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MULTIPLE UNIT FILTER

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Fig. 1.

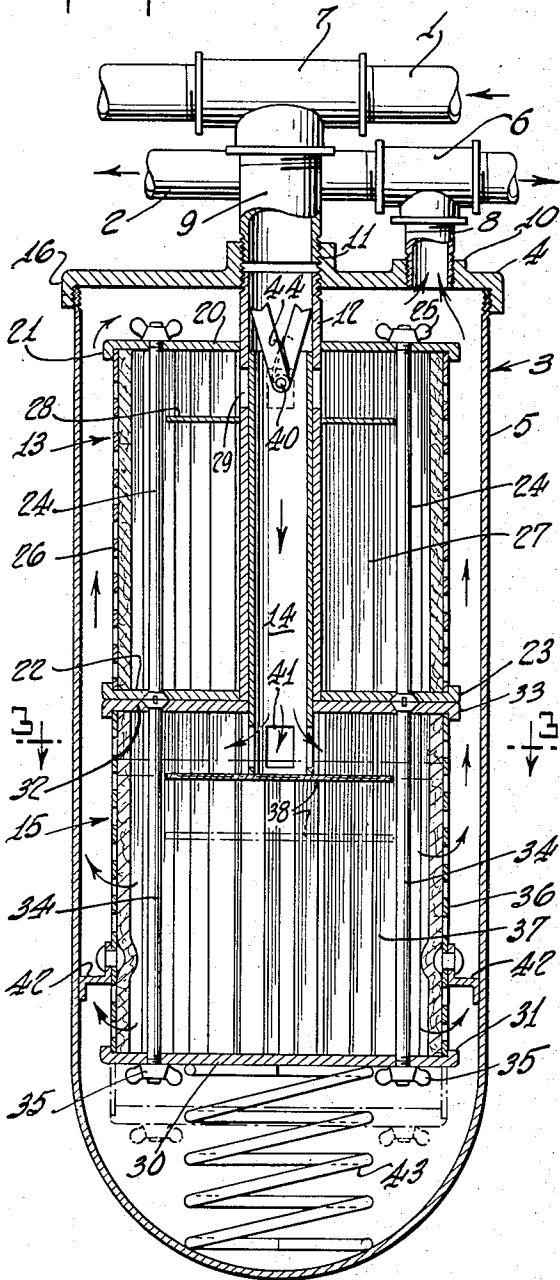


Fig. 2.

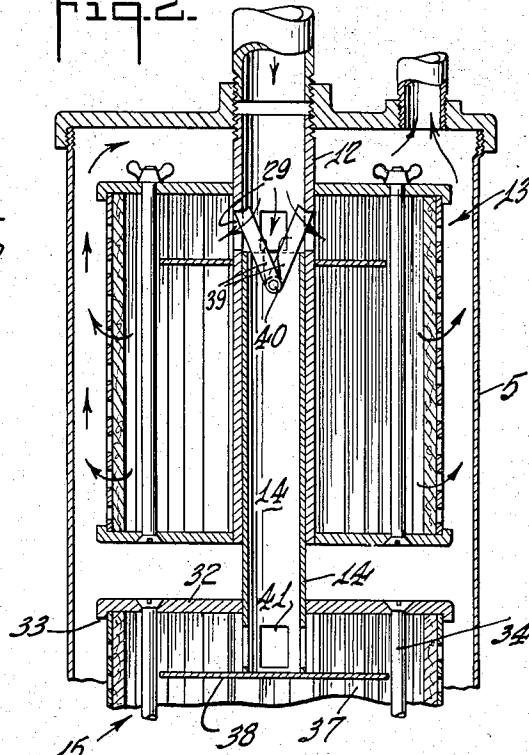
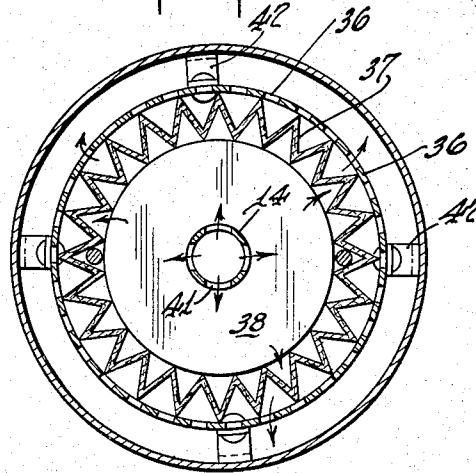


Fig. 3.



