(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 256 544 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **87111886.5**

(51) Int. Cl.⁴: **A47L 5/38**

(22) Date of filing: **17.08.87**

(30) Priority: **19.08.86 CA 516273**

(43) Date of publication of application:
24.02.88 Bulletin 88/08

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(71) Applicant: **Atlantic Re-Nu Consultants Ltd.**
55 Oakmount Drive
Bedford Nova Scotia B4A 2W2(CA)

(72) Inventor: **Ewing, Fred D. c/o Atlantic Re-Nu Consultants Ltd. 55 Oakmount Drive**
Bedford Nova Scotia B4A 2W2(CA)

(74) Representative: **Hoeger, Stellrecht & Partner**
Uhlandstrasse 14c
D-7000 Stuttgart 1(DE)

(54) Vacuum cleaning system.

(57) A central vacuum cleaning system is disclosed, which includes a central tank for collecting a liquid/debris mixture. A vacuum pump is connected to an upper portion of the tank to maintain vacuum therein. Discharge means of the type of a sludge pump removes the mixture from the tank to sewage. The sludge pump is so selected that it can overcome the vacuum prevailing in the tank and generated by the vacuum pump. Thus, the vacuum in the tank does not have to be cancelled, thus avoiding the need for the stoppage of operation, whenever the tank is to be drained. As a result, a more compact tank can be used for the purpose than in known devices. A continuous operation of the device regardless of the instant mode at the central tank is another advantage over prior art.

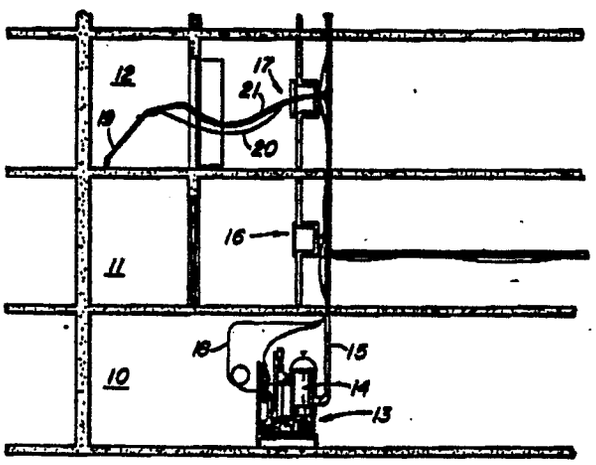

FIG. 1

EP 0 256 544 A2

BACKGROUND OF THE INVENTION

The present invention relates to central vacuum cleaning systems and in particular to a central vacuum cleaning system wherein a plurality of outlets, each for connection to a cleaning head, is disposed throughout a building or the like and operatively associated with a central unit disposed usually in the basement of a building or on a mobile unit. The type of vacuum cleaning system to which the present invention pertains is particularly, but not exclusively, a central vacuum cleaning units operating not only with vacuum but by also capable of injecting or spraying a cleaning liquid, e.g. hot water, at the point of the cleaning head so that the debris returned through the suction conduit of the system to the central debris collecting tank enters the tank in the form of a mixture of solid debris particles and a liquid, e.g. water.

Many central vacuum systems of the above general type have been known for some time and are disclosed in prior art publications. From the standpoint of the present invention, the disadvantages of known central vacuum systems of the above type are seen mainly in that the central tank for collecting the water/debris mixture has to be of a relatively large capacity since its drainage requires the cancelling of the vacuum in the system. This arrangement has a further drawback, namely that during the period of drainage of a central debris collecting tank to a sewage or the like, the entire vacuum cleaning system has to be shut down. This may be of disadvantage particularly when a mobile unit is involved which usually has to have a relatively small tank on a mobile platform and which is normally used under circumstances in which time may be of essence due to rental costs or the like. In relatively large buildings utilizing a central vacuum system, the shutdowns may also give rise to a substantial reduction in productivity of the cleaning operations.

With respect to prior art, reference may be had for instance, to Boswinkle et al. U.S. Patent 3,286,444, issued November 22, 1966 and showing a vacuum system utilizing a layer of water in its central vacuum tank. Figure 1 of that reference and the description in column 4 shows that pressure in chamber 10 of the tank has to be increased before emptying the container to bring about atmospheric pressure. This occurs automatically when the level of water in the tank reaches a predetermined height.

