C. A. HARDY.

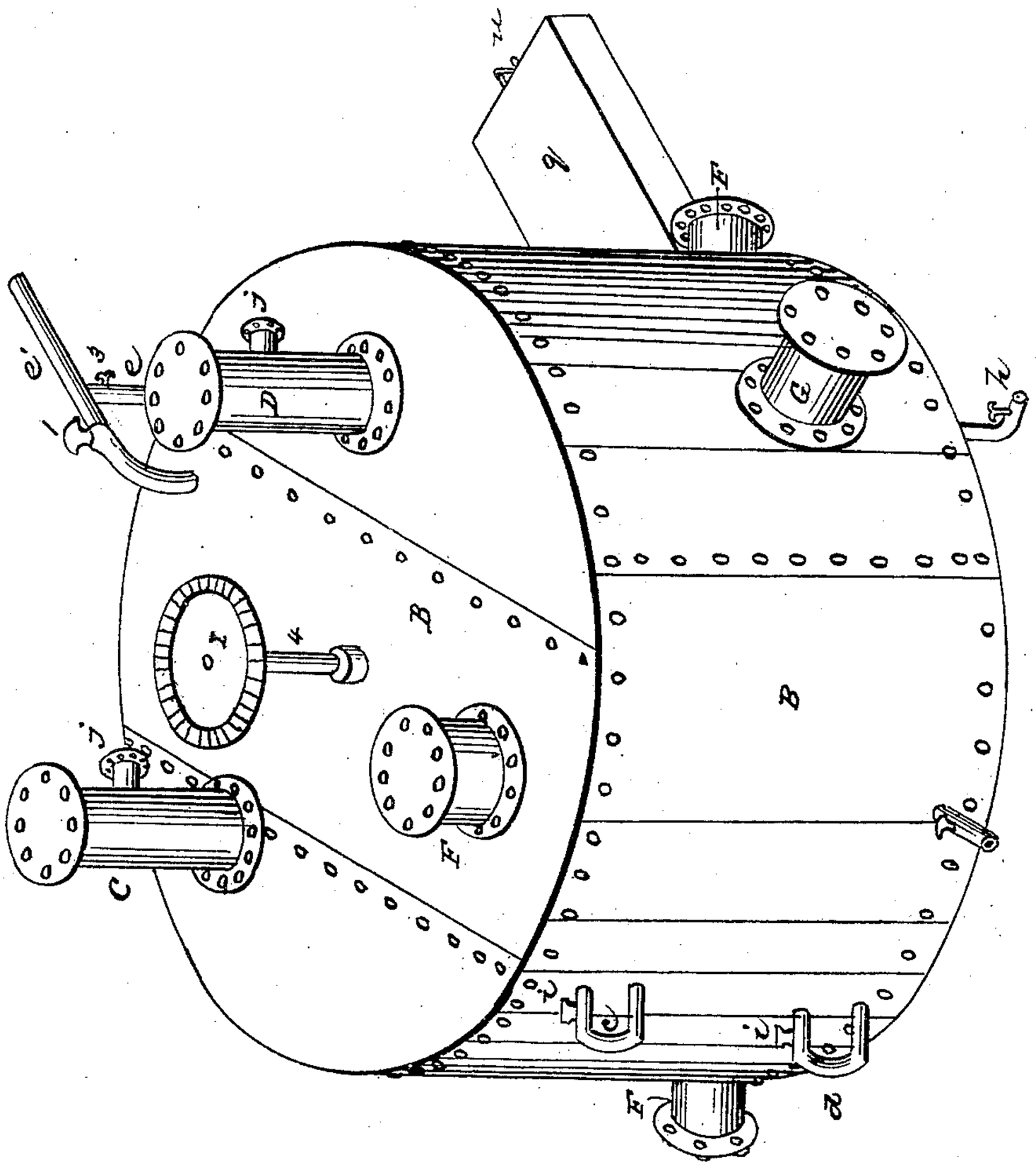
Oil Still.

3 Sheets—Sheet 1.

No. 51,042.

Patented Nov. 21, 1865.

FIG. 1.



WITNESSES:

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3 Sheets—Sheet 2.

