

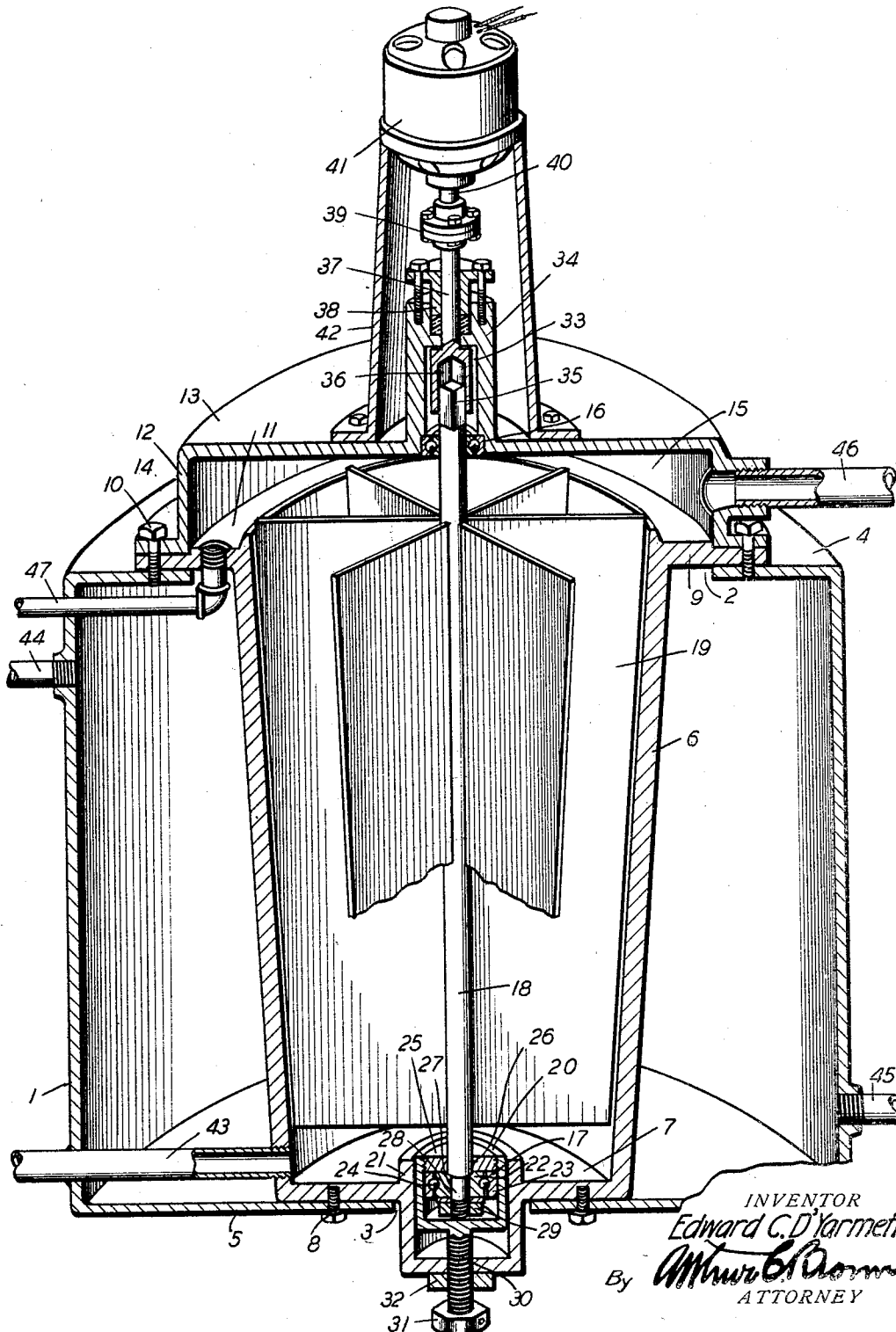
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APPARATUS FOR HEAT TREATING LIQUIDS

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## UNITED STATES PATENT OFFICE

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## APPARATUS FOR HEAT TREATING LIQUIDS

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My invention relates to apparatus for heat treating liquids, and more particularly to apparatus of that character for heat treating hydrocarbon oil for progressively separating the lighter from heavier components of the oil during continuous flow thereof through the apparatus, the present invention being an improvement on apparatus disclosed in Letters Patent of the United States, No. 1,732,805, issued October 22, 1929, to Edward C. D'Yarmett and having for its principal object to control heat treatment of the liquid by regulation of flow of the liquid through the heating zone of the apparatus.

In accomplishing this object, I have provided improved details of structure, the preferred form of which is illustrated in the accompanying drawing, showing in a single figure a central vertical section of apparatus embodying my invention.

