March 9, 1926. 1,576,108

G. L. FOGLER

SEPARATOR

Filed July 5, 1923

FIG. 1

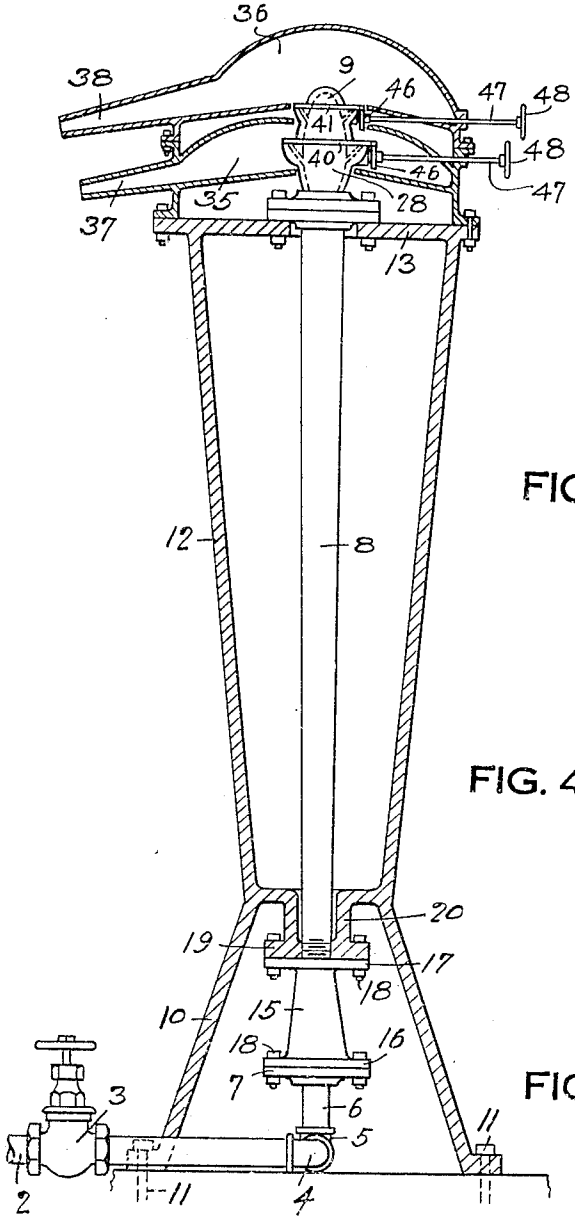


FIG. 2

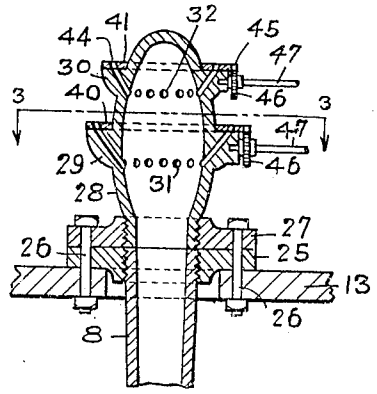


FIG. 3

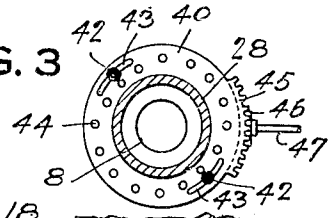


FIG. 4

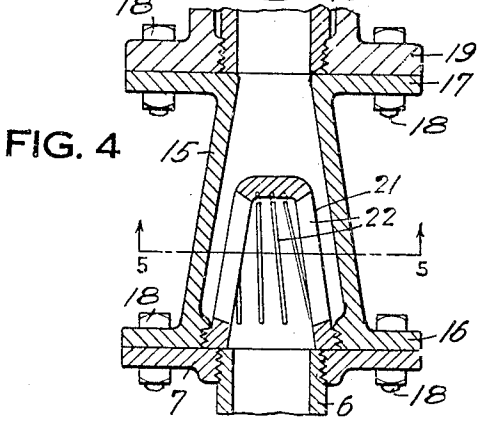
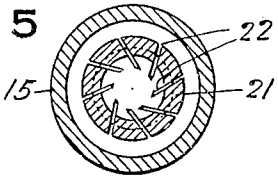


FIG. 5



INVENTOR

George L. Fogler

By Kay Totten & Brown

Attorneys

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UNITED STATES PATENT OFFICE.

GEORGE L. FOGLER, OF TULSA, OKLAHOMA.

SEPARATOR.

Application filed July 5, 1923. Serial No. 649,628.

To all whom it may concern:

Be it known that I, GEORGE L. FOGLER, a citizen of the United States, and resident of Tulsa, in the county of Tulsa and State of Oklahoma, have invented a new and useful Improvement in Separators; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the separation of fluid mixtures containing materials of different specific gravities, and its object is to provide a novel method and apparatus which shall operate on a principle radically different from that of centrifugal separators heretofore employed for similar purposes, and which may be operated to separate solids from liquids, or liquids from other liquids of different specific gravities, in a rapid and inexpensive manner.

