

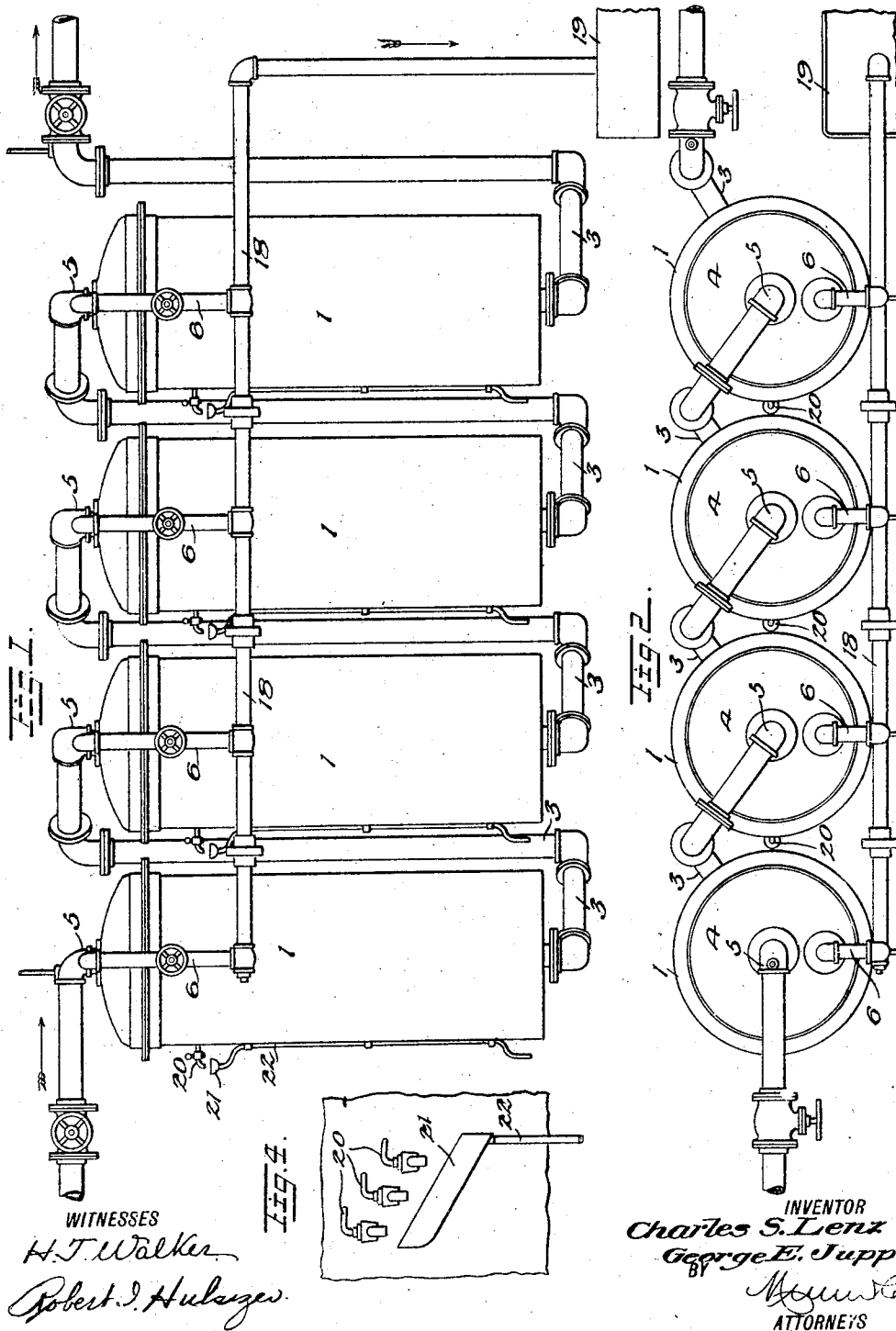
Jan. 11, 1927.

