Jan. 8, 1952 W. ALEXANDER 2,581,341

APPARATUS FOR SEPARATING LIQUIDS

Filed Dec. 27, 1946 2 SHEETS—SHEET 1

FIG. 1

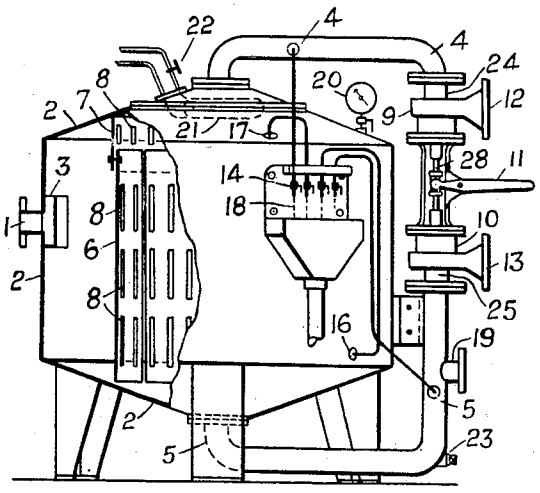
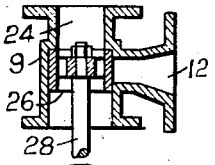


FIG. 3A



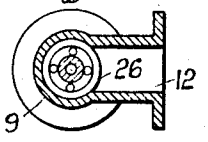


FIG. 3B

FIG. 5

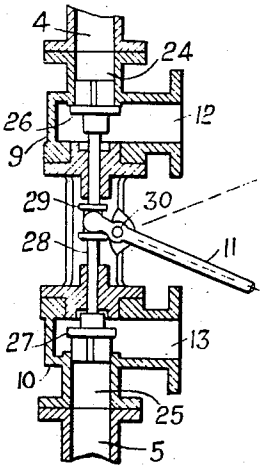


FIG. 2A

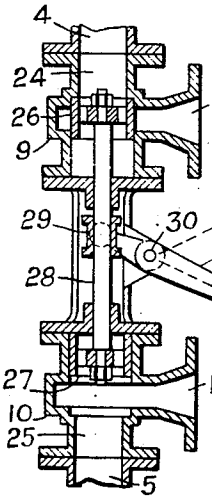
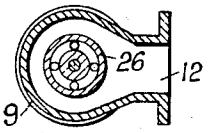