Separators now in common use operate on the general principle of placing the mixture to be separated in a bowl which is rotated at high speed so as to develop sufficient centrifugal force to throw the heavier material radially to a greater extent than the lighter material. According to my present invention no moving parts operate on the mixture to be separated, but the mixture is delivered under a suitable pressure head to an apparatus which changes the movement of the fluid mixture from a straight-line advancing movement to a whirling movement whereby the mixture is rotated rapidly around the axis of its path of movement. Such a whirling action, if produced under low pressure, would have only the effect of mixing the ingredients of the mixture more thoroughly together, but I have discovered that, when a fluid mixture is deflected or whirled in a stationary channel under sufficient pressure to make the whirling movement very rapid, a separation occurs according to the specific gravity of the materials present. I have also discovered that this separation takes place in a manner contrary to the manner in which the same materials would be separated in a centrifugal machine of the whirling-bowl type. That is to say, in my present system the heavier materials are caused to approach the center of the whirling mass while the lighter materials are concentrated in the outer portions of the mass. This result indicates that the action of centripetal force in the whirling material is greater than the oppositely acting centrifugal force, and I therefore prefer to term my novel device a centripetal separator. The centripetal force involved is described in standard reference works. Apart from theoretical considerations, it is a fact that when a mixture of liquids, or a suspension of a solid in a liquid, has passed the deflector device herein disclosed, an effective separation takes place.

In the accompanying drawing, Fig. 1 is a vertical central sectional view, with parts in side elevation, of a separating device constructed in accordance with my invention; Fig. 2, is an enlarged fragmentary vertical section of part of the structure shown in Fig. 1; Fig. 3 is a horizontal view, partly in section taken substantially on the line 3—3, Fig. 2; Fig. 4 is a vertical central sectional view of the deflector portion of the device, and Fig. 5 is a horizontal section taken substantially on the line 5—5, Fig. 4.

In the drawing the numeral 2 indicates a supply pipe through which the fluid mixture to be separated is supplied under pressure. The pipe 2 is provided with a valve 3 and is connected by means of fittings 4 and 5 to a short vertical pipe 6, the upper end of which is screw-threaded and is received in a threaded opening in a plate 7 which forms a part of a deflector device, the construction of which will be described in detail below. A vertical pipe 8, which may be of any desired height, receives the fluid from the top of the deflector and extends upwardly to a separating head indicated generally by the numeral 9. The pipe 8 increases in diameter upwardly in order to facilitate the separating action. The entire device is mounted upon a support 10 which may be secured to a floor, table or the like by means of bolts 11. A casing 12 surrounds the vertical pipe 8 and supports a top plate 13 upon which rests the separating head construction. The support 10 and the casing 12 are shown as being hollow conical enclosures, but they may, if desired, consist merely of bars or the like since their function is merely to support the other parts of the device.

The deflector consists of an upwardly tapering casing 15 having lower and upper flanges 16 and 17 which are respectively secured by means of bolts 18 to the plate 7 and to a flange 19 which is carried by a fixed annular bracket 20. The casing 15 is internally screw threaded to receive the threaded

lower end of a frusto-conical deflector member 21, in the sides of which are a series of slots 22. It will be observed that the slots 22 are inclined with respect to the sides of the cone-shaped member 21 and are also inclined with respect to the horizontal radii of this member, the latter deflection, in this case, being 45°, as best shown on Fig. 5. The lower end of the tapering vertical pipe 8 is screw threaded to enter a threaded opening in the flange 19. The upper end of the pipe 8 is also screw threaded and is received in an opening in a coupling member 25 which is secured by means of bolts 26 to the plate 13. Upon the member 25 rests another similar coupling member 27 having a screw threaded opening in which is received the lower end of a head 28, the sides of which may be curved in the manner best shown in Fig. 2. Two annular shoulders 29 and 30 are formed on the outside of the head 28, and two series of inclined openings 31 and 32 extend through the shoulders 29 and 30, respectively. It will be observed that the openings 32 enter the cavity of the head 28 at points nearer the vertical axis of the pipe 8 and of the head 28 than the openings 31. These two series of openings therefore provide means for removing the materials of different specific gravity which have been separated from each other by the whirling movement set up by the deflector device. The openings 31 discharge into an enclosure 35 while the openings 32 discharge into an enclosure 36. The enclosures 35 and 36 are provided with spouts 37 and 38, respectively through which the separated products are discharged into suitable containers. When mixtures containing hydrocarbons are separated in this manner, the products may be discharged directly from the spouts 37 and 38 into vessels containing water or solutions of acids or alkalies such as are used in treating hydrocarbon oils.

Means are preferably provided for controlling the effective areas of the openings 31 and 32. One simple arrangement for this purpose is shown in the drawing and consists of perforated plates 40 and 41 which rest upon the upper surfaces of the shoulders 29 and 30, respectively, and may be secured thereon by means of screw bolts 42 which extend through curved slots 43 in the plates 40 and 41 as shown on Fig. 3, and into the screw threaded openings in the shoulders 29 and 30. The perforations 44 in the plates 40 and 41 are similar in number and arrangement to the discharge openings 31 and 32. The plates 40 and 41 may be provided with toothed segments 45 engaged by gears 46 which are carried by rods 47 having hand wheels 48 secured to their outer ends. By turning the hand wheels 48, the plates 40 and 41 may be adjusted to change the effective size of the openings 31 and 32.

