4.

With regard to claim 5, Hillesund teaches minimization of position correction to minimize acoustic noise generated by the streamer, not environmental influences, e.g. salinity, etc. on steering streamers. Thus Hillesund does not anticipate claim 5.

With regard to claim 6, Hillesund teaches producing relative velocity of birds from vessel speed and heading, but not the master controller compensates for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry as claimed. The present invention compensates for maneuverability (vessel

type, cable diameter, array type deployed configuration device type, etc.) Thus, Hillesund does not anticipate claim 6.

With regard to claim 7, Hillesund teaches a computer monitor but not a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to compensate for a failed streamer. Thus, Hillesund does not anticipate claim 7.

With regard to claim 8, Hillesund teaches a computer monitor but not a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to move a failed streamer out of the array. Thus, Hillesund does not anticipate claim 8.

With regard to claim 9, Hillesund teaches obtaining velocity of the positioning device, not status of each streamer. Nor does it teach detaching a failed streamer. Thus, Hillesund does not anticipate claim 9.

With regard to claim 10, Hillesund does not teach claim 1 as discussed above, thus Hillesund does not anticipate claim 10, which depends from claim 1.

With regard to claim 11, Hillesund, page 7, paragraph 2, does not teach positioning streamers at a plurality of depths or varying temporal resolution of the array. There is no mention of varying temporal resolution in Hillesund. Thus, Hillesund, does not anticipate claim 11.

With regard to claim 12, Hillesund teaches controlling a bird wing angle on page 17, but does not teach rotating an entire plane of streamers an angle  $\theta$  as claimed. Thus, Hillesund does not anticipate claim 12.

With regard to claim 13, Hillesund does not anticipate claim 1 or claim 4 (discussed above) from which claim 13 depends, thus, Hillesund does not anticipate claim 13.

With regard to claim 14, Hillesund does not teach issuing vertical and horizontal positioning commands, or sensing environmental factors, or comparing the array geometry versus time. Thus Hillesund does not anticipate claim 14.

With regard to claim 15, Hillesund teaches minimization of position correction to minimize acoustic noise generated by the streamer, not environmental influences, (e.g. salinity, etc.) on steering streamers. Thus Hillesund does not anticipate claim 15.

With regard to claim 16, Hillesund teaches producing relative velocity of birds from vessel speed and heading, but not the master controller compensating for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry as claimed. The present invention compensates for maneuverability (vessel type, cable diameter, array type deployed configuration device type, etc.) Thus, Hillesund does not anticipate claim 16.

With regard to claim 17, Hillesund teaches a computer monitor but not a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to compensate for a failed streamer. Thus, Hillesund does not anticipate claim 17.

With regard to claim 18, Hillesund teaches a computer monitor but not a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to move a failed streamer out of the array. Thus, Hillesund does not anticipate claim 18.

With regard to claim 19, Hillesund does not disclose positioning a streamer vertically and horizontally relative to a second streamer in the array, as claimed. Hillesund teaches only horizontal steering (p.6, line 20) of the streamers. Vertical position is monitored but not steered as described on p.8, ll. 6-10, "the global control system 22 will typically acquire the following...the location of the birds in the horizontal plane..." Thus, Hillesund does not anticipate claim 19.

With regard to claim 20, Hillesund does not disclose positioning a streamer vertically and horizontally relative to a second streamer in the array, as claimed. Hillesund teaches only horizontal steering (p.6, line 20) of the streamers. Vertical position is monitored but not steered as described on p.8, ll. 6-10, the "global control system 22 will typically acquire the following...the location of the birds in the horizontal plane..." Thus, Hillesund does not anticipate claim 20.

With regard to claim 21, Hillesund does not anticipate claim 20 from which claim 21 depends, thus Hillesund does not anticipate claim 21.

With regard to claim 22, Hillesund does not disclose positioning a streamer vertically and horizontally relative to a second streamer in the array, as claimed. Hillesund teaches only horizontal steering (p.6, line 20) of the streamers. Vertical position is monitored but not steered as described on p.8, ll. 6-10, the “global control system 22 will typically acquire the following...the location of the birds in the horizontal plane...” Thus, Hillesund does not anticipate claim 22.

With regard to claim 23, Hillesund teaches minimization of position correction to minimize acoustic noise generated by the streamer, not environmental influences, (e.g. salinity, etc.) on steering streamers. Thus, Hillesund does not anticipate claim 23.

With regard to claim 24, Hillesund teaches producing relative velocity of birds from vessel speed and heading, but not the master controller compensating for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry as claimed. The present invention compensates for maneuverability. (vessel type, cable diameter, array type deployed configuration device type, etc.) Thus, Hillesund does not anticipate claim 24.