C. S. LENZ ET AL

1,614,074

SEPARATOR

Original Filed May 26, 1922 2 Sheets-Sheet 1



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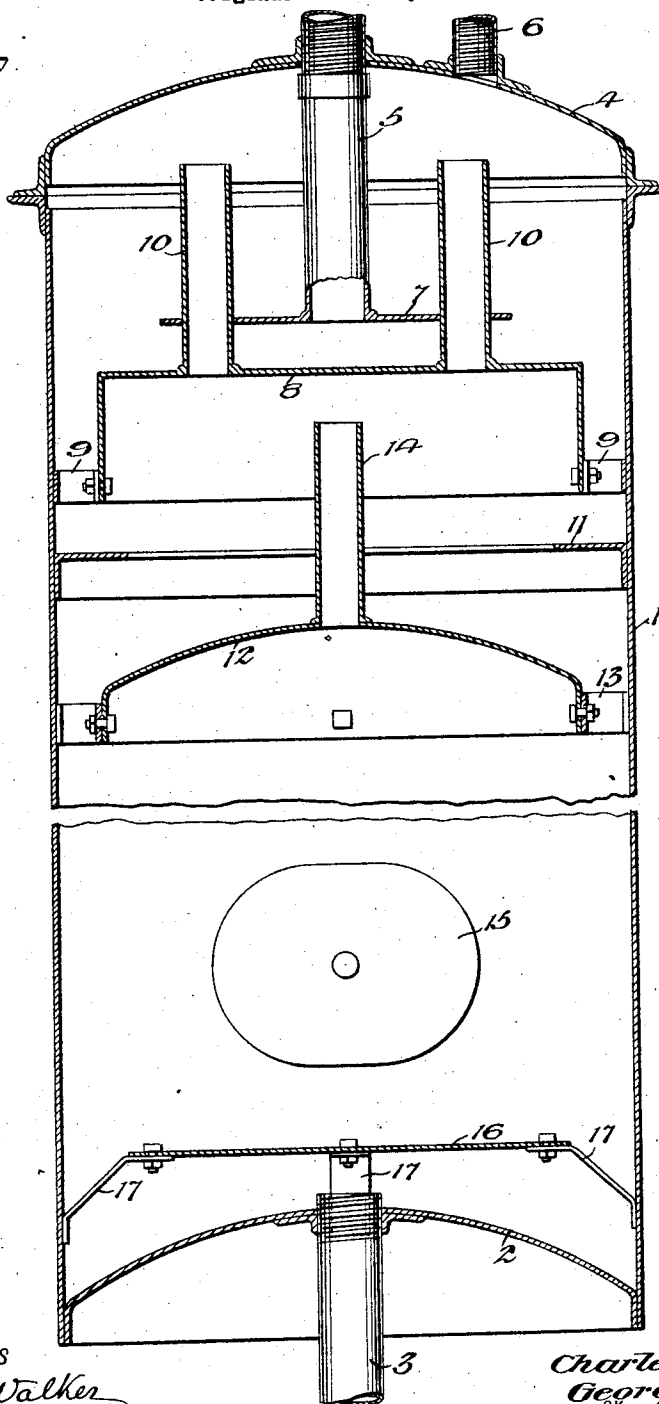
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Original Filed May 26, 1922 2 Sheets-Sheet 2

Fig. 3



WITNESSES

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Patented Jan. 11, 1927.

1,614,074

UNITED STATES PATENT OFFICE.

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SEPARATOR.

Application filed May 26, 1922, Serial No. 563,795. Renewed December 3, 1923.

This invention relates to a separator, and has particular reference to a device designed to separate fluids of different density from each other, such as oil and water.

5 An object of the invention is to provide a simple and practical means whereby the different oils and other waste material accumulated in the bilges, pump-wells and tanks of a vessel can be trapped and recovered and
10 thereby can be prevented from being pumped overboard with the discharged water into the water adjacent to a vessel when such bilges, pump-wells and tanks are emptied while the vessel is in harbors, rivers or near the shore.
15 The objectionable feature and the difficulty in properly disposing of such discharge reside in the fact that a substantial portion of the oil content therein, exists as a persistent emulsion of fine oil particles dispersed in water, and impossible to coalesce
20 and separate by the normal setting at rest of the discharged fluid.