Another known arrangement is disclosed in U.S. Patent 3,705,437 issued to Rukavina Jr. et al. December 12, 1972. In this reference, it is stated that the vacuum tank 28 drains or is emptied by a sump pump. Again, this arrangement requires discontinuity of the operation as the spent cleaning liquid is drawn from the cleaning surface of the sweep of air from around the edges of foot 57 through channel 54 and hoses 6 and 9 to a vacuum tank. From this tank, the debris water will drain or be pumped out by a sump pump. The vacuum must be cancelled in the container before the container is drained.

In Fisher et al. U.S. Patent 4,198,724, issued April 22, 1980, an automatic window washer is disclosed which includes a storage tank 56 from which used cleaning liquid is to be removed and the tank recharged with new cleaning liquid. The structure of storage tank 56 enables both operations to be performed simultaneously. This is accomplished by first closing an inlet valve 250 and opening drain valve 326. Thereafter another inlet valve 174 is opened so that new cleaning liquid can be introduced into a lower compartment 170 of the tank. The closing of valve 270 results in the discontinued operation of a vacuum pump 50. Accordingly, this arrangement again shows the need for discontinuing the vacuum within the collecting tank. Other arrangements pointing out to the same drawbacks include Zell et al. U.S. Patent 4,530,131 issued July 23, 1985 and Ogden U.S. Patent 4,480,309 issued April 8, 1986.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide improvement in the above art of central vacuum cleaning systems.

In general terms, the present invention provides, for use in a central vacuum cleaning system: a central debris collecting tank for a mixture of debris and a liquid, said tank being provided with a first conduit adapted to communicate the tank with a vacuum pump, said first conduit having an inlet in said tank at a first level; return conduit means adapted to be connected, exteriorly of the tank, with a debris return piping of an associated central vacuum cleaning system, said return conduit means terminating in said tank at a second level disposed below said first level; and a drainage conduit having an inlet port in said tank and at a level below said second level, said drainage conduit being arranged for operative connection to a sludge pump.

The present invention can also be defined, in general terms, as providing a vacuum cleaning system of the type including a central debris collecting tank, return conduit means communicating said tank with a plurality of working outlets, each

working outlet including a vacuum hose connection means, a pressurized liquid outlet connection means and an electric control unit for actuating a vacuum pump operatively connected to said central tank to induce suction at the vacuum hose connection, said vacuum hose connection and said pressurized liquid outlet connection being arranged for an operative connection to a cleaning head adapted to drive a cleaning liquid into a floor covering and to return to said conduit means a mixture of debris and said fluid for collection in said tank, said system comprising, in combination: a first conduit communicating the tank with a vacuum pump, said first conduit having an inlet port within the tank and disposed at a first level; said return conduit means having a discharge port within said tank at a second level disposed below said first level; a drainage conduit having an inlet port in said tank, said inlet port being disposed at a third level disposed below said second level; discharge means operatively associated with said drainage conduit for removal of said mixture while maintaining a vacuum at the inlet port of the first conduit.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described by way of an exemplary embodiment with reference to the accompanying drawings, wherein:

FIGURE 1 is a simplified, diagrammatic section of a building including the arrangement of the present invention;

FIGURE 2 is a simplified, diagrammatic.view of a central vacuum tank incorporating an exemplary arrangement of its operating and draining system;

FIGURES 3 and 4 are a front view and a side view, respectively, showing a typical central vacuum unit according to the present invention; and

FIGURE 5 is a partly sectional view showing the inside arrangement of the tank of the unit of FIGURES 4 and 5.

