July 12, 1938. J. H. VITAL 2,123,490

DECOKING AND REFINING APPARATUS

Original Filed March 20, 1936 3 Sheets-Sheet 1

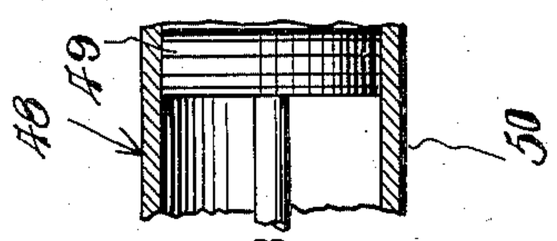

FIG. 1A.

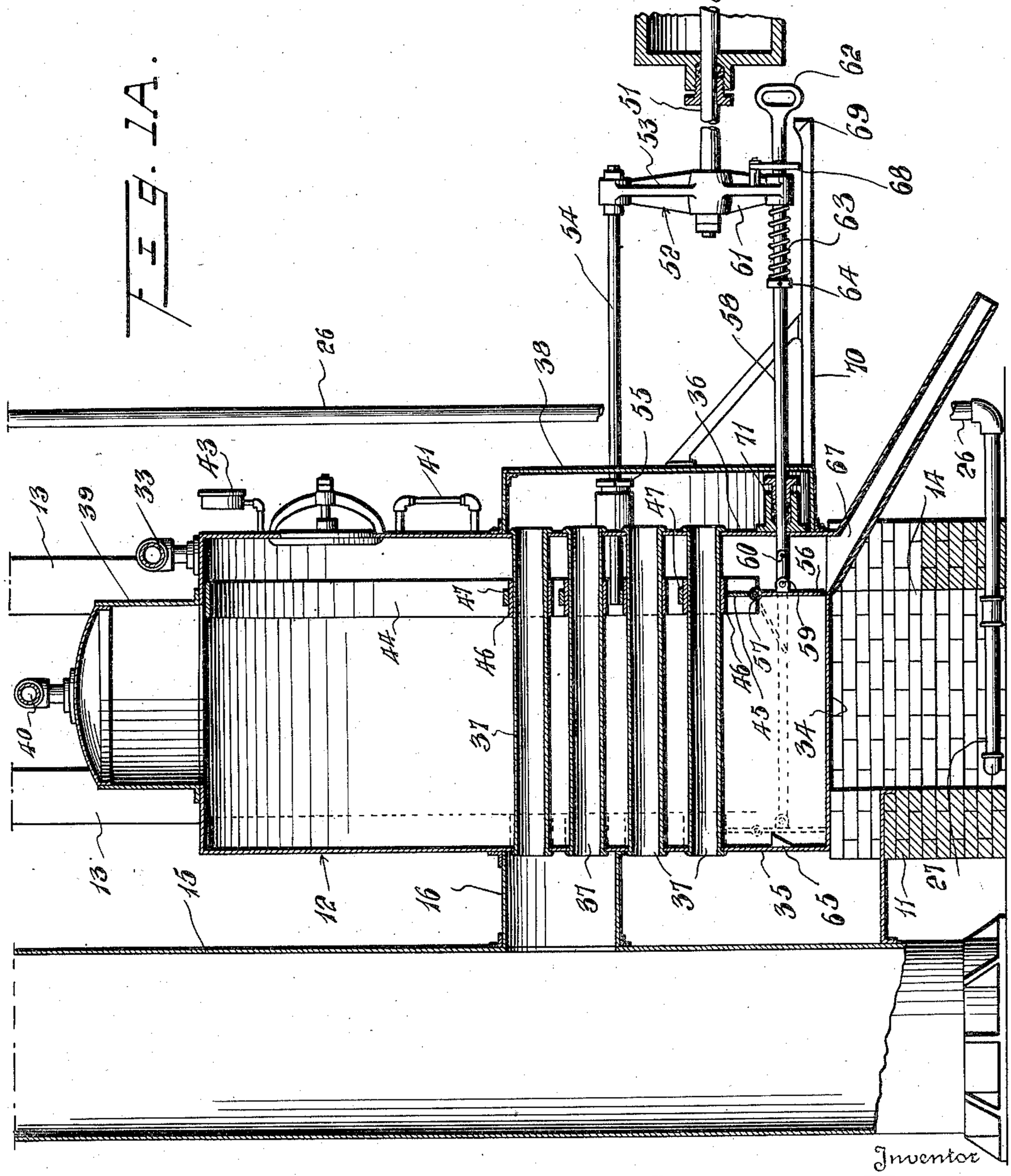

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FIG. 1B.