With regard to claim 25, Hillesund does not disclose positioning a streamer vertically and horizontally relative to a second streamer in the array, as claimed. Hillesund teaches only horizontal steering (p.6, line 20) of the streamers. Vertical position is monitored but not steered as described on p.8, ll. 6-10, the “global control system 22 will typically acquire the following...the location of the birds in the horizontal plane...” Thus, Hillesund does not anticipate claim 25.



With regard to claim 26, Hillesund does not disclose positioning a streamer vertically and horizontally relative to a second streamer in the array, as claimed. Hillesund teaches only horizontal steering (p.6, line 20) of the streamers. Vertical position is monitored but not steered as described on p.8, ll. 6-10, the “global control system 22 will typically acquire the following...the location of the birds in the horizontal plane...” Thus, Hillesund does not anticipate claim 26.

With regard to claim 27, Hillesund teaches minimization of position correction to minimize acoustic noise generated by the streamer, not environmental influences, (e.g. salinity, etc.) on steering streamers. Thus, Hillesund does not anticipate claim 27.

With regard to claim 28, Hillesund does not teach repeating the array geometry versus time in a subsequent data acquisition run as claimed. Thus, Hillesund does not anticipate claim 28.

With regard to claim 29, Hillesund does not teach comparing the positions of the streamers versus time and the array geometry versus time to a desired streamer position and array geometry versus time and issues positioning commands to the ASPDs to maintain the desired streamer position and array geometry versus time as claimed. Thus, Hillesund does not anticipate claim 29.

With regard to claim 30, Hillesund teaches minimization of position correction to minimize acoustic noise generated by the streamer, not environmental influences, e.g. salinity, etc. on steering streamers. Thus, Hillesund does not anticipate claim 30.

With regard to claim 31, Hillesund teaches producing relative velocity of birds from vessel speed and heading, but not the master controller compensating for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry as claimed. The present invention compensates for maneuverability. (vessel type, cable diameter, array type deployed configuration device type, etc.) Thus, Hillesund does not anticipate claim 31.

With regard to claim 32, Hillesund teaches a computer monitor but not a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to compensate for a failed streamer. Thus, Hillesund does not anticipate claim 32.

With regard to claim 33, Hillesund teaches a computer monitor but not a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to move a failed streamer out of the array. Thus, Hillesund does not anticipate claim 33.

With regard to claim 34, Hillesund teaches obtaining velocity of the positioning device, not status of each streamer. Nor does it teach detaching a failed streamer. Thus, Hillesund does not anticipate claim 34.

With regard to claim 35, Hillesund does not teach claim 1 as discussed above, thus Hillesund does not anticipate claim 35, which depends from claim 1.

With regard to claim 36, Hillesund, page 7, paragraph 2, does not teach positioning streamers at a plurality of depths or varying temporal resolution of the array. There is no mention of varying temporal resolution in Hillesund. Thus, Hillesund does not anticipate claim 36.

With regard to claim 37, Hillesund teaches controlling a bird wing angle on page 17, but does not teach rotating an entire plane of streamers an angle  $\theta$  as claimed. Thus, Hillesund does not anticipate claim 37.

With regard to 38, Hillesund does not anticipate claim 1 or claim 4 (discussed above) from which claim 38 depends, thus, Hillesund does not anticipate claim 38.

With regard to claim 39, Hillesund does not disclose positioning a streamer vertically and horizontally relative to a second streamer in the array, as claimed. Hillesund teaches only horizontal steering (p.6, line 20) of the streamers. Vertical position is monitored but not steered as described on p.8, ll. 6-10, the “global control system 22 will typically acquire the following...the location of the birds in the horizontal plane...” Thus, Hillesund does not anticipate claim 39.

With regard to claim 40, Hillesund teaches minimization of position correction to minimize acoustic noise generated by the streamer, not environmental influences, (e.g. salinity, etc.) on steering streamers. Thus, Hillesund does not anticipate claim 40.

With regard to claim 41, Hillesund teaches producing relative velocity of birds from vessel speed and heading, but not the master controller compensates for maneuverability in the positioning

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commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry as claimed. The present invention compensates for vessel type, cable diameter, array type deployed configuration device type, etc. Thus, Hillesund does not anticipate claim 41.

With regard to claim 42, Hillesund teaches a computer monitor but not a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to compensate for a failed streamer. Thus, Hillesund does not anticipate claim 42.

With regard to claim 43, Hillesund teaches a computer monitor but not a monitor for determining the status of each streamer, wherein the master controller adjusts the array geometry to move a failed streamer out of the array. Thus, Hillesund does not anticipate claim 43.