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FIG. 4

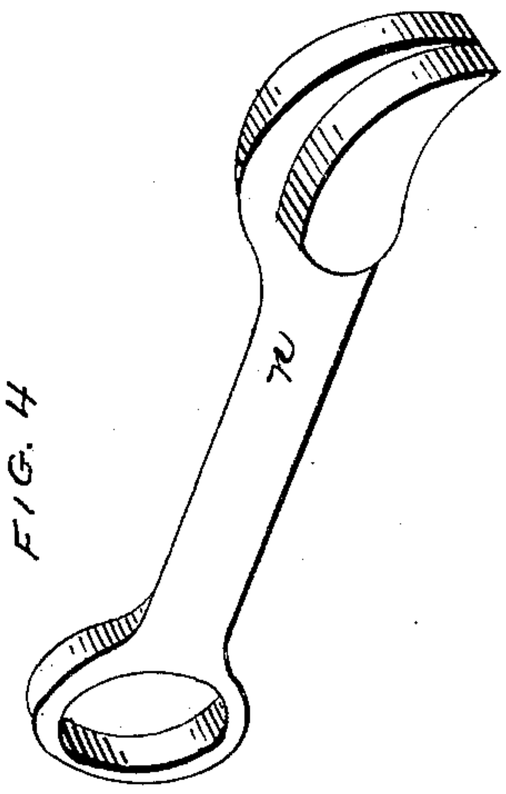

FIG. 3.

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3 Sheets—Sheet 3.

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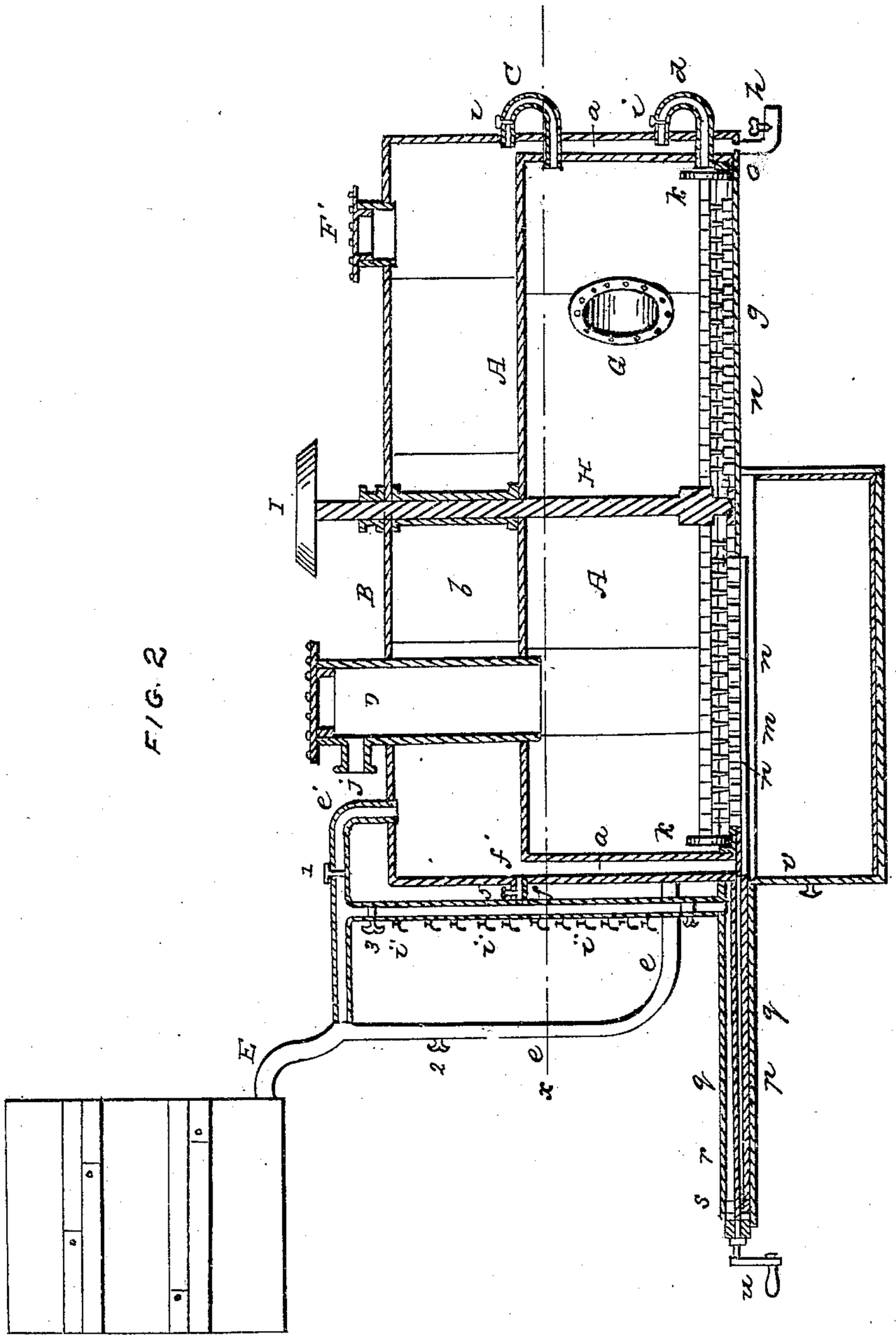
FIG. 2



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UNITED STATES PATENT OFFICE.

