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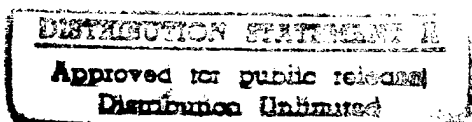
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Serial Number 725,217
Filing Date 26 September 1996
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NOTICE

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OFFICE OF NAVAL RESEARCH
DEPARTMENT OF THE NAVY
CODE OCCC
ARLINGTON VA 22217-5660

DTIC QUALITY INSPECTED 2

19971211 033

3 SPINNING FILTER SEPARATION SYSTEM FOR OIL
4 SPILL CLEAN-UP OPERATION

5 This invention relates in general to the clean up of ocean water oil spills.

6 BACKGROUND OF THE INVENTION7 According to current technology, effective clean up of oil spills from the surface of ocean
8 water is performed by an oil sweeper vessel within which oil contaminated water is collected for
9 transport to remotely located on-shore equipment within which oil separation and disposal is
10 performed. The processing of large quantities of oil polluted ocean water is accordingly time
11 consuming as well as costly.12 It is therefore an important object of the present invention to provide a less costly oil spill
13 clean up system involving more rapid processing of large quantities of oil polluted ocean water.
1415 SUMMARY OF THE INVENTION16 In accordance with the present invention, oil polluted ocean water is processed at an oil spill
17 location by continuous separation during pressurized flow of the water through at least two
18 separator devices within which successive reduction in oil concentration is effected with respect
19 to a separated portion of the water by filtered flow through porous membrane walls to
20 correspondingly increase the oil concentration within the other remaining portion of water being
21 processed. The first portion of the processed water when sufficiently reduced in oil
22 concentration is discharged for return to the oil spill location, while the remaining portion is
23 collected until a sufficient level of oil concentration therein is achieved to permit disposal thereof
24 by burning at the oil spill site.
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BRIEF DESCRIPTION OF THE DRAWING FIGURES

A more complete appreciation of the invention and many of its attendant advantages will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing wherein:

FIG. 1 is a side elevation view with parts shown in section, of apparatus associated with the oil clean up system of the present invention; and

FIG. 2 is a block diagram of the oil clean-up system embodying the apparatus shown in FIG. 1.

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DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to the drawing in detail, FIG. 1 illustrates two separator devices 10A and 10B of similar construction associated with one embodiment of the present invention through which an oil spill clean up operation is performed. As shown, the separator devices are arranged in vertical parallel relation to each other for rotation about axes 12 extending centrally through outer cylindrical housings 14 of the separator devices. An inner axial flow chamber 16 aligned with axis 12 is formed within each separator device to which axial flow of water under pressure as the fluent material being processed is conducted. Inflow to the inner chamber 16 of separator device 10A is conducted by conduit section 18 at the lower axial end of housing 14. Fluent material conducted through such axial flow chamber 16 is discharged from the upper axial end of housing 14 of separator device 10A through a conduit section 20.

The inner axial flow chamber 16 in each of the separator devices 10A and 10B is enclosed by a radially inner cylindrical porous wall 22 of a filtering arrangement. An annular chamber 24 is enclosed in surrounding relation to inner chamber 16 by a second cylindrical porous wall 26

1 radially spaced inwardly from the outer imperforate wall of the housing 14 to form a radially
2 outer chamber 28 therein. Outflow from the bottom of chamber 28 in separator device 10A is
3 transferred by conduit section 30 to the lower end of the inner axial flow chamber 16 of separator
4 device 10B from which axial outflow is discharged at its upper axial end through conduit section
5 32. A continuous radial outflow through the filtering walls 22 and 26 in each of the separator
6 devices 10A and 10B is thus established through conduit section 30 between chamber 28 in
7 device 10A and the inner chamber in device 10B to its radially outer chamber so as to effect a
8 successive reduction in concentration of a filter separated contaminant within the fluent material
9 discharged from the lower end of the outer chamber of device 10B through conduit section 34, as
10 shown in FIG. 1.