A further object of the invention is, therefore, to promote the destruction of an emulsion, wherein oil is the dispersed phase and
25 water the dispersion medium, so that the dispersed particles of the former may be caused to coalesce and then be susceptible to normal gravity separation.

30 Another object resides in the provision of apparatus of this description which can be made a part of the usual existing discharge system of a vessel and in series therewith in such manner that there is not required any
35 alteration of the structure of such system or of the vessel itself.

A still further object resides in the provision of a simple, efficient apparatus which can be incorporated in the regular discharge
40 system of a vessel without impairing the efficiency of such a system.

Another object resides in the provision of an apparatus that is simple in construction and operation, can be made at a reasonable
45 cost, does not require additional labor, has no movable mechanical parts to get out of order, occupies a minimum amount of space, and does not interfere with the operation and movements of loading and discharging a
50 vessel.

A further object resides in the particular construction and arrangement of parts which are hereinafter described and claimed and shown in the accompanying drawings.

The invention is illustrated in the drawings, of which—

Figure 1 is a side elevation of a battery of separators made in accordance with our invention.

Fig. 2 is a plan view thereof.

Fig. 3 is a vertical longitudinal section through one of the separators, each tank being similar to the others in the series.

Fig. 4 is a partial detail elevation of the side of one of the tanks showing means for
65 determining the character of the liquid within the tank at several desired levels.

The form of the invention shown in the drawings is a preferred form, although it is understood that modifications in the construction and arrangement of the parts and
70 in the character of the materials used may be adopted without departing from the spirit of the invention.

The preferred form of our invention as
75 illustrated in the drawings includes a settling tank 1 having a curved bottom 2 in which is disposed an outlet pipe 3, a hood-shaped top cover or closer 4 in which an inlet pipe 5 is disposed for the ingress of the
80 oil and water, and an outlet pipe 6 for the egress of the oil which has been separated from the water during the operation of the apparatus. On the lower end of the inlet pipe 5, which is disposed a suitable distance
85 below the top of the tank, we place a flanged plate or disk 7 the peripheral edges of which are disposed a suitable distance from the sides of the tank. Beneath the plate 7 is disposed an inverted cup-shaped hood 8, which
90 is supported by suitable brackets 9 disposed on the side walls of the tank. Discharge pipes 10 extend upwardly from the top of the hood 8, the upper ends of these discharge pipes being disposed adjacent and
95 beneath the hood-shaped top cover 4 of the tank.

The plate 7 carried by the lower end of the inlet conduit 5 and the top of the hood 8 cooperates to define substantially parallel
100 surfaces of a radially-extending and substantially horizontally-disposed passageway. A mixture of oily matter and water enters between these plates and substantially centrally thereof, such mixture then flowing
105 outwardly and radially and the velocity of flow diminishes directly with the increase in flow area as the fluid passes outwardly.

This arrangement of having the fluid mixture pass horizontally while at the same time checking the velocity of flow promotes separation of oily matter from the water. Oily matter which separates tends to segregate and move upwardly; and, as the radially flowing stream passes beyond the outer margin of the plate 7, oily matter which has separated out and is at the top of the radially flowing stream immediately passes upwardly into the upper region of the tank. Since the flat top portion of the hood 8 is of larger area than the plate 7, further separation of oily matter from the water is promoted and takes place while the radially flowing stream passes over the plate 8 and beyond the margin of the plate 7. After passage over the plate 8, the water with its residuum of oily matter passes around the hood 8 and then over the baffle 4 and other separating devices to promote segregation of the remainder of the oily matter from the water before the water is finally discharged through the outlet conduit 3.