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MULTIPLE UNIT FILTER

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11 Claims. (Cl. 210—164)

This invention relates to the filtering of fluids generally, whether liquid or gases, but is more specifically designed to operate on liquids such as crank case oil, sugar cane juice, etc.

3 The main object of the invention is to prolong the efficient action of such a filtering apparatus by making it in the form of a plurality of separate units which will be automatically brought into action sequentially as one or another of said
10 units becomes clogged with accumulated solid impurities which it has strained out of the fluid that has run through it, and the preferred method of securing that result is to make such separate units relatively movable and then utilize the
15 motion of one which is produced by the increased fluid pressure on it, resulting from increased clogging of its filter membranes, to open the feed connection to another, and therefore less used and less clogged unit.

20 The best form of apparatus embodying my invention at present known to me is illustrated in the accompanying sheet of drawings in which

Fig. 1 is a vertical section of a multi-unit filter shown suspended from supply and discharge
25 pipes, the parts being shown in full lines in position for operation of the first or lower unit only.

Fig. 2 is a similar view with parts broken away showing certain of the parts in the positions for a filtering operation through the second, upper
30 unit, and

Fig. 3 is a cross section on line 3—3 of Fig. 1.

Throughout the drawing like reference characters indicate like parts.

1 indicates a section of a supply pipe for a filtering system, and 2 the pipe for carrying away the filtered fluid discharged therefrom. The portion of such filtering system here shown comprises a casing indicated generally by 3, which is suspended from such piping by its inlet and outlet connections therewith. Such connections
40 comprise the nipple or short coupling 8 having a thread at one end for screwing into the boss 10 on casing cover 4 and another thread at its other end for screwing into the T-coupling 6 of pipe 2, together with a short pipe section 9 screwed into a T-coupling 7 on pipe 1 at one end and at the other into boss 11 on cover 4. Into the lower part of the opening through this boss is also
45 screwed the pipe 12, by which the upper filter unit indicated generally at 13 is directly supported, while the lower filter unit indicated generally at 15 depends from a second pipe 14 which has a good working substantially liquid-tight fit in 12. The two filter units are enclosed in a
50 chamber 5, by the surrounding casing shell 3

which screws into the internally threaded flange, or annular lip, 16, on the under side of cover 4.

The lower unit 15 can thus move toward or from the upper one 13 as pipe or tube 14 telescopes into or out of tube 12, and 15 is biased
5 toward 13 by compression spring 43 confined between the bottom or closed end of casing 3 and the adjacent end plate 30 of said unit 15.

Ports in the wall of tube 12 near its upper end are indicated at 29, 29; and 39, 39, indicate pawls
10 pivoted at 40 near the upper end of tube 14 which are biased by spring 44 to engage the upper edges of two opposite ports when tube 14 and unit 15 carried thereby are forced downward far enough
15 against the resistance of spring 43.

The two filter units 13 and 15 are substantially duplicates in details of construction. The upper one 14 comprises the strainer cylinder 26 of perforated metal held between top plate 20 having
20 downwardly extending flange or annular lip 21 and bottom plate 22 having a similar upwardly extending lip 23, by means of tie rods 24, 24, fast at one end in the lower plate and having threaded upper ends projecting through the top plate to carry thumb nuts 25, 25. Within the perforated
25 container so formed is the cylindrically arranged filtering element 27, formed of a relatively thin but self-supporting sheet of suitable material (usually a felt) bent into a series of zigzag convolutions extending parallel to the tie rods.
30 Within such cylindrical filter element is the distributing flange 28 carried on pipe 12 just below ports 29. Centrally perforated plates 20, 22, and flange 28 all have a tight friction fit on the exterior of tube or pipe 12.