With regard to claim 44, Hillesund does not disclose positioning a streamer vertically and horizontally relative to a second streamer in the array, as claimed. Hillesund teaches only horizontal steering (p.6, line 20) of the streamers. Vertical position is monitored but not steered as described on p.8, ll. 6-10, the global control system 22 will typically acquire the following...the location of the birds in the horizontal plane... Thus Hillesund does not anticipate claim 44.

With regard to claim 45, Hillesund does not disclose positioning a streamer vertically and horizontally relative to a second streamer in the array, as claimed. Hillesund teaches only horizontal steering (p.6, line 20) of the streamers. Vertical position is monitored but not steered as described on p.8, ll. 6-10, the “global control system 22 will typically acquire the following...the location of the birds in the horizontal plane...” Thus, Hillesund does not anticipate claim 45.

With regard to claim 46, Hillesund does not disclose positioning a streamer vertically and horizontally relative to a second streamer in the array, as claimed. Hillesund teaches only horizontal steering (p.6, line 20) of the streamers. Vertical position is monitored but not steered as described on p.8, ll. 6-10, the “global control system 22 will typically acquire the following...the location of the birds in the horizontal plane...” Thus, Hillesund does not anticipate claim 46.

With regard to claim 47, Hillesund does not disclose positioning a streamer vertically and horizontally relative to a second streamer in the array, as claimed. Hillesund teaches only horizontal steering (p.6, line 20) of the streamers. Vertical position is monitored but not steered as described on p.8, ll. 6-10, the “global control system 22 will typically acquire the following...the location of the birds in the horizontal plane...” Thus, Hillesund does not anticipate claim 47.

With regard to claim 48, Hillesund teaches minimization of position correction to minimize acoustic noise generated by the streamer, not environmental influences, (e.g. salinity, etc.) on steering streamers. Thus, Hillesund does not anticipate claim 48.

With regard to claim 49, Hillesund teaches producing relative velocity of birds from vessel speed and heading, but not the master controller compensating for maneuverability in the positioning commands to compensate for maneuverability influences on the positioning of the streamers and the array geometry as claimed. The present invention compensates for maneuverability (vessel type, cable diameter, array type deployed configuration device type, etc.) Thus, Hillesund does not anticipate claim 49.

With regard to claim 50, Hillesund does not disclose positioning a streamer vertically and horizontally relative to a second streamer in the array, as claimed. Hillesund teaches only horizontal steering (p.6, line 20) of the streamers. Vertical position is monitored but not steered as described on p.8, ll. 6-10, the “global control system 22 will typically acquire the following...the location of the birds in the horizontal plane...” Thus, Hillesund does not anticipate claim 50.

June 26, 2003

Respectfully submitted,



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INVENTOR: Zmac  
TITLE: Separation Tracking and Positioning...  
SERIAL NO.: 02/082,952; Filed: June 15, 2001;  
DOCKET NO.: 594-23539-US  
SHEET 1 OF 6