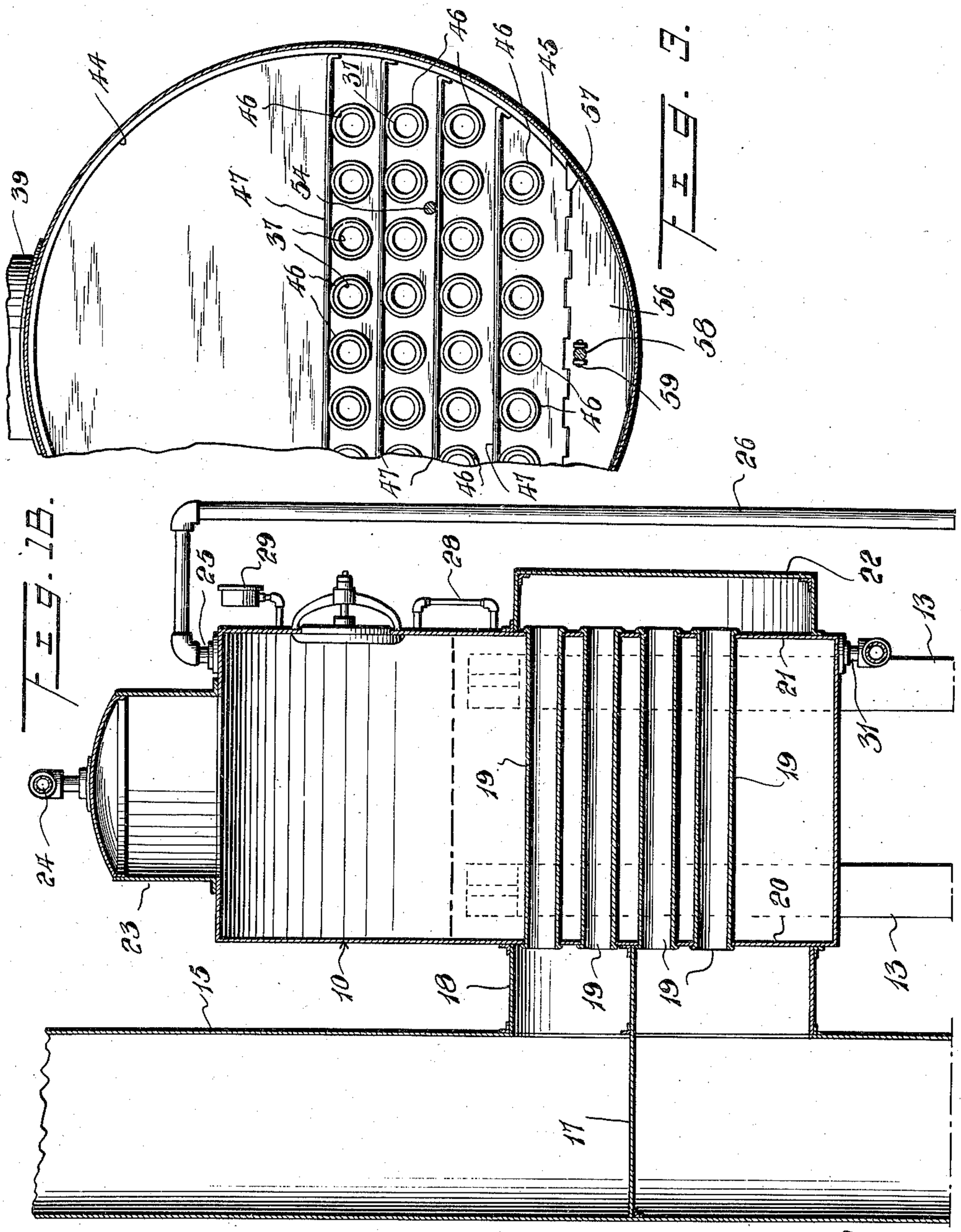

FIG. 1.