The lower unit 15 comprises a similar casing formed by perforated metal cylinder 36 held between bottom plate 30 having annular lip 31 and top plate 32 having annular lip 33, by tie rods
40 34, 34, fast at one end in said top plate and projecting through the bottom plate to engage thumb nuts 35, 35. In this casing is confined a filter element 37 similar to 27, and within that is the deflecting plate, or flange, or spreader 38 carried on and extending across the lower end of tube 14.
45 To prevent this lower unit being moved radially of casing 3 so as to jam tube 14 in tube 12, I may rivet guide lugs 42, 42, on the exterior of cylinder 36 so shaped as to slide along the interior of
50 shell 5.

Ports 41, 41, in the lower portion of tube 14 open into the interior of the lower unit 15 immediately above deflector plate 38. Top plate 32 is fast on the lower portion of tube 14, just above
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the ports 41, 41, so that the whole lower unit is supported from, and moves with said tube.

In constructing and operating the above described embodiment of my invention spring 43 is so designed that when installed it will normally hold unit 15 in the raised position indicated in full lines in Fig. 1 against any unbalanced pressure of fluid entering said unit from feed pipe 1 through tubes 12 and 14. In such position the upper end of tube 14 closes ports 29, 29, in tube 12, as shown in Fig. 1, so that any access of the fluid to the interior of the upper unit 13 is then cut off. Accordingly all the entering fluid passes through the ports 41 formed in the walls of tube 14 out onto the spreader plate or flange 38 and thence to the inner surface of the filter element 37, down along the walls of which it runs until whatever part of it has not been forced through the filter walls reaches the bottom plate 30. The portion which has been forced through the filter element and the perforations in the metal cylinder 36 out into the chamber 5 passes upward through the outlet connection 8 into discharge pipe 2.

When, however, the filter element 37 has become sufficiently clogged with solid material filtered out of the incoming fluid the pressure of the latter within this lower unit 15 increases and gradually overcomes the resistance of spring 43. As a result the lower unit 15 moves slowly downward (as indicated in dot-and-dash lines in Fig. 1) carrying with it the single tube 14. Then, when such downward movement of the upper end of said tube begins to open ports 29 in outer tube 12 a portion of the incoming fluid is thereby admitted to the interior of the upper filter unit 13 and forced by deflecting plate 28 to travel down the inner surfaces of the convolutions of filtering element 27, through the walls thereof and through the perforated cylinder 26, into the surrounding portion of the interior of casing 3. Thence it flows upward and out through coupling 8 to pipe 2 along with whatever filtrate is still coming up from the partially clogged lower unit 15. As the clogging of such lower element increases the fluid pressure on the bottom plate 30 of said lower unit 15 similarly increases and spring 43 is further compressed, thereby permitting tube 14 to move farther and farther down, until ports 29 are completely opened and pawls 39 drop into engagement with the upper edges of two of them to hold the parts in such finally assumed position. This automatically produced adjustment of the parts gives the fluid the same freedom of access to the upper unit as to the lower one, and the operation thereafter continues until the former is also clogged so badly as to reduce filtering efficiency of the apparatus as a whole to a point that renders cleaning and/or replacement of the filter elements necessary.

Thereupon the supply can be shut off, the casing shell 3 unscrewed from casing cover 4 and removed, together with filter unit 15, tube 14 sliding out of tube 12. The separated units can then be taken apart by loosening the thumb nuts 25 and 35, fresh filtering elements 27 and 37 substituted for the clogged ones, the other parts cleaned, and all put together again and the several units reassembled in the casing, as shown in Fig. 1, for a resumption of filtering operation.

Cover plate 4 can be removed from its supports by using a pipe wrench to turn both nipples 8 and 9 in such direction as to unscrew them from the bosses 10 and 11 on said plate and so release the entire unit.

While I have shown only two filter units connected together, the application of the principles of my invention is not limited to such number. Also various changes could be made in the details of the construction shown and certain features thereof omitted, without departing from the substance of my invention so long as the same general principles of operation and cooperation are retained to a sufficient degree and the modified structures so produced are still within the definitions outlined in the appended claims, or in some of them.

Having, therefore, described my invention, I claim:

1. In a filtering apparatus, the combination of a plurality of separate distinct and severally complete filtering cells each provided with a body of filtering material, a common source of fluid to be filtered adapted to deliver the same under pressure to the cells, a common discharge receptacle receiving the filtrate from all of the cells, and means for utilizing the pressure of the incoming fluid to effect delivery thereof to the filtering cells in succession, the said means including pressure responsive elements associated with said source of fluid and actuated by back pressure in a clogged cell to which the fluid is flowing to deliver the fluid to another cell through which the flow is comparatively free.