Referring in detail to the drawing:—

1 designates an outer heating vessel, circular in cross section and having concentric openings 2—3 in its top and bottom walls 4—5.

Extending concentrically through the furnace 1 and spaced from the side wall thereof is an inner vessel or shell 6, circular in cross section but of gradually reduced diameter from top to bottom, the bottom 7 of the shell resting on the bottom of the furnace and secured thereto preferably by stud bolts 8. The upper end of the shell extends through the top opening 2 of the furnace and has a lateral flange 9 overlying the top of the furnace and secured thereto preferably by stud bolts 10; the flange being downset from the rim of the shell to provide a trough 11 between the rim of the shell and the side wall 12 of a dome 13, having a lateral flange 14 overlying the flange 9 of the shell 6 and also preferably secured to the top of the furnace by the stud bolts 10. The dome 13 is of sufficient depth to provide a collection chamber 15 over the top of the shell for a purpose later described.

Journalled in bearings 16—17 in the dome 13 and shell bottom 7, respectively, is a shaft 18 provided with radial vanes 19 tapered correspondingly to the tapered shell and adapted for rotation with their outer edges in more

or less spaced relation to the inner surface of the shell dependent on vertical adjustment of the shaft 18. The bearing 17 at the bottom of the shell is preferably located in a cup 20 mounted in a collar socket 21 formed integrally with the bottom 7 of the shell and extending above and below the bottom to provide a housing of sufficient depth for vertical adjustment of the cup in the socket.

In its more detail construction, the preferred form of the bearing 17 and cup-adjusting mechanism includes inner and outer ball races 22—23 for the bearing balls 24 retained in the cup 20 by a head plate 25 threaded into the top of the cup, the shaft 18 being rotatably extended through an aperture 26 in the head plate 25 and having a reduced portion 27 extending through an aperture 28 in the race member 22, so that the shoulder on the shaft seats on the race member and is held thereto by nuts 29 on the threaded end of the reduced shaft portion or shank 27.

To provide adjustment of the shaft, the cup 20 has a screw shank 30 having threaded connection with the bottom of the socket 21, and provided with a wrench square 31 whereby the shank may be rotated to effect its adjustment in the socket, and with a locknut 32 whereby the shank may be held in an adjusted position.

The upper end of the shaft 18 projects through the bearing 16 into the chamber 33 of a hood 34 on the dome 13, and is provided with a squared head 35 slidably seated in the socket 36 of a coupling rod 37 rotatably extended through the top of the hood and through a stuffing box 38 thereon. At its upper end the coupling rod is connected through the coupling 39 with the shaft 40 of a motor 41, preferably of electrical type, and supported on a housing 42 carried by the dome 13 and inclosing the hood 36 and shaft coupling elements.

Liquid for treatment in the shell is supplied preferably to the bottom of the shell through a conduit 43 leading through the furnace and shell walls, and a fluid medium, such as steam, is preferably supplied through the furnace in counter flow to the

liquid being treated by an inlet pipe 44 opening through the furnace wall near the top thereof, and an outlet pipe 45 opening through the furnace wall near the bottom thereof and diametrically opposite the inlet pipe so that the heating medium entering the furnace will flow downwardly over and about the side wall of the shell.

Leading from the side wall 12 of the dome 13 is a vapor outlet line 46, and leading from the bottom of the trough 11, preferably diametrically opposite the vapor outlet line, is a line 47 for offtake of liquid residue entering the trough over the rim of the shell.

In treating liquid with the apparatus described, the shaft 18 is adjusted vertically to provide a desired space between the edges of the rotatable vanes and the inner surface of the shell, the motor placed in operation to rotate the shaft and vanes, and the fluid-heating medium passed through the heating chamber to heat the interior of the shell through the wall thereof.

When the shell has been heated to a proper temperature, charging stock, such as crude oil, is admitted to the bottom of the shell and rising therein is subjected to centrifugal force generated by the rotating vanes and thrown to the wall of the shell. Oil rising in the shell and thrown to the wall thereof flows over the inner surface of the shell in a film of substantially uniform thickness and during its upward travel is subjected to heat from the surrounding chamber of a proper temperature to drive off lighter components of the oil as vapors, which rise through the space between the vanes and surrounded by the film into the dome chamber above the shell, from which the vapors are conducted through the outlet line to a condenser (not shown). During its upward travel the film is rotated as well as maintained by the rotating vanes, the rate of travel of the oil through the shell and consequently the time period during which the oil is subjected to treating heat, will, with constant feeding pressure and top speed of the vanes be determined by the spacing of the vanes relative to the wall of the shell. Consequently, the treatment of the oil may be regulated not only by temperature in the heating chamber but by mechanical adjustment of the shaft and vanes, a quick adjustment for change of treatment being effected by manipulation of the lower shaft bearing to raise or lower the shaft and correspondingly retract or advance the vanes from or toward the shell.