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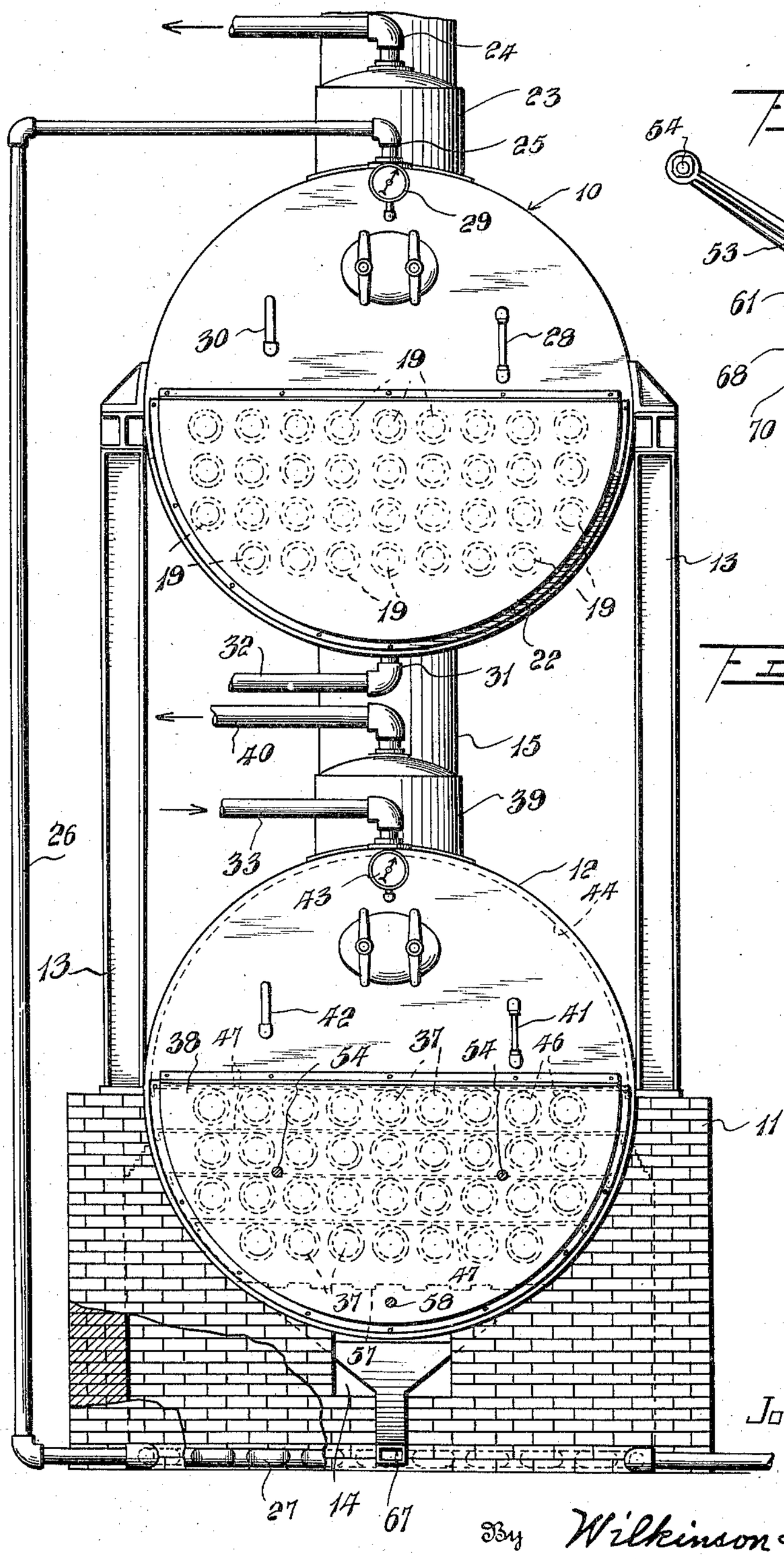

FIG. 4.