In the operation of the apparatus described above a fluid mixture containing fractions of different specific gravities is forced under high pressure through the pipe 2, and enters the deflector device through the pipe 6. The fluid issues through the inclined slots 22 and is thus set in rapid whirling movement in the space between the deflector 21 and the casing 15. This action may be said to transform the pressure head under which the fluid is supplied into a velocity head, or, in other words, the fluid is caused to whirl around its vertical axis of upward movement at a speed commensurate with the pressure at which the fluid is supplied. The whole mixture then ascends into the flaring pipe 8. The whirling movement of the mixtures continues as the mixture rises in the pipe 8 and the fractions of the mixture are separated into annular layers which issue from the openings 31 and 32 and are discharged from the apparatus through the spouts 37 and 38. It will be noted particularly that no moving parts act upon the fluid that is being separated but, on the contrary, the rotary movement of the fluid is produced solely by the inclination of the slots 22 in the deflector.

The pressure under which the mixed fluids are delivered to the deflector will necessarily vary for different materials, and I therefore do not wish to be limited to any range of pressure except that the lower limit of pressure is that which for any given mixture, will produce separation of the constituents instead of mere agitation and mixing.

I have shown and described the structure which I now prefer to employ in carrying out my invention. It will be understood, however, that many changes in the construction and arrangement of parts may be made without departing from my invention as set forth in the appended claims. It will also be understood that my invention is not restricted to the treatment of any particular fluid mixture, but is of general application and may be used for separating the fractions of any fluid mixture containing materials of different specific gravities whether the individual fractions are solids, liquids or gases.

I claim as my invention:

1. Apparatus for separating the constituents of fluid mixtures comprising a vertical tube of upwardly increasing diameter, means for supplying fluid to the lower end of said tube, means for causing said fluid before entering said tube to rotate around the vertical axis of said tube, and means for removing the separated materials from the upper end of said tube.

2. Apparatus for separating the constituents of fluid mixtures comprising a casing of upwardly decreasing diameter, a frusto-conical deflector member disposed within

said casing, and having radially inclined slots formed in its sides, and a tubular member for receiving the fluid from said deflector.

3. Apparatus for separating the constituents of fluid mixtures comprising a casing of progressively decreasing diameter, a frusto-conical deflector member disposed within said casing and having radially inclined slots formed in its sides, and a tube of progressively increasing diameter for receiving the fluid from said deflector.

4. Apparatus for separating the constituents of fluid mixtures comprising a vertical frusto-conical casing of upwardly decreasing diameter, a stationary frusto-conical deflector disposed within said casing and having slots formed in its sides, the said slots being inclined both lengthwise and radially, means for supplying fluid under pressure to the interior of said deflector member, and a vertical pipe connected to receive fluid from the upper end of said casing.

5. Apparatus for separating the constituents of fluid mixtures comprising a vertical frusto-conical casing of upwardly decreasing diameter, a stationary frusto-conical deflector disposed within said casing and having slots formed in its sides, the said slots being inclined both lengthwise and radially, means for supplying fluid under pressure to the interior of said deflector, a vertical pipe connected to receive fluid from the upper end of said casing, the said pipe being of upwardly increasing diameter, and means at the upper end of said vertical pipe for separately removing the constituents of said mixture.

6. Apparatus for separating the constituents of fluid mixtures comprising a vertical frusto-conical casing of upwardly decreasing diameter, a stationary frusto-conical deflector disposed within said casing and having slots formed in its sides, the said slots being inclined both lengthwise and radially, means for supplying fluid under pressure to the interior of said deflector member, a vertical pipe connected to receive fluid from the upper end of said casing, the said pipe being of upwardly increasing diameter, means at the upper end of said vertical pipe for separately removing the constituents of said mixture, the said means comprising a head having hollow converging walls and connected to the upper end of said vertical pipe, external shoulders formed on the walls of said head, discharge openings extending through said shoulders and communicating with the interior of said head at different distances from the central vertical axis of said head, means for varying the effective size of said openings, and means for collecting and discharging the materials issuing from said openings.

7. Apparatus for separating the constituents of fluid mixtures comprising a casing of progressively decreasing diameter, a frusto-conical deflector member disposed within said casing and having radially inclined slots formed in its sides, and a tube for receiving the fluid from said deflector.

8. Apparatus for separating the constituents of fluid mixtures comprising a casing of progressively decreasing diameter, a frusto-conical deflector member disposed within said casing and having radially inclined slots formed in its sides, and a tube for receiving the fluid from said deflector, the said tube being provided with a plurality of radially spaced outlets at a point removed from that at which the fluid enters it.

In testimony whereof I, the said GEORGE L. FOGLER, have hereunto set my hand.

GEORGE L. FOGLER.