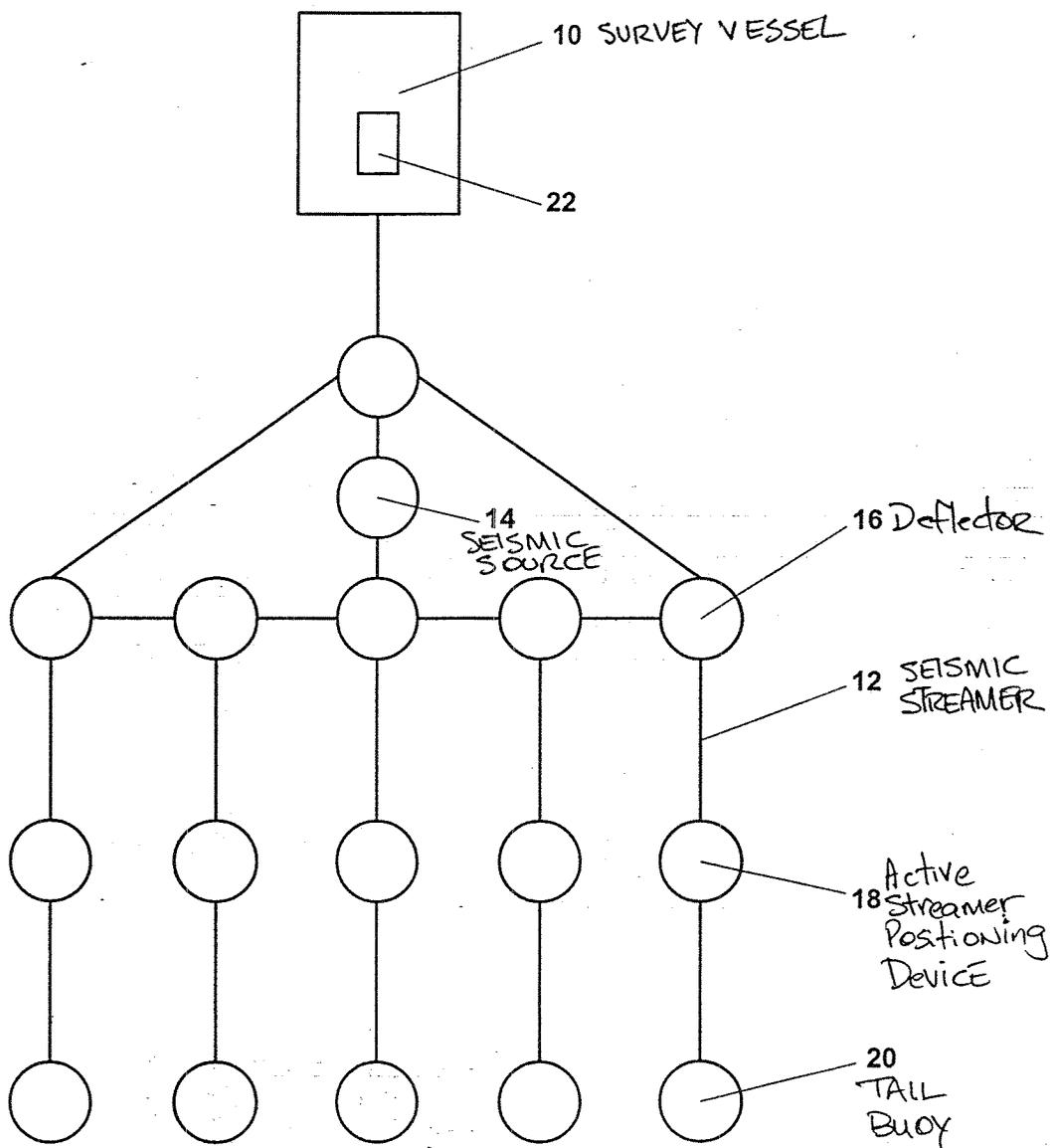


Figure 1



INVENTOR: Zabc  
TITLE: A Separation Tracking and Positioning...  
SERIAL NO.: 09,832,952; Filed: June 15, 2001;  
DOCKET NO.: 594-23539-US  
SHEET 2 OF 6