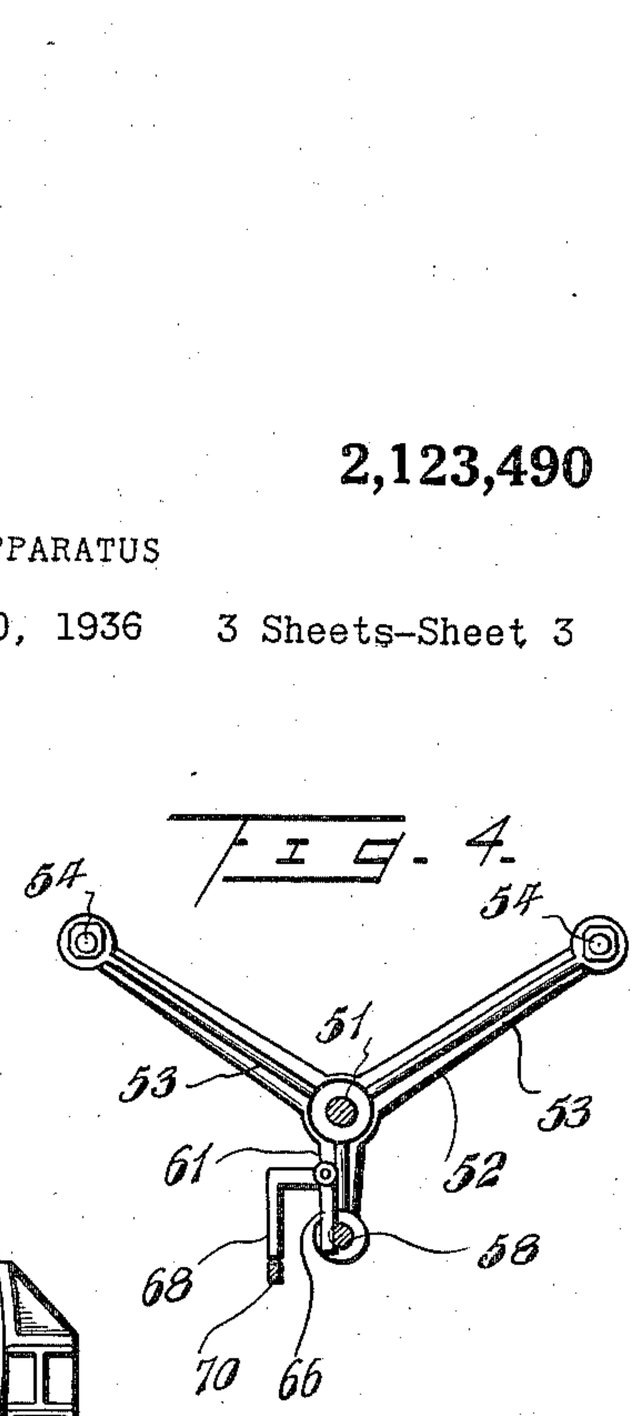

FIG. 2.

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2,123,490

DECOKING AND REFINING APPARATUS

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Application March 20, 1936, Serial No. 69,959
Renewed December 6, 1937

12 Claims. (Cl. 196—122)

This invention relates to a refining means and more particularly to a means for continuously refining oil or like fluids.

An object of this invention is to provide an improved refining means whereby the lighter liquids may be drawn off from the heavier liquid or fluid in a continuous process without the use of tanks or stills having spray means incorporated therein.

Another object of this invention is to provide in a refining means of this character means whereby the accumulations of coke or carbon on the inside surface of the still or boiler is constantly removed and drawn off from the still with the heavier fluids.

A further object of this invention is to provide a tubular boiler or heating means for the oil and means engaging about the tubes within the heater and also engaging the inside surface of the heater so as to constantly clean the surfaces of the tubes and the boiler or heater and thus permit a continuous refining of the oil in addition to preventing any accumulation of coke or carbon on the interior of the boiler or heater.