The lateral walls of the hood 8 are disposed a distance from the side walls of the tank 1 in accordance with the desired flow of the liquid, but these discharges in effect are restricted. Below the bracket plates 9 and adjacent to the side walls of the tank 1 is a ring-shaped baffle plate 11 the edges of which extend inwardly toward the center of the tank. As the liquid flows downward through the narrow passage between the hood 8 and the wall of the tank 1 it strikes the baffle plate 11 and is deflected inwardly into the large outer space beneath the bell or hood 8. By this action the pressure of the liquid is decreased so that it has a tendency to expand and the oil or other matter mixed with the water tends to flow upwardly into the bell or hood 8 and from thence through the pipes 10, up beneath the hood cover 4, and thence out through the oil discharge pipe 6.

Disposed next beneath the hood 8 is a bell or hood 12, preferably having a curved upper wall and suitably supported a desired distance from the side walls of the tank 1 by bracket plates 13. A discharge pipe 14 extends from the bell 12 to a point beneath the hood 8. In like manner, as the fluid moves downwardly from the baffle plate 11 it strikes the upper surface of the hood 12 and moves thence through the restricted passage between the hood 12 and the side walls of the tank 1 and thence into the inlet chamber beneath the bell 12. This causes a repetition of the tendency of the oil to separate from the water and float up beneath the bell 12. The oil will then pass through the discharge pipe 14 to a point beneath the bell 8 and thence through the discharge pipes 10 to a point beneath the bell or hood-shaped cover 4 and thence out to the oil discharge

pipe 6. A suitable manhole plate 15 is disposed in the side of the tank so that entrance can be had to the interior of the tank. Near the bottom of the tank we provide a baffle plate 16 disposed over the opening of the outlet pipe 3 and supported from the tank by bracket plates 17. This plate 16 is intended to prevent the direct discharge of fluid through the pipe 3, the fluid having to pass around the plate 16.

In other words, it will be noted that fluid entering the pipe 5 and containing oil, water and other waste material, is forced to pass through a tortuous path during which it moves first through restricted passages and then into enlarged chambers in the above-mentioned tortuous manner; and the enlarged chambers are so associated with oil-collecting devices, such as hoods, that the oil in its tendency to separate from the water when entering these enlarged chambers will be collected beneath these hoods and thence discharged in the manner above described.

The relation of the size and proportion of the various passages and chambers through which the fluid is forced to pass is determined in accordance with the pressures used and the speed of flow desired.

The outlet pipe 3, as shown in Fig. 1, extends upwardly to a point above the tank 1 and is connected to the inlet pipe of another tank, if more than one tank is being used. In fact, in Fig. 1 a battery of four tanks is shown, the liquid discharged from one tank passing to the inlet pipe of the next. The oil discharge pipes 6 are shown connected to a common pipe 18 which may lead to any suitable oil reservoir such as 19. It is, of course, understood and within the scope of the invention to use these tanks in any number of groups in series or parallel.

In Fig. 4 we show a plurality of gauge cocks 20 connected into the side of the tank 1 at different levels whereby we may determine the condition of the contents at the desired level at any time. Beneath these cocks is disposed a trough 21 having a discharge pipe 22 connected thereto.

In the operation of this device the successive passage of the fluid through restricted passages and then into larger chambers where the velocity of movement of the liquid is decreased constantly permits a more ready separation of the oil from the mixture. It is so arranged that the collectors or hoods are disposed immediately adjacent and above these points where the body of the liquid is to some extent halted in its movement so that as the oil separates at different points it is collected and led to the discharge point.

It will also be observed that the flow of the oil upward through the tank has a tendency to create beneath each hood a par-

tial vacuum which will assist in the separation of the ingredients.

We claim:

1. A separating device which includes a tank, a plurality of hoods disposed within said tank, uptake conduits connected to the hoods, each of the hoods being spaced from the walls of the tank a desired distance to form restricted passages therebetween for the flow of fluid, and an annular baffle plate secured to the tank wall and disposed between hoods.