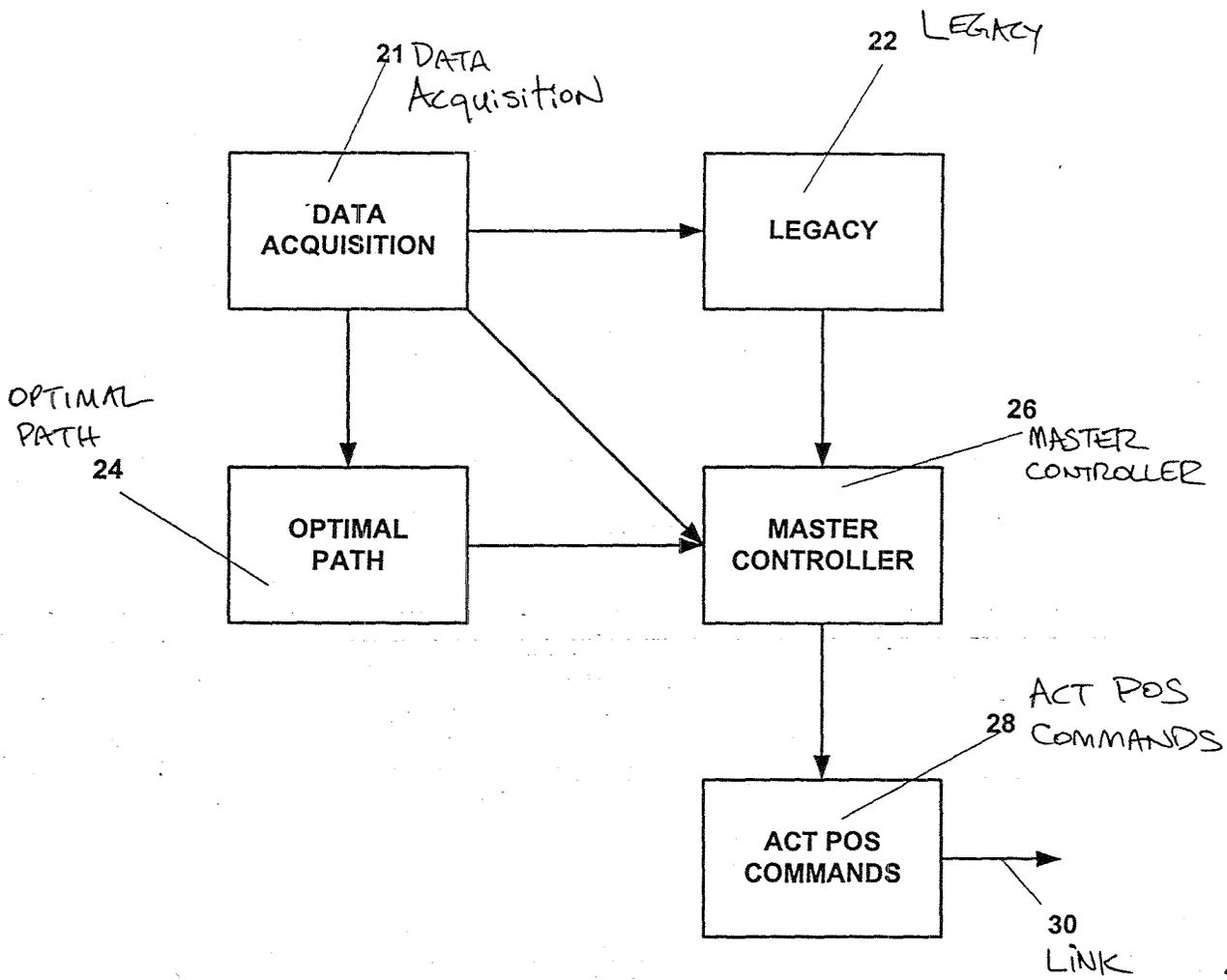


Figure 2

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 TITLE: [unclear] e Separation Tracking and Positioning...  
 SERIAL NO.: 6,708,952; Filed: June 15, 2001;  
 DOCKET NO.: 594-23539-US  
 SHEET 3 OF 6