DETAILED DESCRIPTION

The present invention and the field to which it pertains will best be understood by referring to FIGURE 1 which shows a partial cross-sectional view of a building utilizing the present invention. The building has a basement area 10, a ground floor area 11 and the second floor 12, it being understood that the number of floors is optional. As is well known in the art, the central vacuum system includes a central vacuum unit 13 comprising a debris collection tank 14 which communicates through a roughed-in piping system 15 with a plurality of outlets 16, 17 at floors 11 and 12 of the building. In the shown embodiment, a water/chemical mixture is forced through a pipe 18 to the different outlets 16, 17. When a cleaning head or nozzle 19 is plugged into the respective outlet 17, the cleaning liquid mixture is supplied to the head by pressurized hose 20 and returned by a vacuum hose 21 which is in communication with the piping system 15. Since the piping system 15 and the vacuum hose 21 communicate with the tank 14 in which vacuum is maintained, they serve for return of a mixture of debris particles and liquid, the latter originally supplied through pressurized hose 20, back to the tank 14. Therefore, the piping system 15 is to be viewed as an embodiment of what is generally referred to as "return conduit means".

The above central vacuum system is well known in the art and does not require further detailed description. It will suffice to say at this point that from the standpoint of the present invention it is preferred to operate with the arrangement having pressurized hose 20 but such arrangement is not absolutely vital for the carrying out of the present invention, as long as other means are provided for developing a liquid-debris layer at the bottom of the tank 14, as will be described hereinafter.

The general arrangement of the tank 14 with respect to the remaining parts of the central station 13 will be described in greater detail as the present specification proceeds. For the time being, reference may be had to FIGURE 2 which shows, in a very simplified, diagrammatic way and with certain parts omitted for the sake of clarity, the general arrangement of the tank 14 within the system.

FIGURE 2 shows that the tank 14 is provided with a first conduit 22 which communicates the tank 14 with a vacuum pump 23. The first conduit 22 terminates within the tank 14 at a first level 24 which is near the top of the tank 14. The piping system 15, on the other hand, terminates within the tank 14 at a second level 25 disposed below the first level 24. A drainage conduit 26 communicates with the interior of tank 14 near the bottom 27 , i.e. at a level which is below the second level. The drainage conduit 26 is provided with a sludge pump 28; the sludge pump 28 is of the type capable of developing, at its suction side 29, vacuum of approximately 19" of mercury which is in excess of the vacuum which the vacuum pump 23 is capable of developing within the tank 14, the latter being approximately 13" of mercury. A one-way check valve 30 disposed downstream of the sludge pump 28 prevents return of air or of the pumped mixture from sewage 31 or the like.

The above brief description of FIGURE 2 describes the basic features of the structure of the present invention. Reference may now be had to FIGURE 5 which shows a cross-sectional view, similar to that of FIGURE 4, but which also includes diagrammatic representations of additional elements of the present system. First of all, a water inlet 32 is shown which is provided, at its discharge end, with a mist creating nozzle 33. The water inlet 32 with nozzle 33 is preferred even if the system operates with a cleaning liquid delivered through the pipe 18, as described above.

Reference numeral 34 denotes an emergency shut-off overflow sensor. The sensor is displayed at a level 35 which is above the second level 25 but well below the first level 24.

The inlet port of first conduit 22 is provided with a fine mesh screen 36. The vacuum pump or rotary blower 23 has a discharge vent 37 - (FIGURES 3 and 4) usually connected to a silencer or the like noise reducing equipment (not shown in the drawing). The highly pressurized fluid for cleaning purposes, supplied through pipe 18 is delivered by a system including a motorized mixing valve 38 connected to a hot water source by a chemical injector remote control unit (not shown), a piston pump 40 driven by electric motor 41 and by many other control and operation units and sensors well known in the art and therefore not described in greater detail.

In operation, the unit is activated by starting the vacuum pump 23. This generates vacuum within the collection tank 14 which is transmitted to the different outlets 16, 17. When a hose 21 is inserted in an outlet 17, the vacuum is transmitted to the nozzle 19. Any debris collected by the nozzle 19 returns through vacuum hose 21 and piping system 15 into the tank 14. If the pressurized hose 20 supplies cleaning liquid, then the returning mixture is that of solid debris particles and a liquid. If the use of the cleaning liquid is not desired, then suitable means for supply of water mist is connected to water inlet 32 (FIGURE 5), as is well known in the art.