2. In a fluid filtering apparatus the combination of a plurality of separate filtering cells movable relatively one to another, a common source of fluid to be filtered and a connection from said source to each cell, a common discharge passage from all the cells, and valve means actuated by the aforesaid cell movement to sequentially deliver to said cells the fluid to be filtered.

3. In a fluid filtering apparatus the combination of two distinct filtering units, one of which is movable relative to the other, a common source of fluid to be filtered adapted to deliver the same under pressure, a normally open connection from said source to one unit and a normally closed connection from the source to the other unit, one of the units being responsive in movement to the inlet pressure of the fluid and movable by such pressure when clogging of the unit opposes free flow through the same, and mechanism associated with said movable unit and said normally closed connection to open the connection when said unit has moved to a predetermined extent.

4. A combination such as defined in claim 3 in which each of said units comprises a cell having walls of filtering capacity, and with the interior of which said supply connections communicate, and in which said mechanism comprises telescoping conduit sections in the connection to the movable unit openings in one of said conduit sections communicating with the second mentioned unit and adapted to be uncovered by movement of the other section for the flow of fluid to the last mentioned unit; and a spring tending to shorten said connection but yieldable to permit it to be lengthened when the mechanism is actuated as hereinbefore described.

5. A construction such as defined in claim 3 combined with means adapted to automatically lock the parts in the relative positions assumed when said normally closed connection has been opened.

6. In a filtering apparatus the combination of a filtering unit comprising a cell having filtering walls, a supply pipe extending through said cell and having a port opening into the cell interior, a second unit comprising a separate

cell having filtering walls and a tube telescoping at one end into said supply pipe and at the other end opening into said cell interior, together with a spring normally tending to move said second unit in a direction such as to force its said tube into said supply pipe far enough to close the said port in the latter but capable of flexure in the opposite direction far enough to open said port, said spring being constructed so as to be flexed in such manner whenever the pressure of fluid in said tube reaches a predetermined amount.

7. A structure such as defined in claim 6 in which said port is located near that portion of the cell wall through which said pipe enters said cell interior, combined with a deflecting flange on said pipe's exterior located adjacent the side of said port most remote from said wall portion and extending radially from said pipe nearly to the interior surfaces of the adjacent filtering walls of said cell so as to distribute the inflowing fluid directly and evenly to said filter surfaces.

8. A structure such as defined in claim 6 in which the opening from said telescoping tube to the interior of said second cell is located in the tube periphery and near that portion of said cell walls through which said tube extends, combined with a deflecting plate closing the extreme end of said tube and extending radially therefrom nearly to the surrounding filtering walls of said cell.

9. A structure such as defined in claim 6 combined with locking means pivoted on the end of said telescoping tube adjacent said port which are adapted to engage one edge thereof so as to hold said tube in position assumed after a sub-

stantial opening of said port has occurred, and mechanism for normally biasing said locking means toward locking position.

10. In a filtering apparatus the combination of an elongated tubular casing and two filtering units contained therein, one of said units being fixed in one end portion of said casing and the other being of less transverse dimensions than, and movable in, the other end portion thereof, said movable unit having a valved connection to said fixed one which connection consists of telescoping sections one connected to the fixed unit and the other to the movable unit for operation of the valve by the movable unit, and a plurality of transversely extending spaced-apart projections on the movable unit for guiding its movements in said casing but allowing fluid to flow freely around them.

11. In a fluid filtering apparatus the combination of a tubular structure having peripheral walls provided with a lining of filtering material, an axially disposed tube of much less diameter fixed therein, adapted to be connected to a source of fluid supply, and having a port in its walls opening into the interior of said structure near one end thereof, and a single flange fixed on said last mentioned tube exterior at a point immediately adjacent the inner edge of said port and extending nearly to said lining at all points of its periphery; whereby a thin annular sheet of any fluid discharged from said inner tube through its said port is uniformly distributed along and over the entire interior of said filtering lining.

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