A still further object of this invention is to provide in a scraping means for the tubes and the inside surface of the heater a means which is operable automatically to move the bottom scraping means to an inoperative position on one stroke of the cleaning means.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views.

Figure 1A is a vertical section partly in detail of the lower refining still embodied in this invention.

Figure 1B is a vertical section partly in detail of the upper still which is connected to the lower still embodied in Figure 1A and which forms a continuation of Figure 1A taken on the line A—A of Figure 1A.

Figure 2 is a front elevation of the two stills the view being partly broken away and partly in section.

Figure 3 is a fragmentary vertical section of the inside of the lower heater and still embodied in Figure 1A.

Figure 4 is a front elevation partly in section of the yoke connected to the tube and heater cleaning means and showing the automatic tripping means for the cleaning gate at the bottom of the still.

Referring to the drawings, the numeral 10 designates generally an upper still or refining member which is supported in an elevated position by means of supporting posts 13 which engage a base structure 11. A lower still or refining member 12 is disposed below the upper still 10 and is supported on the base structure 11 which is constructed in the form of a hollow base having a combustion chamber 14 therein, in which a suitable heating means may be mounted so as to heat the lower half of the lower still 12. A stack 15 has a nipple 16 adjacent the lower portion thereof which is connected to the outlet portion of the heating means for the lower still 12.

The upper still 10 is heated by providing a horizontally disposed wall 17 across the stack 15 so that the heated gases and air will enter the lower portion of the still 10 and then pass through an outlet 18 into the stack 15 above the wall 17. The upper still 10 has a plurality of tubes 19 which are connected to the end walls 20 and 21 and which are open at each end. A boxing 22 is secured to the front wall 21 across the ends of the tubes 19 so that the hot gases and air may pass longitudinally therethrough from the stack 15 below the partition 17 and then enter the front end of the uppermost tubes and travel in a reverse or rearward direction and finally enter the stack 15 above the partition 17.

The upper still 10 has a dome 23 in the top thereof and a vapor lead-off line 24 is connected to the top of the dome so that the lighter fractions rising in the dome 23 may be drawn off therefrom by a suitable suction or vacuum means (not shown) and which may be disposed at a remote point from the still 10. The oil enters the upper still 10 through an inlet connection 25 which is connected to a pipe 26 extending vertically and which, at the lower end, is connected to a preheating coil 27 disposed in the lower portion of the firebox 14. The oil is pumped from a source of supply through the preheating coil 27 and then forced upwardly through the pipe 26 to the intake connection 25 in the upper still 10. An oil level gauge or sight glass 28 is connected to the front wall 21 at a point slightly above the uppermost series of tubes 19 and a pressure gauge 29 is connected to the still 10 adjacent the upper portion thereof so that the pressures inside the still 10 may be readily determined. A thermometer 30 is also connected to the front wall 21 of the still 10 so that the temperature of the oil and vapor in the still can be readily determined.

The still 10 has an outlet 31 in the lower portion thereof which is connected by means of a pipe 32 to a pump and an inlet pipe 33 is connected to this pump (not shown) and is connected to the top of the lower still 12. The upper and lower stills are of cylindrical construction and are identical substantially in all respects. The lower still 12 comprises a cylindrical body 34 having a rear end wall 35 and a front end wall 36. A plurality of horizontally disposed tubes 37 are secured to the end walls 35 and 36 and are open at each end thereof. The front wall 36 has a boxing 38 similar to the boxing 22 so that the hot gases and air may enter the lower tubes 37 from the rear pass forwardly therethrough and then enter the forward ends of the upper tubes 37 and pass rearwardly therethrough into the outlet 16 and then into the stack 15.

The top of the still 12 has a dome 39 and a vapor draw-off connection 40 is connected to the dome 39 this connection 40 being connected to a suction means (not shown) and which may be connected also to a condensing and separating means for separating the different fractions embodied in the vapor thus drawn off. The still 12 has a sight glass 41 connected to the front wall 36 and also has a thermometer 42 and a pressure gauge 43.