As the debris/liquid mixture is delivered through piping system 15, or a dry debris is blown into a layer of water supplied by the nozzle 33, it eventually reaches a level slightly below the second level 25. This is sensed by a suitable level sensor (not shown in the drawings) which then actuates the sludge pump 28 while the vacuum pump 23 maintaining vacuum within the tank 14 continues to operate.

As mentioned above, the sludge pump 28 can overcome the vacuum within the tank and will thus remove from it virtually all of the debris/liquid mixture accumulated at the bottom of tank 14. If for any reason the sludge removal fails, there is a second level sensor 34 (FIGURE 5) which will automatically shut down the entire system as soon as the debris/liquid mixture reaches level 35.

Under normal circumstances, however, the arrangement is such that vacuum is maintained within the tank 14 in a continuous fashion which means that the capacity of the tank 14 can be relatively small resulting in a light-weight tank 14. Even more important, the entire system does not have to be shut down whenever it is desired to empty the vacuum tank 14 which is of advantage not only from the standpoint of economy of the overall operation but also from the standpoint of efficient cleaning operation.

Those skilled in the art will appreciate that many modifications may exist of the exemplary embodiment described above without departing from the scope of the present invention as set forth in the accompanying claims.

Claims

1. A vacuum cleaning system including a central debris collecting tank, return conduit means communicating said tank with a plurality of working outlets, each working outlet including a vacuum hose connection, a pressurized liquid outlet connection and an electric control unit for actuating a vacuum pump operatively connected to said central tank to induce suction at the vacuum hose, said vacuum hose connection means and said pressurized liquid outlet connection means being arranged for operative connection to a cleaning head adapted to drive a cleaning liquid into a floor covering and to return to said conduit means a mixture of debris and said fluid for collection in said tank, said system comprising in combination:

(a) a first conduit communicating the tank with a vacuum pump, said first conduit having an inlet port within the tank and disposed at a first level;

(b) said return conduit means having a discharge port within said tank at a second level spaced vertically below said first level;

(c) a drainage conduit having an inlet port in said tank, said inlet port being disposed at a third level spaced vertically below said second level;

(d) discharge means operatively associated with said drainage conduit for removal of said mixture while maintaining a vacuum at the inlet port of the first conduit.

2. A vacuum cleaning system as claimed in claim 1, wherein said discharge means includes a sludge pump in said drainage conduit, said sludge pump being of the type capable of operating, at suction end thereof, with negative pressure below

that in the tank, whereby the sludge pump can remove the mixture to a drainage without interrupting vacuum in the tank.

3. A vacuum cleaning system as claimed in claim 2, wherein said drainage conduit is provided with a non-return valve disposed between the sludge pump and an outlet of the drainage conduit.

4. For use in a central vacuum cleaning system:

a central debris collecting tank for a mixture of a debris and a liquid, said tank being provided with a first conduit adapted to communicate the tank with a vacuum pump, said first conduit terminating in said tank at a first level;

return conduit means adapted to be connected, exteriorly of the tank, with a debris return piping of an associated central vacuum cleaning system, said return conduit means terminating in said tank at a second level disposed below said first level; and

a drainage conduit having an inlet port in said tank and at a level below said second level, said drainage conduit being arranged for operative connection to a sludge pump.