FIG. 2B



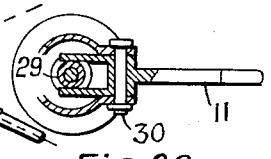


FIG. 2C

FIG. 4A

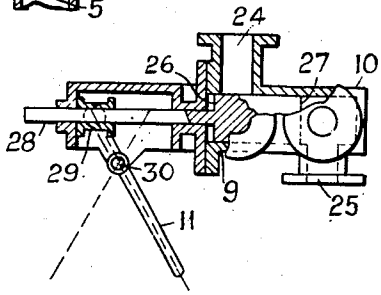


FIG. 4B

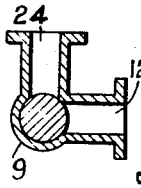


FIG. 4C

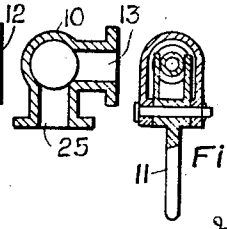


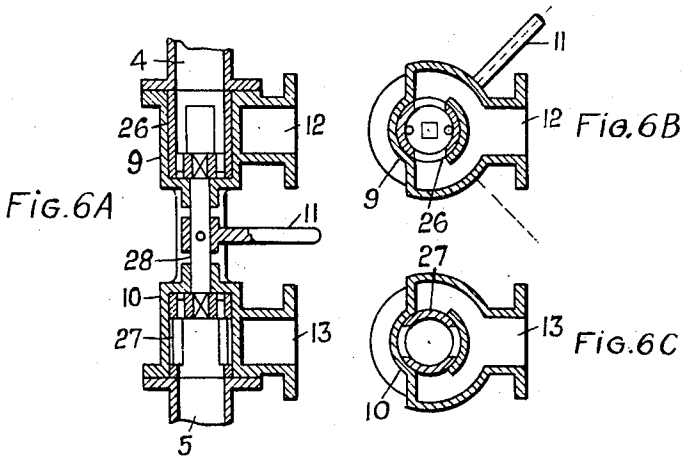
FIG. 4D

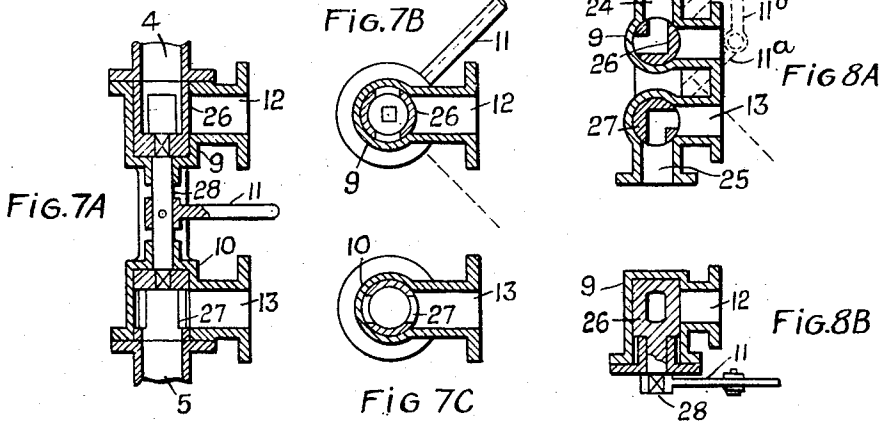
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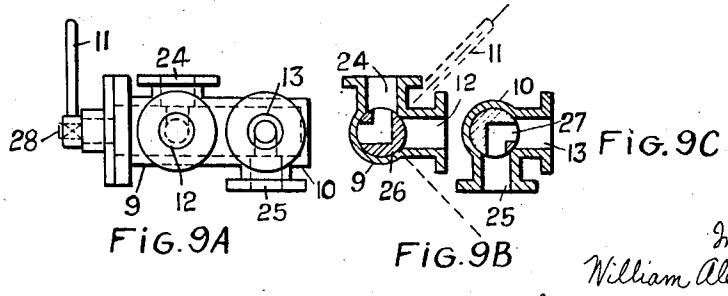
Jan. 8, 1952 W. ALEXANDER 2,581,341

APPARATUS FOR SEPARATING LIQUIDS

Filed Dec. 27, 1946 2 SHEETS—SHEET 2







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Patented Jan. 8, 1952

2,581,341

UNITED STATES PATENT OFFICE

2,581,341

APPARATUS FOR SEPARATING LIQUIDS

William Alexander, Glasgow, Scotland; Mary Miller Durney or Young executrix of said William Alexander, deceased

Application December 27, 1946, Serial No. 718,789
In Great Britain October 4, 1946

6 Claims. (Cl. 210—51)

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This invention relates to non-automatic separator apparatus for separating two liquids.

In what follows, the lighter liquid is referred to as oil, and the heavier as water. The term non-automatic indicates that the discharge valves for oil and water respectively are operated by hand.

In prior non-automatic separators the said valves are not mechanically coupled, i. e., they move independently, and they are sometimes of lift type, and sometimes of gate or sluice type. The independent adjustments of their openings are done by the comparatively slow method of turning screwed valve spindles. The slowness is accentuated by the adjustments being made in sequence. Also, the relative adjustments or openings may be incorrect; for example, both valves may be full open when instead, for correct working of the separator, one should be fully or partly closed while the other is full open. Again, the valves, being of the said types, are thus not balanced in respect of fluid pressure, the lack of balance being worse when either valve is in the closed position. Thus, unbalanced fluid pressure and corresponding mechanical friction have to be overcome at the instant of opening a valve and during its further movement. The large effort needed for this is given by means of plus screws formed on the valve spindles working in minus screws fixed to the valve casings, and could not be given so easily by means of hand-operated levers.

A non-automatic separator according to the invention includes coupled oil and water valves which move simultaneously, one opening while the other closes.

The valve movement is given preferably by means of a hand lever which enables adjustment of valve openings to be done quickly.

Each of the coupled valves may be in its own casing, or both be in a common casing.

The valves may be coaxial or may have spaced parallel axes, and may have reciprocating or rotary movement.

In some cases the valves may be balanced with respect to fluid pressure, in other cases the valves may be unbalanced.

The separator includes an outer shell incorporating at least one internal baffle having narrow and comparatively long substantially vertical slots which produce curved flow of the incoming liquid, tending to induce vertical films or filaments of oil which float up much more rapidly than horizontal ones.

An internal guide-plate is provided internally of

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the outer shell opposite the open end of the inlet that admits the mixture of oil and water to the separator, for the purpose of causing most of the admission current to be directed in a substantially circumferential direction along the surface of the separator shell, thereby ensuring minimum of disturbance in the general mass of contained liquid.

To enable the invention to be readily understood reference will now be made to the accompanying diagrammatic drawings which illustrate an example of an improved separator with its fittings, and examples of various coupled valves and their casings.

Fig. 1 is a elevation, partly in section, of a separator and components.

Fig. 2 (*a*) is a sectional elevation of balanced piston valves each in its own casing, and Figs. 2 (*b*) and (*c*) are respectively, a plan section through a valve and casing and a plan partly in section.