CHARLES A. HARDY, OF PITTSBURG, PENNSYLVANIA.

IMPROVEMENT IN OIL-STILLS.

Specification forming part of Letters Patent No. **51,042**, dated November 21, 1865.

To all whom it may concern:

Be it known that I, CHARLES A. HARDY, of the city of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Oil-Stills; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a perspective representation of my improved still. Fig. 2 is a vertical section through the center of the still. Fig. 3 is a horizontal section at the line *x x*, Fig. 2. Fig. 4 is a perspective representation of one of the shovels of the scraper.

In the several figures like letters of reference denote similar parts.

The still represented in the drawings consists of two chambers or vessels placed concentrically one inside of the other and having a common bottom. They may be conveniently made of sheet or boiler iron, and of cylindrical shape, although I do not restrict myself to the use of the material or shape designated. The inner chamber, A, is of smaller diameter than the outer chamber, B, as seen in Fig. 2, so as to leave an annular space, *a*, around the inner chamber. It is not, however, absolutely necessary that the space *a* should extend all around the inner chamber, nor that the sides of the inner chamber, A, should be exactly parallel with the sides of the outer chamber, B. The height of the inner chamber, A, is less than that of the outer chamber, B, so as to leave a space, *b*, on top of the inner chamber. There are two heads on top of the still for the egress of the volatile products of distillation, one of which, C, opens into the space *b*, outside of the inner chamber, A, and the other, D, extends through the space *b* and opens into the inner chamber, A. Each head C and D has an escape-pipe, *j*, leading to the condenser. The cap or covering on top of the heads C D is removable, so that through them access may be had to the interior of the chambers A and B for the purpose of cleansing or repairs or for cooling the stills by the free passage of air. The spaces *a* and *b* are not separated in any way, the former being around and the latter on top of the inner chamber, A.

A communication between the interior of the outer chamber, B, and the interior of the inner chamber, A, is effected by means of the siphons *c* and *d*, one being placed at or near the top of the inner chamber, A, and the other at or near its bottom. The short arm of these siphons, which is uppermost, opens into the outer chamber, B, and the long arm passes through the space *a* and opens into the interior of the chamber A. The orifice of the short arm of the upper siphon, *c*, is about on a level with the top of the inner chamber, A, and the lower arm of the lower siphon, *d*, enters the inner chamber, A, as near the bottom as possible. A valve, *i*, is placed in each siphon outside of the still, by which the flow of oil from the outer to the inner chamber is regulated at pleasure.

E is the supply-pipe, which conducts the crude oil to be distilled from an elevated tank into the outer chamber, having a branch, *e*, leading into the lower part of the outer chamber, B, and a branch, *e'*, which opens into the top of the still, and another branch, *f*, serving as a stand-pipe, which communicates with the valve-case, as hereinafter described. The stand-pipe *f* has a number of cocks, *i'*, at various heights, by means of which the height of the oil either in the outer chamber, B, or inner chamber, A, may be easily ascertained.

A valve, 1, is placed in the branch *e'* of the supply-pipe, which is only opened when crude oil is to be admitted to the top of the still, but the supply is ordinarily effected through the branch *e*, which has a valve, 2, to regulate the flow of oil into the outer chamber, B. There is also a valve, 3, at top of the stand-pipe *f*, and a valve, 4, near its lower end. If it is desired to ascertain the height of oil in the inner chamber, A, it is done by closing the upper valve, 3, and opening the lower valve, 4, which allows the oil from the interior of the inner chamber (with which the valve-case *q* communicates) to rise in the stand-pipe. If it is desired to test the height of oil in the outer chamber, B, both of the valves 3 and 4 are closed and a valve, 5, in the connecting-pipe *f*, is opened, and as the connecting-pipe *f'* is situate at the level of the top of the inner chamber, A, the stand-pipe *f* will show how high the oil stands above that level. The stand-pipe *f*, may be also used to clean out the valve-case *q* whenever it becomes clogged with sediment by opening the valves 3 and 4 and allowing the crude oil from the supply-tank to run directly through the valve-case into the interior of the inner chamber, A.