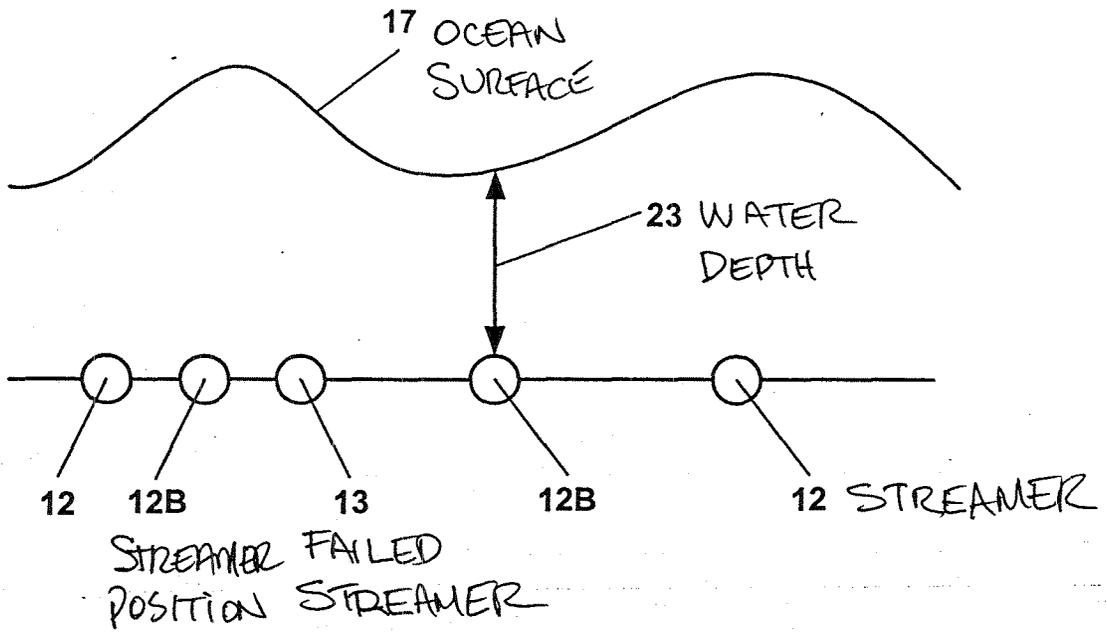


Figure 3A

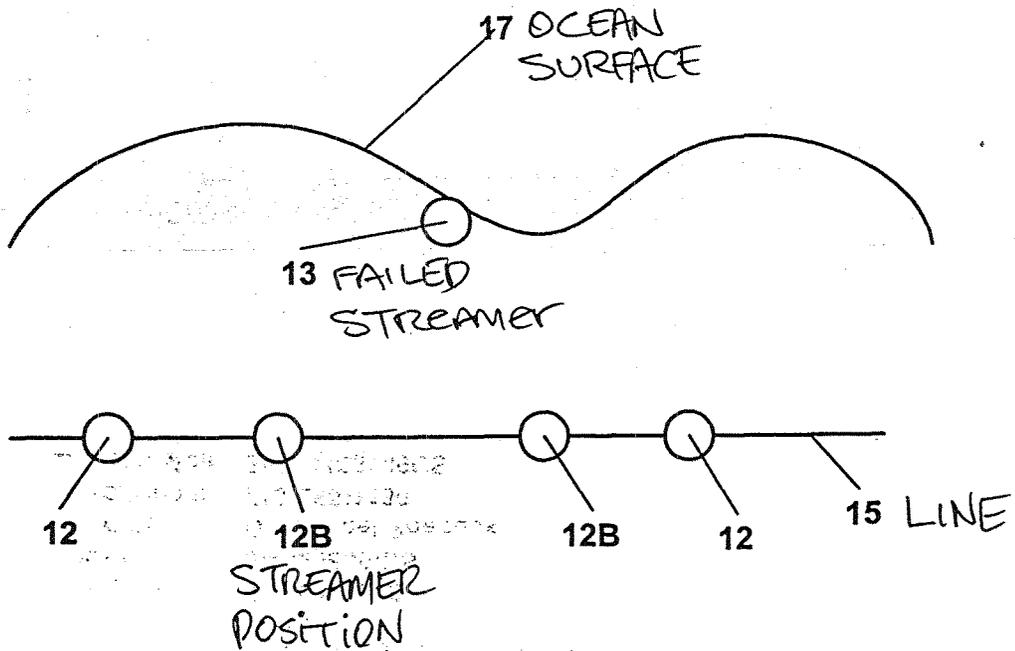


Figure 3B



INVENTOR: Zriac  
TITLE: A Method for Separation Tracking and Positioning...  
SERIAL NO.: 6,210,952; Filed: June 15, 2001;  
DOCKET NO.: 594-23539-US  
SHEET 4 OF 6