The oil in the upper still 10 is only heated through such a temperature as is necessary to vaporize the lighter fractions therein and this heating is not of such a degree as to form any material accumulation of carbon or coke on the outer surfaces of the tubes 19 or on the inside surface of the still 10. However, the oil in the lower still 12 is heated to a greater degree than the oil in the upper still 10 and this higher temperature causes an accumulation of solids in the form of carbon or coke on the tubes 37 and the inside of the cylindrical body 34. In order to provide a means whereby the inside surface of the cylindrical body 34 may be kept free from the accumulations of solids, I have provided a substantially circular cleaning member 44 which contacts with the inside surface of the cylindrical wall 34. This cleaning member 44 is constructed in the form of a relatively narrow band which is split at the bottom with a connecting bar 45 connecting the free ends thereof.

The periphery or outer surfaces of the tubes 37 are cleaned by means of annular cleaning members in the form of sleeves 46, there being one cleaning member for each tube 37. The tubes or cleaning members 46 are secured to cross bars 47 as by welding or the like, and the ends of the cross bars 47 are secured by welding or other suitable means to the inside surface of the circular cleaning band 44. The cleaning means comprising the band 44 and the tube cleaning members 46 are moved back and forth in the still 12 by means of a power member, generally designated as 48, which in the present instance is in the form of a reciprocating piston 49 in a cylinder 50 and which has a piston rod 51 connected to a yoke 52. The yoke 52 has a pair of upwardly divergent arms 53 which are connected to bars 54. The bars 54 extend through the boxing 38 and are slidable through glands 55 carried by the front wall 36 within the interior of the boxing 38.

A segmental bottom cleaning plate 56 is hingedly secured as at 57, to the lower edge of the lower bar 45 and a rod 58 is secured as by a pivotal connection 59 to the bottom cleaning member 56. Preferably, the inner end of the rod 58 has a hinged portion 60 so that the bottom cleaning member 56 may be rocked, as shown in dotted lines in Figure 1A. The rod 58 is slidable through an extension 61 carried by the yoke 52 and has a handle 62 at its outer end. An expanding spring 63 is disposed about the rod 58 and at one end engages against the inner side of the extension 61 and at the other end engages against a collar 64 secured to the rod 58. The spring 63 constantly urges the bottom cleaning member 56 to an inoperative position and when the power member 48 moves the cleaning means comprising the band 44 and the sleeves 46 to the innermost position, the gate or bottom cleaning member 56 will strike an abutment 65 carried by the inner side of the rear wall 35. This abutment 65 will cause a compression of the spring 63 and when the cleaning member 56 is in a substantially vertical position a pawl 66 pivotally carried by the yoke 52 will drop into a notch in the rod 58 and thereby hold the spring 63 compressed and also hold the cleaning member 56 in operative vertical position.

An outlet 67 is disposed in the bottom of the cleaning member 12 adjacent the forward end and when the cleaning member 44—46—56 arrives adjacent the front wall 36 the pawl 66 is tripped to a released position by means of an arm 68 carried by the pawl 66 which engages a cam 69 which is fixedly disposed in the path of the arm 68. In the present instance, the cam 69 is carried by the outer end of a rod 70 which is fixedly carried by the front of the still 12. The rod 58 slides through a gland or stuffing box 71 secured to the front wall 36 within the boxing 38. This boxing 38, and the same is true of the boxing 22, is preferably removably secured to the front wall of the still.

In the use and operation of the hereinbefore described refining means and process, the oil is initially forced into the preheating coil 27 and then flows upwardly through the vertical pipe 26 and into the intake pipe 25 of the upper still 10. The lighter fractions arising from the heated oil in the still 10 are drawn off from the dome 23 through the outlet pipe 24 and then treated in a conventional means for the purpose of separating the different fractions in the lighter vapors. The residue in the still 10 is pumped out through the outlet connection 31 and the pipe 32 and is then pumped back through the pipe 33 into the lower still 12. The temperature of the oil in the lower still 12 is raised to a higher degree than the oil in the upper still 10 so that the heavier fractions will vaporize and rise into the dome 39 from which the vapors are drawn off through the suction pipe 40. During the process of heating the oil in the lower still 12, the de-coking or cleaning means comprising the members 44–46 and 56 are moved back and forth by means of the power member 48.