A pipe, *h*, which is furnished with a cock

and is inserted through the bottom of the still into the annular space *a*, serves to draw off all the oil from the outer chamber, B. The pipe *g*, also furnished with a cock, is the discharge-pipe from the inner chamber, A.

The still is furnished with a sufficient number of man-holes, F F, which open into the annular space *a* of the outer chamber, B, and which may be placed diametrically opposite to each other on the side of the still, and one man-head, F′, on top, opening into the space *b* above the inner chamber, A. When the covering of these man-heads is removed they allow a current of cold air to pass through the annular space *a* and upper space, *b*, outside of the inner chamber, A, and thus rapidly cool the still when it is desired so to do. There is also a man-hole, G, which opens into the inner chamber, A, and is used when it is desired to clean or repair it.

The still has a bottom, *g*, which may be made flat, as in the drawings, or inclined upward or downward from the circumference to the center of the still, as may be desired, and to which the outer and inner chambers, A and B, are riveted and secured, the inner chamber, A, being fastened to the bottom *g* by the angle-irons *o*, which also serve as a track for the wheels *k* to revolve on.

The circular wall on which the still rests is under the annular space *a*, between the outer and inner chambers, which is thus protected from the direct action of the fire of the furnaces, while by this arrangement the whole bottom of the inner chamber is over the furnace excepting where the pit or opening for the residuum is situate.

In the center of the still is a vertical shaft, H, the lower extremity of which turns in a slot, *l*, in the center of the still-bottom *g*, and which extends upward through both chambers A and B and out at the top of the outer chamber, B. On top of the shaft H is a beveled cog-wheel, I, by which motion is communicated to the shaft, which is caused to revolve on its axis. From the shaft H, near its lower end, radiate four arms, *l*, (more or less,) at the outer end of each of which, near the circumference of the inner chamber, A, is a small wheel, *k*, which rests and turns upon the angle-irons *o*. These wheels *k* serve to support the arms *l l l l*. On each of the arms *l l* are placed a number of small scrapers or shovels, *n*, each of which has a hub or sleeve which slips over its arm *l*, the extremity of each scraper resting on the bottom *g* of the still. As the sleeves of the scraper turn freely on the arms *l l*, the scrapers rise to pass over any inequality or obstruction in the bottom of the still, such as the rivet-heads and overlapping seams of the iron plates composing the still-bottom. These shovels or scrapers *n* serve to clean the sediment away from the bottom of the still without agitating the oil which it contains, and draw the sediment round to the pit or opening *m* in the bottom of the still.. This opening *m* extends from the side of the inner chamber, A, to within a short distance of the center of the still, (as shown in Figs. 2 and 3,) and is closed when it is desired to clean out the pit by means of a sliding door or valve, *p*, which works between slides in the bottom of the still. The opening *m* and its valve *p* are slightly tapering toward the center of the still, so that when the valve *p* is closed it may fit so tightly as to prevent any escape of oil from the inner chamber of the still.

Projecting from one side of the still, at the level of the still-bottom, is a flat hollow case, *q*, into the top of which the stand-pipe *f* enters and which communicates with and opens into the inner chamber, A. In this valve-case *q* the valve *p* is drawn when the pit is to be opened, by means of the screw-shaft *r* working in a nut or female screw, *s*, projecting upward from the outer end of the valve *p*. The screw-shaft passes through a stuffing-box at the end of the valve-case *q* and is turned by a winch, *u*.

Under the opening *m* in the still-bottom is placed a drawer, *v*, which receives all the residuum deposited in it by the action of the shovels *n* when the slide-valve *p* is open. The drawer is surrounded by a wall of masonry, so as to be protected as much as possible from the action of the heat of the furnace under the still.

The pit *m* and valve *p* may be used without any drawer or movable receptacle for the residuum, in which case the pit *m* is closed by a door, and is opened to clean out the residuum when the sliding valve *p* is closed. The use of a drawer, however, is preferable, as it prevents any waste of oil, and it should be made tapering, so as to fit closely to the sides of the pit.

Having thus described the construction of my improved still, I will proceed to explain its operation and advantages.

The crude oil is supplied into the outer chamber, B, from a tank or other reservoir by the supply-pipe E, usually through the branch *e*, the oil filling the annular space *a* and covering the top of the inner chamber, A, to any required height, ascertained by the cocks in the stand-pipe *f*, when the valve 5 in the connecting-pipe *f′* is opened. Here it is exposed to a gentle heat radiated from the walls of the inner chamber, A, as no part of the outer chamber is exposed to the direct action of the furnace. By this means the most volatile constituents of the oil are carried off through the head C and its escape-pipe *j*, and may be condensed and collected in a separate receiver before the oil enters the main still. The crude oil in the outer chamber, B, is also heated before being received into the inner chamber, A, or main still, and thus a great saving of heat is effected, as the heat radiated from the walls of the main still A, or inner chamber, which would otherwise be lost, is utilized and returned to the main still when the crude oil is admitted by the siphons *c* or *d*.