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13 The radially inner filtering wall 22 of each separator device according to one embodiment is
14 formed by a fluortex hydrophobic separation membrane with 50 μm pores therein which serves
15 to prevent inflow of droplets of oil as the contaminant, larger than 50 μm , into the annular
16 chamber 24 so as to thereby reduce oil concentration within the water being processed. A further
17 reduction in oil concentration is then effected by inflow of the water being processed to chamber
18 28 through filtering wall 26 formed by a hydrophilic separation membrane with 2 μm pores
19 therein. The water so processed by radial outflow through the porous separation membranes of
20 filtering walls 22 and 26 in separator device 10A is again so processed by radial outflow through
21 comparable separation membranes within separator device 10B to supply a portion of the
22 processed water to discharge conduit section 34 with a desired reduced concentration of oil
23 therein. In order to maintain a proper continuous radial outflow through the separation
24 membranes of the filtering walls 22 and 26 without clogging, the separator devices 10A and 10B
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1 are rotated about the axes 12 thereof to centrifugally enhance the radial outflow through the
2 filtering walls. The portions of the processed water mixtures respectively leaving the separator
3 devices 10A and 10B through conduit sections 20 and 32 are correspondingly increased in oil
4 concentration to an extent accommodating on-site disposal thereof by burning within a furnace
5 after being collected within a reservoir tank or the like.
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7 The oil spill clean up operation hereinbefore described in connection with the apparatus
8 illustrated in FIG. 1, is summarized by reference to FIG. 2 diagramming the separator devices
9 10A and 10B rotated by spin motors 36A and 36B as part of a system for clean-up of water
10 polluted at an oil spill site or location 38. The polluted water from such location 38 is fed under
11 pressure by pump 40 to the separator device 10A through conduit section 18 for axial flow
12 through chamber 16 therein. The successively reduced concentration of oil within the portion of
13 the processed water delivered through conduit section 34 from separator device 10B is
14 discharged, as denoted in FIG. 2 by reference numeral 42, for return of sufficiently purified water
15 to the oil spill site 38. The other portion of the processed water is continuously fed by conduit
16 sections 20 and 32 from the inner chambers 16 of the separator devices for a sufficient period of
17 time to a collection reservoir 44 within which the increased concentration of oil therein becomes
18 high enough to permit on-site furnace combustion thereof.
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22 Obviously, other modifications and variations of the present invention may be possible in
23 light of the foregoing teachings. It is therefore to be understood that

24 the invention may be practiced otherwise than as specifically described.
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1 Navy Case No. 77,495

2 SPINNING FILTER SEPARATION SYSTEM FOR OIL
3 SPILL CLEAN-UP OPERATION

4 ABSTRACT OF THE DISCLOSURE

5 Oil spill polluted water is conducted under pressure in sequence through separator devices to
6 collect and burn a polluted water mixture having its oil concentration increased by extraction of
7 water therefrom during axial flow through the separator devices. Such water extraction is
8 effected by sequential radial outflow through oil flow blocking filter walls of the separator
9 devices in response to rotation thereof.
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DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

SPINNING FILTER SEPARATION SYSTEM FOR OIL SPILL CLEAN-UP OPERATION

the specification of which

(check one) is attached hereto was filed on _____ as Application Serial No. _____ and was amended on _____

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
(Number)	(Country)	Day/Month/Year Filed	Yes	No

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)	(Filing date)	Status
		(patented, pending, abandoned)

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number), and hereby certify that the Government of the United States has the irrevocable right to prosecute this application:

John L. Forrest, Jr., Reg. No. 29,378; Roger D. Johnson, Reg. No. 26,745; Jacob Shuster, Reg. No. 19,660; Howard Kaiser, Reg. No. 31,381; Gary G. Borda, Reg. No. 35,455

SEND CORRESPONDENCE TO: **Office of Counsel (Patents), Code 004**
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DIRECT TELEPHONE CALLS TO:
Jacob Shuster
(301) 394-2174

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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I believe I am the original first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

SPINNING FILTER SEPARATION SYSTEM FOR OIL SPILL CLEAN-UP OPERATION

the specification of which

(check one) [X] is attached hereto [] was filed on _____ as Application Serial No. _____ and was amended on _____

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Table with 3 columns: Prior Foreign Application(s), Priority Claimed, and Yes/No. Includes sub-headers for Number, Country, Day/Month/Year Filed.