2. A separating device which includes a tank, upper and lower hoods disposed within said tank, uptake conduit means connected to the upper hood and terminating a short distance from the top of the tank, uptake conduit means connected to the lower hood and terminating within the upper hood and a short distance from the top thereof, each of the hoods being spaced from the walls of the tank a desired distance to form restricted passage therebetween for the flow of fluid, and an annular baffle plate secured to the tank wall and disposed between the hoods.

3. A separating device which includes a tank, a plurality of hood members, one of the hood members constituting the tank cover and the other of said hood members being disposed within the tank and spaced from the walls thereof a desired distance to form restricted passages therebetween for the flow of fluid, the spaces formed between the hood members acting as enlarged chambers, a plurality of baffle plates disposed between the hood members and discharge means connecting each inside hood member to a point beneath the hood member above it.

4. A separating device which comprises a tank having an inlet pipe, a hood beneath said pipe and spaced from the walls of the tank a desired distance, a baffle plate on the lower end of the inlet pipe spaced from the upper surface of the hood and from the walls of the tank a desired distance, a baffle ring disposed beneath the hood and adapted to deflect the flow of the liquid passing between the hood and the tank wall towards the center of the tank, and a second hood disposed beneath the first hood and beneath the baffle ring, a discharge means connecting the second hood to a point beneath the first hood, discharge means connecting the first hood with the upper portion of the tank, and discharge means communicating with the upper portion of the tank.

5. A separating device which includes a tank having an inlet pipe at its top and an outlet pipe at its bottom, a baffle plate disposed over and spaced from the outlet pipe to force the discharging liquid to take a tortuous path in leaving the tank, a plurality of hoods disposed within the tank, dis-

charge means extending from one hood to a point beneath the hood immediately above it, each of said hoods being spaced from the walls of the tank a distance sufficient to provide a restricted passage therebetween, whereby the flow of the fluid through said passage is increased, the space between the hoods being sufficiently enlarged relative to the size of the restricted passages to cause the flow of the fluid to be checked, whereby the lighter element of the fluid, or a mixture of fluids will tend to separate and be trapped beneath one of the hoods.

6. A separating device which includes a tank having an inlet pipe at its top and an outlet pipe at its bottom, a baffle plate carried by the lower end of the inlet pipe, a hood arranged below the baffle plate and spaced from the wall of the tank a desired distance, uptake conduit means connected to the hood and extending toward the top of the tank, and outlet means for separated lighter fluids connected to the top of the tank, and outlet means for the heavier fluids connected to the tank.

7. A separating device for fluids consisting of a tank having a top, an inlet pipe for fluid mixture terminating in the tank and below the top, a baffle carried by the pipe at the lower end thereof, baffle means spaced a desired distance below the first baffle and from the wall of the tank, outlet means for the heavier fluid connected to the tank below the baffle means, and outlet means for the lighter fluid connected to the top.

8. In separating apparatus for liquids, the combination of a plurality of connected tanks, each tank including an inlet conduit extending below the top, a baffle connected to the conduit, a hood within the tank and spaced from the baffle and from the tank wall, a baffle ring below the hood and carried by the tank wall, outlet means for the heavier liquid below the baffle ring of each tank and outlet means carried by the cover of each tank for the lighter liquid.

9. A separating device which includes a tank, a plurality of hoods disposed within said tank, each of the hoods being spaced from the walls of the tank a desired distance to form restricted passages therebetween for the flow of fluid, the space formed between the hoods acting as enlarged chambers, a plurality of bevel plates disposed between the hoods, and discharge means connecting each hood to a point beneath the hood above it, said tank receiving a continuous flow of liquid therethrough and being full of liquid at all times.

10. A separating device which includes a tank having an inlet pipe at its top and an exhaust or discharge pipe at its bottom, a plurality of hoods disposed at intervals in the tank between the inlet and the discharge,

said hoods along their outer edges being spaced from the side walls of the tank to provide restricted passages therebetween for the flow of the fluid, and outlet means for the lighter liquids leading from the top of each hood to a point beneath the hood immediately above it, the tank receiving a continuous flow of mixed liquids and being full at all times of said liquid.