While I have referred to movement of the oil upwardly through the shell, direction of travel of the oil may be downwardly through the shell if desired, without change of functioning of the apparatus and without change in the apparatus except arrangement of parts to adapt the structure to such change

of flow. Temperature in the heating chamber may be varied to adapt the treatment for various grades of oil in accordance to treating requirements well known to those familiar with refining practices.

What I claim and desire to secure by Letters Patent is:

1. Apparatus of the character described, an inwardly and downwardly tapered vessel, means surrounding the sides of said vessel for heating the same, means for delivering hydrocarbon oil to the vessel for treatment therein, centrifuging means in the vessel for directing the hydrocarbon oil to the wall of the vessel for travel thereover in the form of a film, and means for regulating the thickness of said film.

2. Apparatus of the character described including a housing, a vessel tapering downwardly within and spaced from the side wall of the housing to provide a heating chamber about the side of the vessel, means for delivering heating medium and hydrocarbon oil for treatment to the heating chamber and vessel respectively, means in the vessel for imparting a rotating movement, thereby directing the hydrocarbon oil to the wall of the vessel for travel thereover in the form of a film, means for predetermining the thickness of said film, a collector at the upper end of the vessel, and separate vapor and oil outlets leading from the collector.

3. Apparatus of the character described, a housing, a downwardly restricted tapered vessel within and spaced from the side wall of the housing to provide a heating chamber about the vessel, means for delivering heating medium and hydrocarbon oil for treatment to the heating chamber and vessel respectively, centrifuging means having radial vanes in the vessel for directing the oil to the wall of the vessel for travel thereover in the form of a film, and means for regulating the thickness of said film.

4. Apparatus of the character described comprising a housing, a tapered vessel within and spaced from the side wall of the housing to provide a heating chamber about the vessel, means for delivering heating medium and hydrocarbon oil for treatment for counter flow in the heating chamber and vessel respectively, centrifuging means including radial vanes in the vessel for directing the oil to the wall of the vessel for travel thereover in the form of a film, and means for regulating the thickness of said film operable from without the housing.

5. Apparatus of the character described including a housing, a tapered vessel within and spaced from the side wall of the housing to provide a heating chamber about the vessel, means for delivering heating medium and hydrocarbon oil for treatment to the heating chamber and vessel respectively, centrifuging means in the vessel for directing

the oil to the wall of the vessel for travel thereover in the form of a film, a collector at the outlet end of the vessel, separate vapor and oil outlets leading from the collector, means for adjusting the centrifuging means to vary the film thickness and means without the housing for placing said centrifuging means in operation.

6. In combination with a tapered vessel, centrifuging means including tapered vanes extending axially of and revoluble in the vessel and spaced from the wall of the vessel to form a film space adjacent said wall, means for vertically adjusting the centrifuging means to vary the film space, and means for heating the wall of the vessel.

7. In combination with a tapered vessel, an adjustable bearing in the bottom of said vessel, an axially extending shaft journaled in said bearing, tapered vanes on the shaft adapted to be spaced from the wall of the vessel to form a film space adjacent said wall, means for adjusting the bearing up and down so as to vary the film space, means for rotating the shaft, and means for heating said vessel.

8. In combination with a tapered vessel, an adjustable bearing in said vessel, a shaft journaled axially in said bearing, tapered radial vanes on the shaft adapted to be spaced from the wall of the vessel so as to provide a film space adjacent said wall, means for adjusting the bearing vertically to vary the space between the outer edges of the vanes and the vessel wall, a slip clutch on the shaft, and means for rotating the slip clutch.

9. A device of the class described comprising a housing having a central opening in its top, a tapered vessel extending through said opening, a laterally extending flange surrounding said vessel and adapted to be secured to the top of said housing, a dome mounted on said flange and having its top spaced upwardly from the upper end of said vessel, a shaft mounted axially in said vessel, a vertically adjustable bearing for the lower end of said shaft, a bearing for said shaft adjacent its upper end, radial vanes having their outer longitudinal edges parallel to the side wall of said vessel carried by said shaft, means for raising and lowering said adjustable bearing and shaft whereby the outer edges of said vanes approach and recede from the vessel wall, and means for placing said shaft in rotation.

In testimony whereof I affix my signature.

EDWARD C. D'YARMETT.