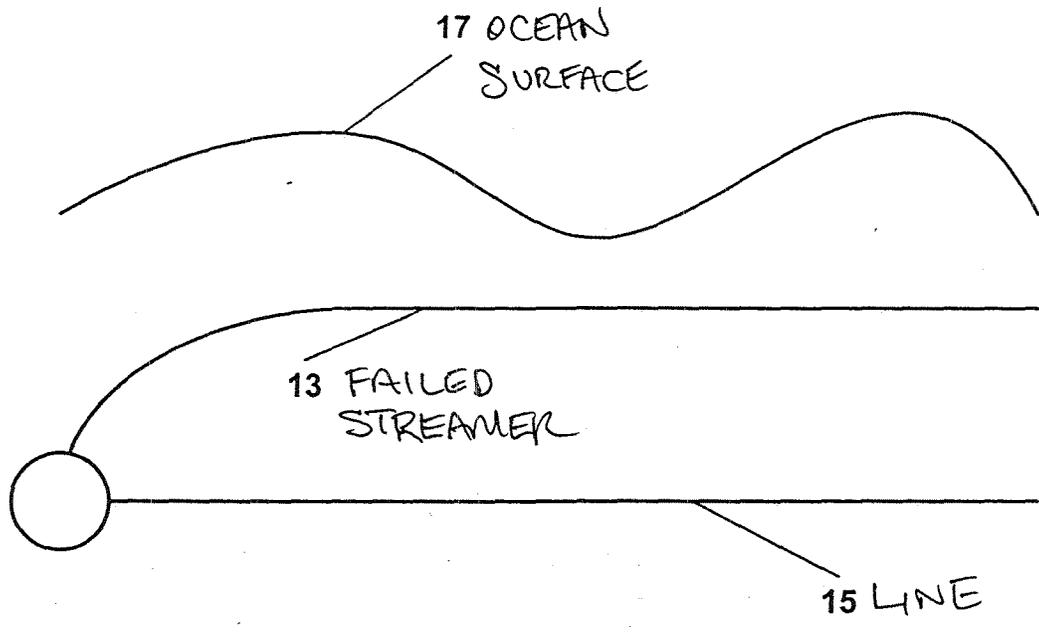


Figure 3C

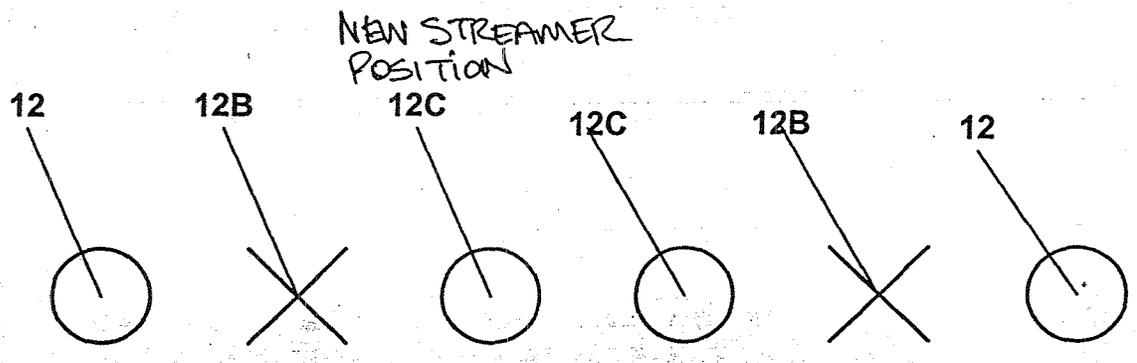


Figure 3D

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WASHINGTON, D.C. 20530

INVENTOR: Zifac  
 TITLE: A Separation Tracking and Positioning...  
 SERIAL NO.: 09/ 62,952; Filed: June 15, 2001;  
 DOCKET NO.: 594-23539-US  
 SHEET 5 OF 6

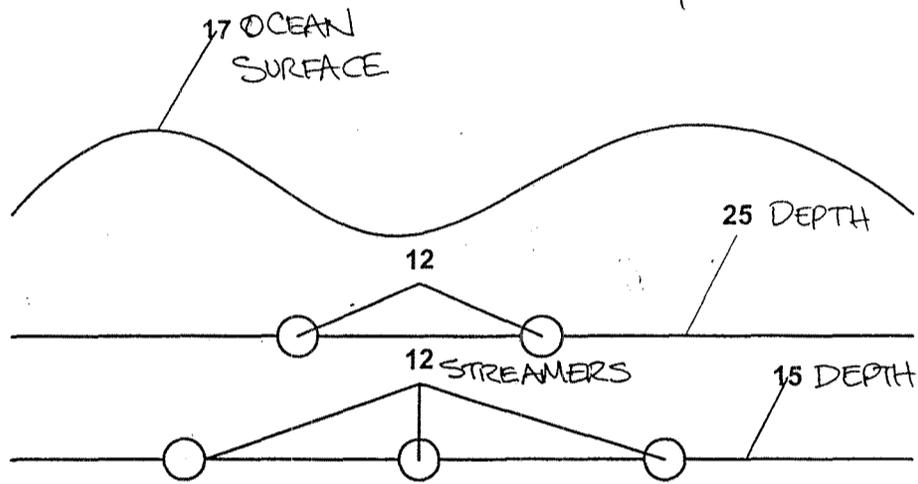


Figure 4

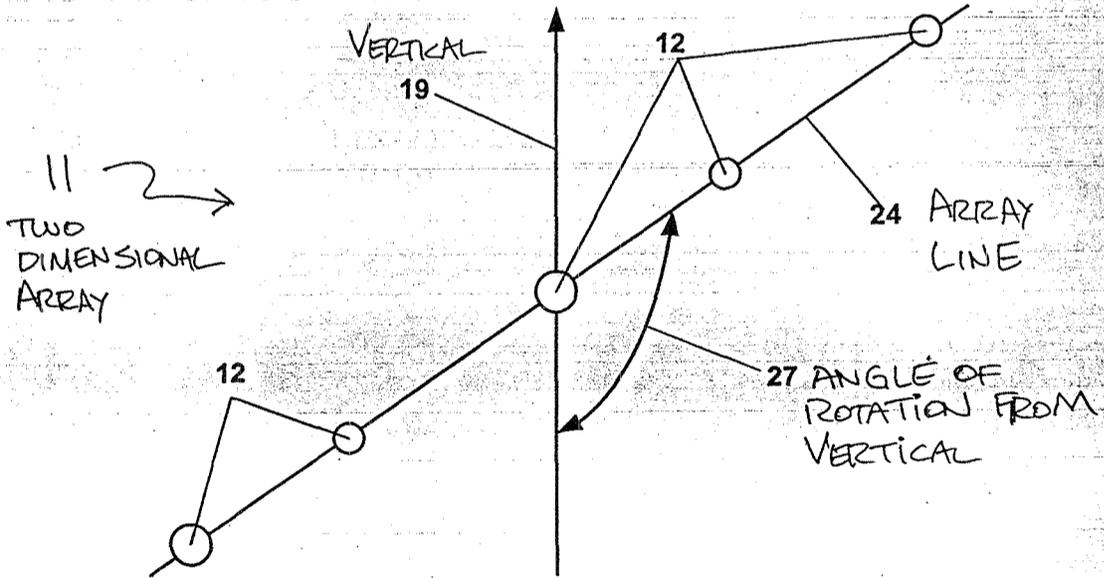


Figure 5



INVENTOR: Z. Tac  
TITLE: Separation Tracking and Positioning...  
SERIAL NO.: 09/082,952; Filed: June 15, 2001;  
DOCKET NO.: 594-23539-US  
SHEET 6 OF 6