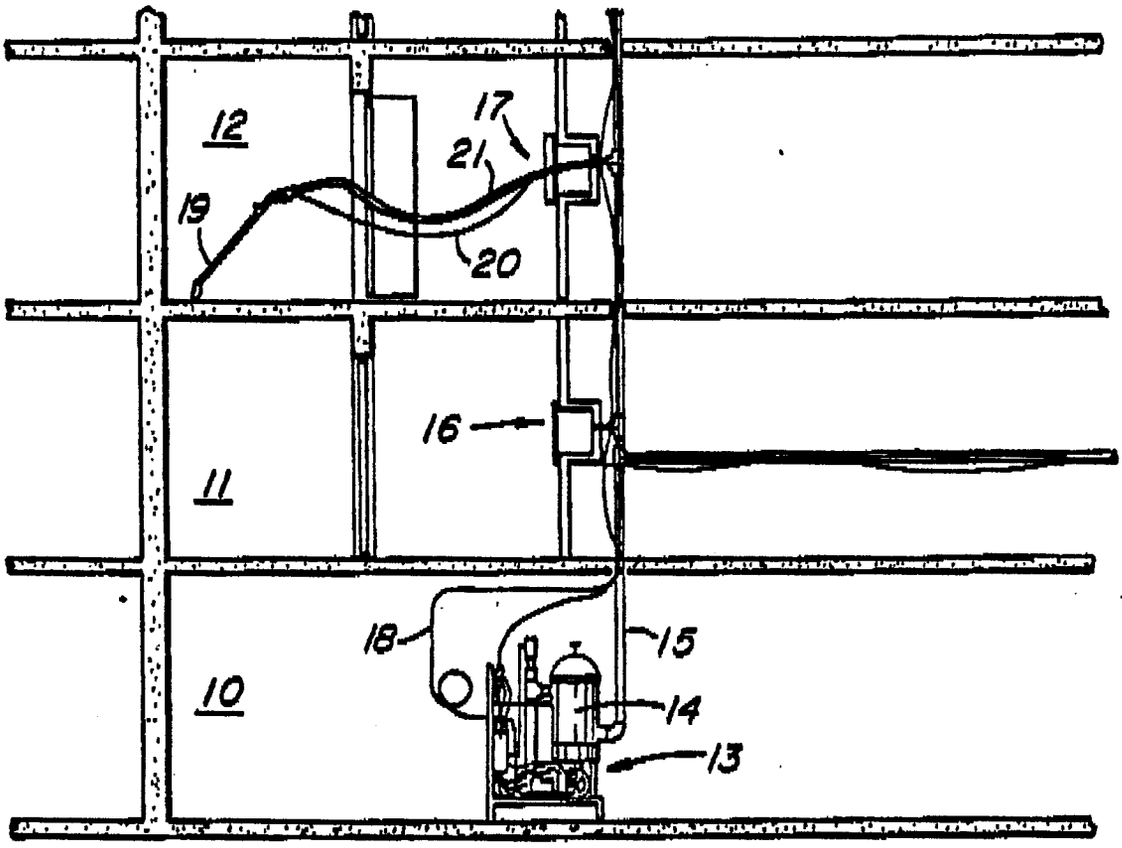
12
17
21
19
20
16
11
18
15
10
14
13

FIG. 1

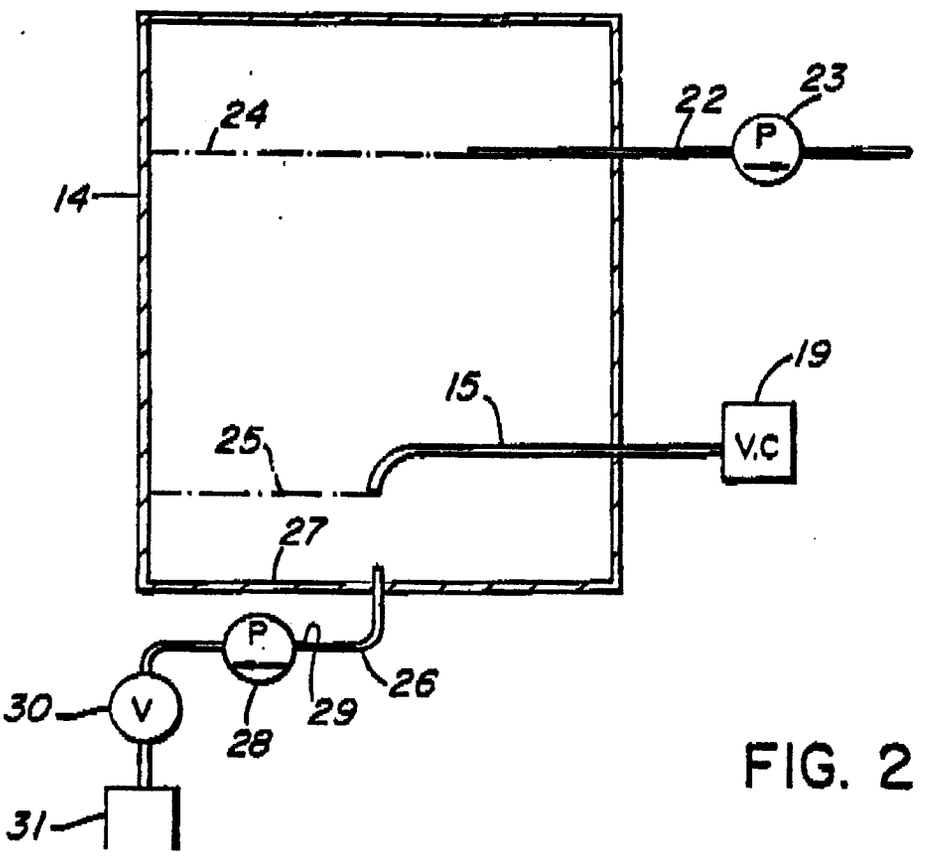
24
22
23
P
14
19
15
V.C
25
27
P
26
30
V
29
28
31