Figs. 3 (*a*) and (*b*) are sectional elevation and plan, respectively, of an unbalanced piston valve, two of which, each in its own casing, are mounted coaxially on a common valve-spindle and operated by a hand lever similarly as indicated in Fig. 2 (*a*).

Figs. 4 (*a*), (*b*), (*c*) and (*d*) are a part sectional elevation and elevation section, respectively, of a casing, lever, and piston or cylindrical valve member the opposite ends of which function simultaneously as, and thus are the equivalent of, two unbalanced coupled piston valves.

Fig. 5 is a sectional elevation of unbalanced lift valves, each in its own casing.

Figs. 6 (*a*), (*b*) and (*c*) are a sectional elevation and sectional plans, respectively, of balanced rotary coaxial valves, each valve being in its own casing.

Figs. 7 (*a*), (*b*) and (*c*) are similar views of unbalanced rotary coaxial valves.

Figs. 8 (*a*) and (*b*) are a sectional elevation and a part sectional plan, respectively, of unbalanced rotary valves in their respective casings, with parallel axes.

Figs. 9 (*a*), (*b*) and (*c*) are an outside elevation and elevation sections, respectively, of a rotary valve member the end portions of which function as or are the equivalent of two rotary unbalanced coupled valves in one casing.

Referring to the drawings, the separator in Fig. 1 has the inlet **1** for oil and water mixture. Inside the shell **2** is a guide-plate **3** fixed opposite the inlet. The space between this plate **3** and the shell **2** is closed top and bottom and is open at the ends. Thus, the mixture admitted

is diverted to flow mainly circumferentially, near to the shell, and the mass of liquid in the separator is much less disturbed than if there were radial flow.

On its way to the oil and water discharges 4 and 5 respectively, the mixture passes through one or more perforated baffles 6, 7. In the particular construction shown the lower part 6 of a baffle is either in one piece or in segments supported by an upper part 7 attached to the shell 2. The perforations 8 are preferably narrow upright slots which cause curved flow round vertical axes in the liquid passing through, and thus encourage the oil to separate out, near the many slot edges, as narrow upright films or vortex threads, which maintain their identity and float up through the water much more rapidly than horizontal ones.

The water finds its way to the bottom and the oil to the top of the separator, where they discharge through the respective pipes or passages 4 and 5 which convey these liquids to valve-casings 9 and 10, the coupled valves in which are simultaneously movable by means of a hand-lever 11. From branch pipes 12 and 13 the oil is conveyed generally to a reclaimed oil tank, and the water generally to waste.

Taps or cocks 14 are connected by pipes to several places, viz., the inside of oil pipe 4 of the water discharge pipe 5, and of the separator body near the points 16 and 17, whereby test sample jets 18 of liquid from these internal places may be made to issue from the taps when desired.

A branch pipe 19 incorporates a relief valve which prevents the pressure inside the separator rising too high, the pressure being indicated by a gauge 20. For reducing the viscosity of cold sluggish oils, and thus reducing their resistance to flow and assisting towards separation of oil and water, a steam-heated pipe or an electrically heated element 21 is provided in the internal oil space, a steam valve or electric switch being represented by 22. A drain 23 is provided for emptying the separator.

The inlets and outlets of the valve casings in the various figures are seen at 24, 12, 25 and 13, and the separate casings at 9 and 10, respectively, which are spaced apart by a distance-piece to which they are fixed. Where there is a common casing, as in Figs. 4 and 9, the oil end is at 9 and the water end at 10. When there are separate valves, the oil valve is 26 and the water valve 27. When there is in one casing a cylindrical member, as in Figs. 4 and 9, the opposite end portions of which member act as oil and water valves respectively, as in Figs. 4 and 9, the oil end is also 26 and the water end also 27. The valve spindle and the lever for moving a valve are shown at 28 and 11, respectively, in the various figures.

It is easily seen, as alternatives, that a balanced reciprocating valve, as in Fig. 2, may be mounted on the same spindle as an unbalanced reciprocating valve, as in Figs. 3 and 5; and that a balanced rotary valve, as in Fig. 6, may be mounted on the same spindle as an unbalanced rotary valve, as in Fig. 7—all consistent with the proper relative valve openings being obtained.

In the case of reciprocating valves, Figs. 2, 3, 4 and 5, the valve spindle has fixed on it a grooved collar 29 with which engages the lever 11, with fulcrum at 30. The levers for moving the rotary valves are mounted directly on the respective valve spindles, as seen in Figs. 6, 7, 8 and 9. In Fig. 8, because the two rotary valves have their axes at a distance from each other, two levers 11 and 11*a* are required, and these are

coupled by the link 11*b*, so that both valves must therefore move together.