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SEND CORRESPONDENCE TO: Office of Counsel (Patents), Code 004 Carderock Division Naval Surface Warfare Center Bethesda, MD 20084-5000 DIRECT TELEPHONE CALLS TO: Jacob Shuster (301) 394-2174

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My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

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the specification of which
(check one) is attached hereto was filed on _____ as Application Serial No. _____ and was amended on _____

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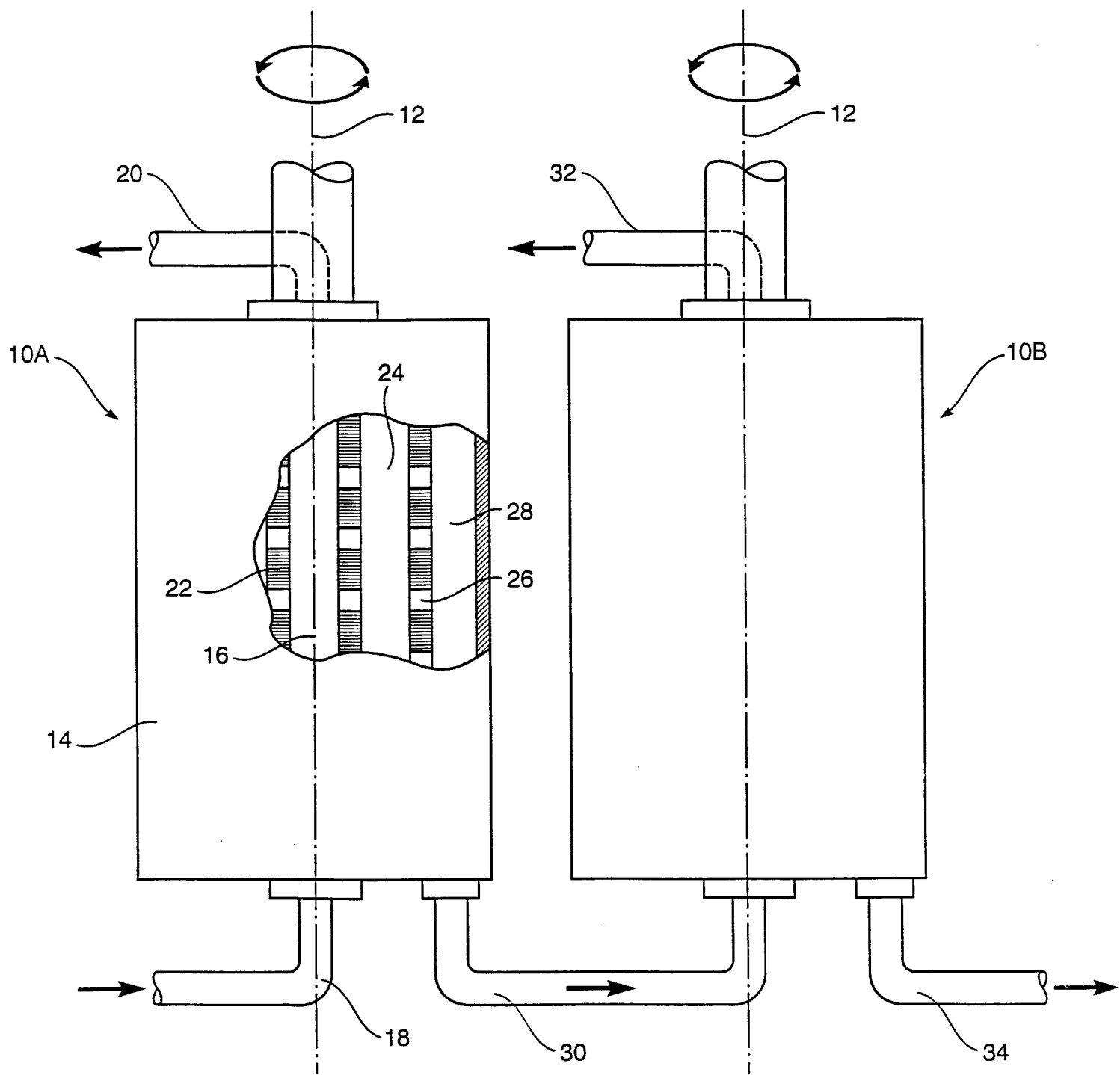