FIG. 2

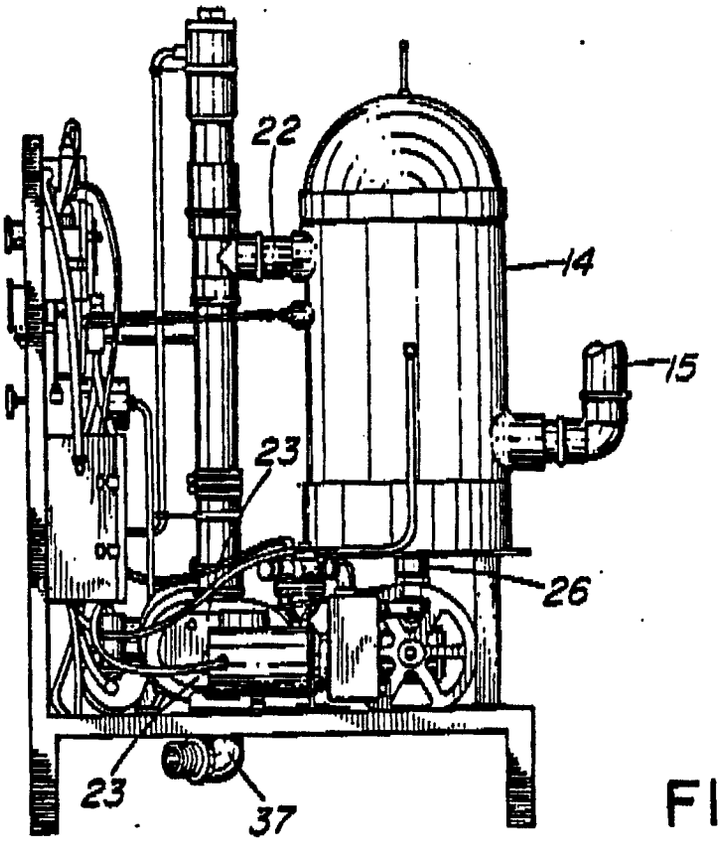

FIG. 3