Assuming that the de-coking means is at the forward end of the still 12 and is moving rearwardly, the bottom cleaning member or gate 56 will be in a released position, as shown in dotted lines in Figure 1A, and will remain in this released position during the rearward movement of the de-coking means. As the de-coking means moves rearwardly, the rear edges of the members 44, and 46 will scrape off the solids on the inside of the cylindrical member 34 and the periphery of the tubes 37, respectively. The gate or bottom cleaning member 56 will strike the abutment 65 as the de-coking means moves rearwardly and

this abutment 65 will swing the cleaning member 56 downwardly into a vertical operative position. At the forward stroke of the power member 48, the forward edges of the cleaning members 44 and 46 will scrape off the accumulated solids and at the same time, the bottom cleaning member 56 will pull forwardly all of the solids which have settled to the bottom in addition to scraping any solids which have accumulated on the bottom of the still 12. When the cleaning member 56 has partially passed over the outlet 67 the releasing arm 68 will swing the pawl 66 out of the notch in the rod 58 in which the pawl engaged at the time the abutment 65 moved the gate 56 to a vertical position and at the same time compressed the releasing spring 63. The arm 68 will engage the cam 69 prior to the outward terminus of the cleaning means so that when the cleaning means moves rearwardly, the bottom cleaning member 56 will be held in released position by the spring 63. The spring 63 is here shown as an expanding spring but it will be understood that the position of this spring may be reversed and a contracting spring used and the pawl 66 positioned on the rear side of the yoke 52.

It will be apparent from the foregoing that the process of refining the oil is exceedingly simple and that difficulties heretofore encountered through the accumulation of solids have been eliminated so that the refining process can be accomplished without the use of spraying devices such as are now commonly used.

It is obvious that various changes and modifications may be made in the details of construction and design of the above specifically described embodiment of this invention without departing from the spirit thereof, such changes and modifications being restricted only by the scope of the following claims:—

What is claimed is:—

1. An oil refining means comprising a still having a cylindrical body, a plurality of heater tubes extending through the body and disposed in parallel relation, a substantially circular band in the body slidably engaging the inside surface thereof, a bar extending across the lower portion of the band, a pivoted plate secured to said bar and engaging the bottom portion of the body, means for moving the band and the plate longitudinally of the body, and means operable at a predetermined point in the movement of the band and the plate to automatically swing the plate to a released position.

2. An oil refining means comprising a still having a cylindrical body, a plurality of heater tubes extending through the body and disposed in parallel relation, a split body scraping band disposed interiorly thereof and engaging the inside surface of the body, a bar connecting the free ends of the band, a bottom cleaning member swingably carried by the bar, means for reciprocating the band and the member in the body, automatic means operable at substantially the end of one cycle of the band and the member to swing the bottom cleaning member to released position and means operable when the band and the member reach the end of the other cycle to swing the member to operative position.

3. An oil refining means comprising a still having a cylindrical body, a plurality of heater tubes extending through the body and disposed in parallel relation, a split body scraping band disposed interiorly thereof and engaging the inside surface of the body, a bar connecting the free ends of the band, a plurality of tube cleaning members engaging about the tubes, means for connecting the tube cleaning members to the band for movement therewith, a bottom cleaning member swingably carried by the bar, means for reciprocating the band, tube cleaning members, and bottom cleaning member in the body, an elongated bar secured at one end to the bottom cleaning member and extending exteriorly of the body, means engaging the bar constantly urging the bottom cleaning member to a released position, and means active at the end of one stroke of the bottom cleaning member to releasably lock the bottom cleaning member in operative position.

4. An oil refining means comprising a still having a cylindrical body, a plurality of heater tubes extending through the body and disposed in parallel relation, a combined body and tube scraping means disposed within the body, means for reciprocating the scraping means within the body, said scraping means comprising a split band engaging the inside surface of the body, annular tube cleaning members engaging about the tubes, means for securing the tube cleaning members to the band for movement therewith, a bottom cleaning member disposed below the split ends of the band, means for securing the bottom cleaning member to the band, means active adjacent the end of one stroke of the scraping means for swinging the bottom cleaning member to a substantially vertical operative position, yieldable means constantly urging the bottom cleaning member to an inoperative position, and releasable holding means active at the end of the other stroke of the scraping means for releasing the bottom cleaning member for movement to an inoperative position by said yieldable means.