The construction makes clear that any fluid pressure on the valves of Figs. 2 and 6 is balanced when either the oil valve or the water valve is closed, thus the valves are easily moved from a closed position. In this position all the other valves represented are unbalanced and so require much greater effort to move them.

The extreme position of the lever, indicated in various figures excepting Fig. 1, corresponds with the oil valve being closed and the water valve full open. The other extreme position (the lever centre lines being indicated) corresponds with the oil valve being full open and the water valve closed. In intermediate lever positions the oil and the water valves are both partly open, and all of the correct relative openings follow from the valves being coupled.

It is preferable, as is easily arranged, that the sum of the areas of the two port openings be at least equal to the area of one full port opening, also that the cross sectional area of each of the oil and the water discharge pipes 4 and 5, Fig. 1, be not less than that of the inlet pipe 1.

Assuming the separator in Fig. 1 to be working, i. e., oil and water mixture entering at 1, and the sample jets 18 issuing from the taps 14, the lever is kept in an intermediate position as long as the sample jets from 4 and 17 show only oil, and those from 5 and 16 show only water. When any water shows in the 17 sample from the upper part of the separator, the oil valve is immediately closed while the water valve is fully opened, by bringing the lever 11 to its lowest position. On the other hand, when any oil shows in the 16 sample from the lower part of the separator, the lever is brought to the highest position, which fully opens the oil valve and completely closes the water valve.

If water shows in both the 4 and 17 sample jets, or oil in both the 5 and 16 jets, then the rate of treatment of the mixture is lessened, generally by slowing down the supply pump.

What is claimed is:

1. A separator apparatus for separating liquids of different specific gravities, comprising a closed separator shell, an inlet passageway for supplying a mixture of liquids of different specific gravities into the shell, an outlet pipe for discharging liquid of one specific gravity from the shell connected into an upper portion of the shell, an outlet pipe for discharging liquid of a higher specific gravity from the shell connected into a lower portio nof the shell, a manually operable discharge valve in each of said outlet pipes for controlling the flow in its pipe independently of the volume of flow therethrough, and means operatively coupling said valves to cause movement of one valve to decrease the flow through its outlet pipe when the other valve is moved to increase the flow through its outlet pipe.

2. A separator apparatus as defined by claim 1 in which said valves have a common casing and are formed by the opposite end portions of a cylindrical member movable in said casing.

3. A separator apparatus as defined by claim 1 in which said valves are rotatable to control the flow through their pipes.

4. A separator apparatus for separating liquids of different specific gravities, comprising a closed separator shell, an inlet passageway for supplying a mixture of liquids of different specific gravities into the shell, a first outlet pipe for

discharging liquid of one specific gravity from the shell connected into an upper portion of the shell, a second outlet pipe for discharging liquid of a higher specific gravity from the shell connected into a lower portion of the shell, a manually operable discharge valve in each of said outlet pipes for controlling the flow in its pipe independently of the volume of flow therethrough, means operatively coupling said valves to cause movement of one valve to decrease the flow through its outlet pipe when the other valve is moved to increase the flow through its outlet pipe, a first sampling jet connected into said upper portion of the shell for indicating the rise of the liquid of said one specific gravity therein, and a second sampling jet connected into said lower portion of the shell for indicating the movement of the liquid of said higher specific gravity therein, whereby the valve in said first outlet pipe may be moved to decrease the flow in the first outlet pipe and the valve in said second outlet pipe is simultaneously moved to increase the flow in the second outlet pipe when liquid of said higher specific gravity flows from said first sampling jet, and the valve in said first outlet pipe may be moved to increase the flow in the first outlet pipe and the valve in said second outlet pipe is simultaneously moved to decrease the flow in the second outlet pipe when liquid of said one specific gravity flows from said second sampling jet.

5. A manually operable apparatus for separating oil from water, comprising a closed separator shell, an inlet passageway for supplying a mixture of oil and water into the shell for separation therein, an outlet pipe connected into the top of the shell for discharging separated oil and having a downwardly-extending portion outside said shell, an outlet pipe connected into the bottom of the shell for discharging separated water therefrom and having a portion extending upwardly outside of the shell toward the downwardly-extending portion of the oil outlet pipe, a first manually operable discharge valve in said downwardly-extending portion of the oil outlet pipe for controlling the flow therein independently of

the volume of flow therethrough, a second manually operable discharge valve in said upwardly-extending portion of the water outlet pipe for controlling the flow therein independently of the volume of flow therethrough, and means operatively coupling said first and second valves to cause movement of the first valve to decrease the flow through the oil outlet pipe proportionately as the second valve is moved to increase the flow through the water outlet pipe.

6. A separator apparatus as claimed in claim 1 characterized in that the movable means of the two valves are pressure balanced by the flow of the liquid in the respective outlet pipes, whereby the hand lever may be moved with comparative ease.

WILLIAM ALEXANDER.

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