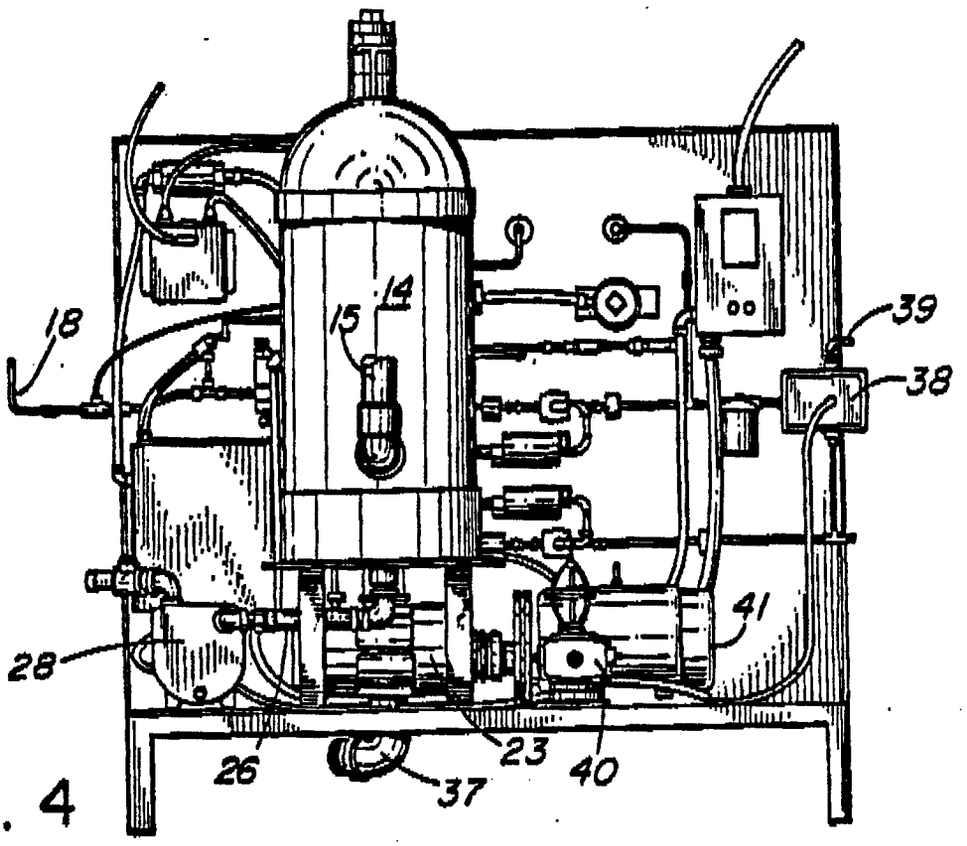

FIG. 4

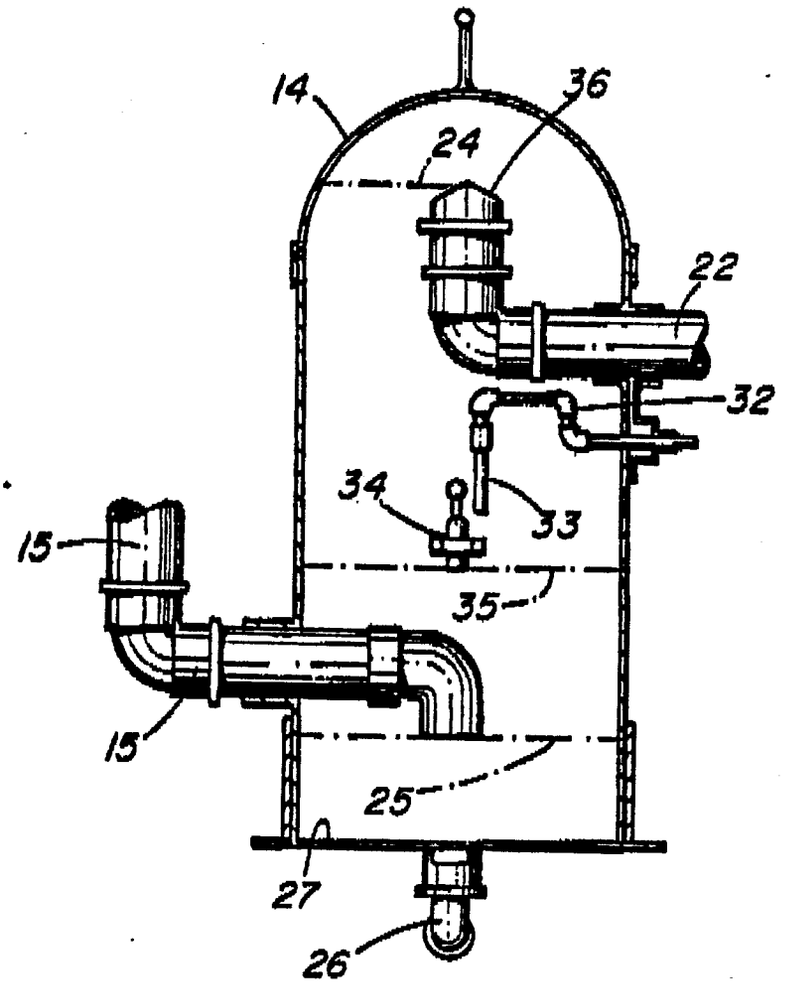

FIG. 5