11. In a device for mechanically breaking oil in water emulsions, the combination of, a series of superposed settling chambers in vertical alignment with one another said chambers including an upper chamber, intermediate chambers and a lower chamber, the upper and the intermediate chambers, each having means at its periphery for conducting fluid to the chamber next below it in a restricted flow, means in the intermediate chambers to radially deflect the flow emerging from the conducting means, a feed conduit in the upper chamber, means associated with said conduit to radially deflect the fluid entering the chamber, an underflow discharge conduit in the lowest chamber and overflow conduits disposed in each chamber, whereby the directional and velocity changes in the flow of emulsified fluid through the tank may promote an effective separation of the water from the oil particles dispersed therein.

12. In a system for breaking oil in water emulsions, including a plurality of multi-chambered tanks interconnected in series by pipes, each of said tanks including an upper chamber, intermediate chambers and a lower chamber in superposed relation one to another, the combination in each tank of, a feed inlet in the upper chamber, a discharge outlet in the lower chamber, means to conduct fluid in a restricted flow from the upper chamber to a contiguous intermediate chamber, and from each intermediate chamber successively to the chamber next below it, means in the upper chamber to divert the feed towards the conduit means, deflecting means in each chamber intermediate and in the lower chamber to oppose a direct passage of the fluid from its point of entry to its point of departure from the chamber, and means in each chamber to overflow the supernatant fluid layer therefrom, whereby the repeated changes in direction and velocity of the emulsified fluid through the system may promote the coalescence of the oil particles dispersed in the water.

13. In a device for separating the disposed phase from the dispersion medium in an

emulsified fluid, as for example, an oil in water emulsion, the combination of, a plurality of expansion chambers disposed in series, restrictive conduits alternating therewith, a feed conduit in the first chamber, baffles in the chambers to radially deflect the flow of fluid therethrough, overflow conduits to remove supernatant fluid from each chamber, and an underflow conduit in the final chamber of the series, whereby the interfacial tension between the dispersed particles and the medium may be affected by the alternating changes in velocity and direction of the fluid in its passage through the device.

14. In a device for separating the dispersed phase from the dispersion medium in an emulsified fluid, as for example, an oil in water emulsion, the combination of, a plurality of contiguously superposed expansion chambers, restrictive conduits therebetween, baffles in the chambers to radially deflect the flow of fluid therethrough, overflow conduits to remove supernatant fluid from each chamber, a feed conduit to introduce fluid into the upper chamber and an underflow conduit to remove separated fluid from the lower chamber, whereby the changes in velocity and direction of the fluid through the chambers may promote the coalescence of the oil particles dispersed in the medium.

15. In a separator, including a series of superposed chambers for separating free oil and emulsified oil from water in successive stages the combination of, a downwardly extending feed conduit axially disposed in the chamber of the first stage to deliver fluid near the base thereof, a spreading device associated with said conduit to distribute the flow axially from the conduit discharge, said device being spaced concentrically from the side of the chamber, to permit escape of free oil to the upper zone of the chamber, peripheral discharge orifices in the base of each chamber to constrict the flow of fluid therethrough, said orifices communicating with the chamber of a succeeding stage, means in the latter to deflect the flow of fluid from the preceding stage radially towards its axis, whereby the oil demulsified by constricted passage and deflected flow may be enabled to escape to the upper zone of the chamber, a discharge outlet in the chamber of the last stage and means in the upper zone of each chamber to remove the supernatant oil therefrom.

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CERTIFICATE OF CORRECTION.

Patent No. 1,614,074,

granted January 11, 1927.

to CHARLES S. LENZ ET AL.

It is hereby certified that error appears in the printed specification of the above mentioned patent requiring correction as follows: Page 4, line 46, claim 12, for "chamber intermediate" read "intermediate chamber"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.
Signed and sealed this 22nd day of February, A. D. 1927.

Seal.

M. J. Moore,
Acting Commissioner of Patents.