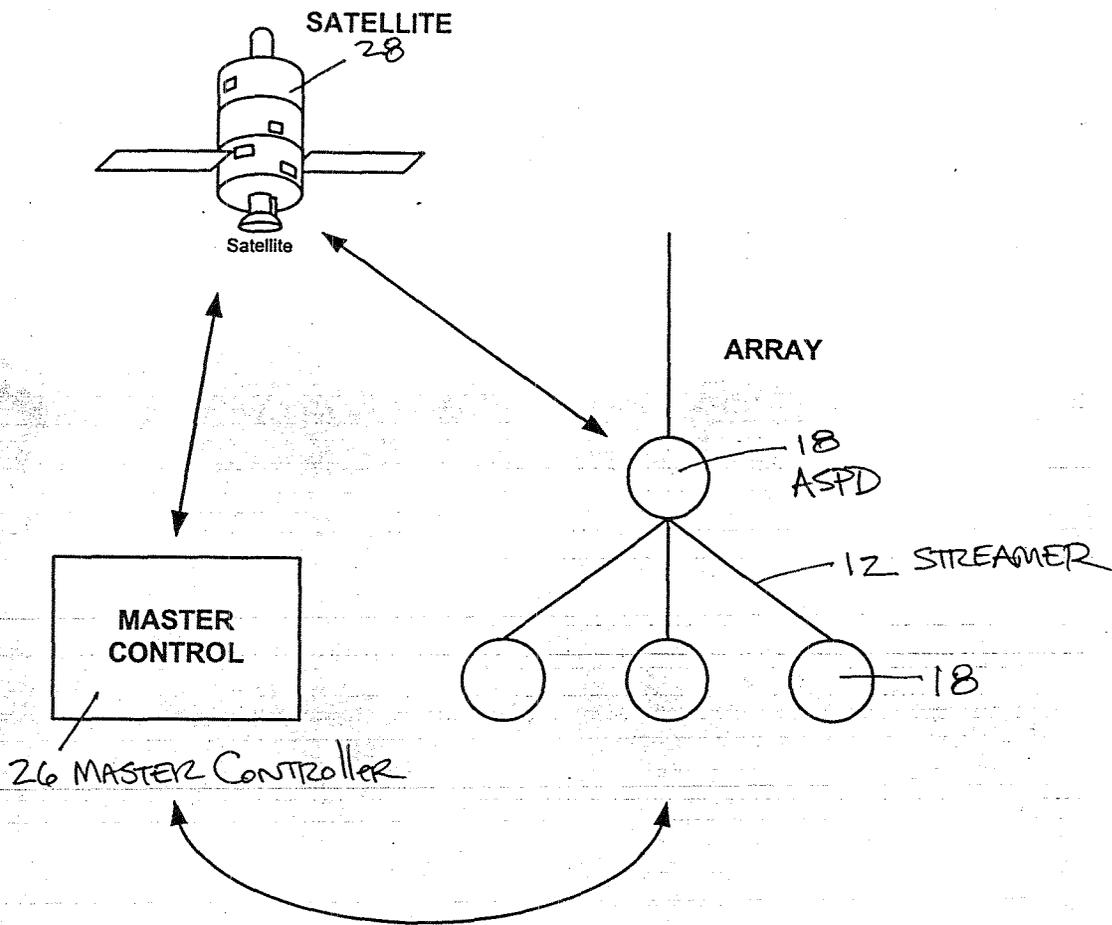
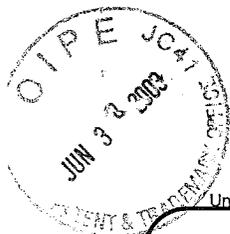


Figure 6



2863

PTO/SB/21 (01-03)

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|  | Filing Date          | June 15, 2001          |              |
|  | First Named Inventor | Zajac                  |              |
|  | Art Unit             | 2863                   |              |
|  | Examiner Name        | Victor J. Taylor       |              |
| Total Number of Pages in This Submission   | 38                   | Attorney Docket Number | 594-23539-US |

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