FIG. 1

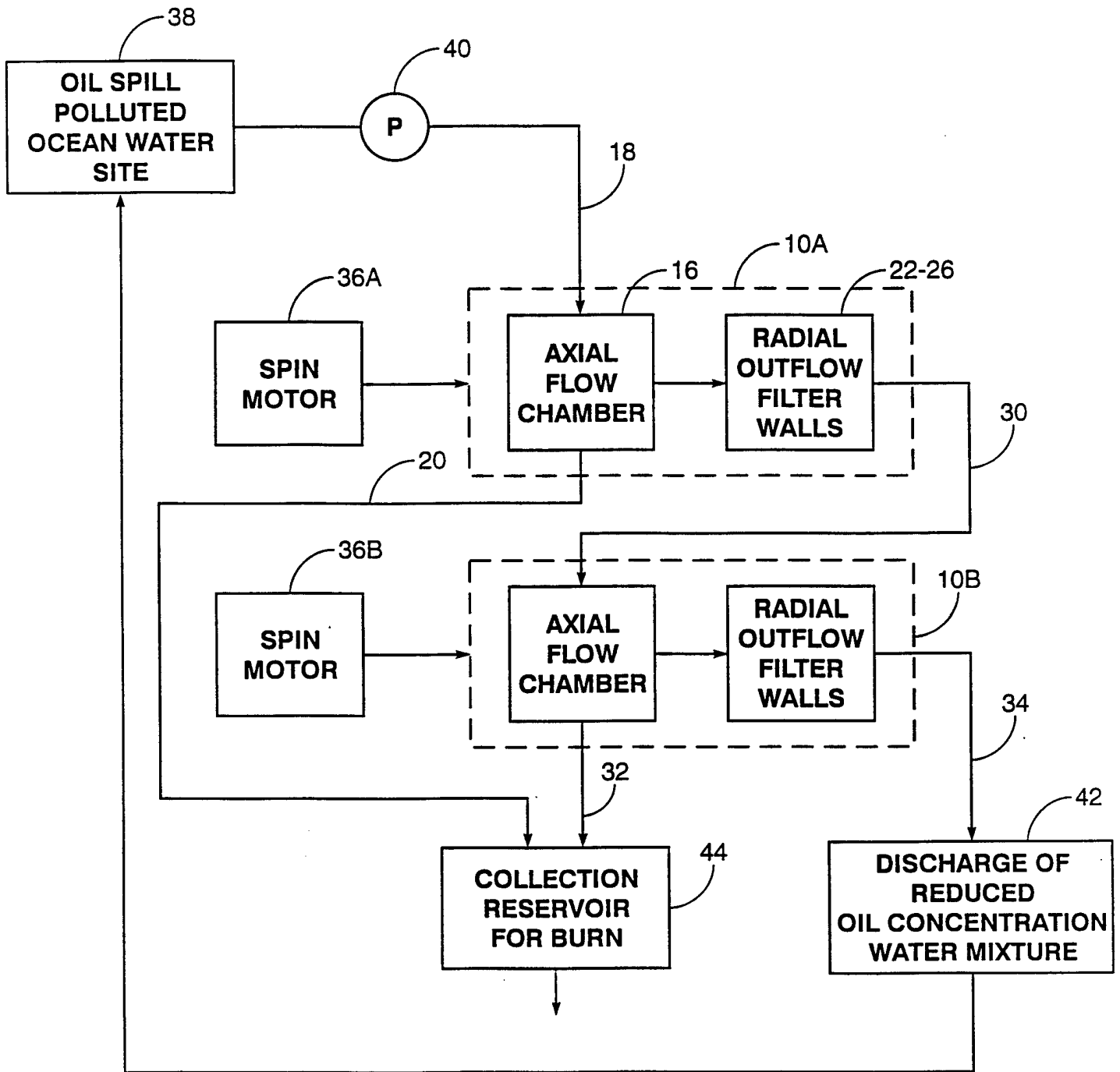


FIG. 2