5. An oil refining means comprising a still having a cylindrical body, means for heating oil in the body, a reciprocal body scraping means interiorly of the body and means for reciprocating said scraping means in the body, said scraping means comprising a segmental band, a pivoted bottom cleaning member secured to the band, yieldable means constantly urging the bottom cleaning member to an inoperative position, means for swinging the bottom cleaning member to a substantially vertical operative position, releasable locking means for holding the bottom cleaning member in an operative position, and means engageable with said holding means adjacent the end of the forward movement of the scraping means to release said holding means.

6. An oil refining means comprising a hollow body, a scraping member within the body engaging a portion of the interior surface thereof, a second scraping member, means pivotally securing said second scraping member to said first scraping member, means for reciprocating said scraping members within the body, spring-pressed means constantly urging said second scraping member to released position, means holding said second scraping member in operative position, and means engageable with said holding means for releasing said holding means at a predetermined point in the movement thereof.

7. An oil refining means comprising a cylindrical body, a member slidably engaging a portion of the inner surface of the body, a second member in the body pivotally carried by the first member and engaging the remaining portion of the inner surface of the body, means for reciprocating said members, spring-pressed means constantly urging said second member to a position disen-

gaged from said body, means for holding said second member in operative position, and means engageable with said holding means for releasing said holding means at a predetermined point in the movement thereof.

8. In an oil refining still, a member movable longitudinally of the still, a wall scraping member, means pivotally mounting said scraping member on said first member, means for reciprocating said first member and said scraping member, spring-pressed means connected to said scraping member constantly urging the scraping member to an inoperative position, releasable holding means for holding said scraping member in operative position, means engageable with said holding means at a predetermined point in the movement of the scraping member for releasing said holding means, and means engageable with said scraping member at another point in the movement thereof for swinging said scraping member to operative position.

9. In a cylindrical oil refining still, a member slidable longitudinally of the still, a wall scraping plate, means pivotally mounting said plate on said member, a draw bar secured at one end to said member and extending through an end of the still, operating means connected to said draw bar, a rod connected at one end to said scraping plate and extending through an end of the still and disposed in parallel relation to said draw bar, a spring engaging said rod and constantly urging said plate to inoperative position, releasable holding means engageable with said rod for holding said plate in operative position, and means for tripping said holding means to released position.

10. In an oil refining still, a member movable longitudinally of the still, means for reciprocating said member in the still, a scraping member pivotally carried by said first member, releasable holding means for holding said scraping member in operative position, yieldable means constantly urging said scraping member to inoperative position, means engageable with said holding means adjacent the end of one stroke thereof for tripping said holding means to released position, and means engageable with said scraping member adjacent the end of the opposite stroke for swinging said scraping member to operative position.

11. In an oil refining still, a member slidable in said still, a second member pivotally carried by said first member and engageable with the inner surface of the still adjacent the bottom thereof, means for reciprocating said members within the still, releasable means for maintaining said second member in operative position, means active adjacent the end of one stroke of said members for swinging said second member to inoperative position, and means active adjacent the end of the other stroke of said members for swinging said second member to operative position.

12. In an oil refining still, a member slidable in said still, a segmental plate pivotally secured to said member and engageable with the bottom of the still to thereby scrape the bottom of the still upon movement of said plate, means for reciprocating said member and said plate within the still, a rod secured at one end to said plate and extending outwardly through an end of the still, a guide for said rod carried by said reciprocating means, a spring engaging about said rod and having one end abutting against said guide, an adjustable collar secured to said rod and engaging against the other end of the spring whereby to tension the spring, said spring constantly urging said plate to inoperative position, coacting means carried by said guide means and said rod for releasably holding said rod against movement, means for tripping a portion of said coacting means whereby to release said rod for movement by said spring to inoperative position adjacent the end of one stroke, and means active adjacent the end of the opposite stroke of said member and said plate to swing said plate to operative position.

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