On first starting the still the inner chamber is filled to the required height with oil without first heating the oil in the outer chamber, as the still-bottom would be injured if exposed to the heat of the furnace when empty. Another important result of this arrangement is that

the space all around the top and sides of the inner chamber, A, filled with crude oil, serves as a jacket or covering to the main still to keep in its heat, and prevents the necessity of encasing the still with bricks or other non-conducting substance. A still thus constructed may also be much more rapidly cooled than a still cased or surrounded with brick, as the removal of the caps of the still-heads C and D and man-holes F F F′ admits a free current of cold air, which soon carries off the heat from the metallic sides of the still when not surrounded with brick or other non-conductor of heat.

As the process of distillation progresses the warm crude oil may be fed in from time to time, or continuously, by means of one or other of the siphons *c* and *d*.

The collection of the pitchy residuum of the distillation of petroleum in the bottom of the still is a great source of annoyance, because it is deposited in continually-increasing quantity, and not only causes the bottom of the still to burn, but prevents the heat of the furnace passing freely to the oil in the still, thus retarding the distillation and necessitating a much hotter fire and a greater waste of fuel, and also discolors the distillate. Various devices have been employed to obviate this difficulty, such as scrapers, &c., but with only partial success.

The advantage of my improved scraper is that the shovels press down close to the surface of the bottom of the still, and any one of them can rise over any obstruction without raising up the whole of the scraper, and any of the residuum which adheres to any of the shovels is removed by the edge of the still-bottom at the side of the pit the scrapers hanging down perpendicularly when they pass over the pit or opening in the still-bottom.

My improved still may be constructed without the space *b* on top of the inner chamber or main still, A, by extending the top or cover of the inner chamber over the annular space *a*. This arrangement will partially accomplish the purpose of my double still, as the crude oil in the annular space *a* will serve as a jacket to the main still, and also become heated before being admitted into the main still. With my still this crude oil may be admitted into the outer chamber without being first allowed to stand in a settling-tank, as the water will separate from the oil in the outer chamber, and may be drawn off by the cock in the bottom of the annular space *a* before being admitted in the inner chamber.

Having thus described my improvement in stills, what I claim as my invention, and desire to secure by Letters Patent, is—

1. Constructing a still for the distillation of oil and other liquids with an outer chamber enveloping it on the top and at the sides so as to leave a space above and around or partly around the inner or main still, thus forming an outer and inner chamber, communicating with each other by means of one or more siphons or valves, for the purpose of heating the oil or other liquid and vaporizing its lighter constituents before its admission into the main or inner still, and thus effecting an economy of heat.

2. Surrounding the main still laterally with a space through which the fluid to be distilled passes before entering the main still, for the purpose of preserving a more uniform temperature in the still and preventing the escape of heat, and also to prevent the necessity of incasing the still with any solid non-conductor of heat, so that when the still is emptied it may be more readily cooled.

3. The use of a coke receptacle or pit extending from a point at or near the circumference of the still toward and near to its center, situate under the bottom of the still and communicating therewith, for the purpose of receiving the residuum deposited therein by means of the scraper.

4. The use of a removable drawer for the coke or residuum, placed under an opening in the bottom of the still, in combination with the valve for closing the opening in the still when the drawer is to be removed, substantially as and for the purpose hereinbefore described.

5. The use of a tapering slide-valve in the bottom of the still, operated by suitable means, for the purpose of closing tightly the opening in the still-bottom, substantially as hereinbefore described.

6. The use of a hollow valve-case so constructed and arranged, substantially as hereinbefore described, as to receive the sliding valve which opens and closes the hole in the still-bottom when the valve is to be withdrawn, without allowing the escape of oil.

7. The use of a scraper consisting of a number of fingers or shovels, pivoted, hinged, or otherwise so attached to revolving arm or arms as to press upon the bottom of the still and rise over any obstructions, for the purpose of cleaning the residuum from the bottom of the still, constructed and operating substantially as hereinbefore described.

In testimony whereof I, the said CHARLES A. HARDY, have hereunto set my hand.

CHARLES A. HARDY.

Witnesses:
A. A. HARDY,
W. BAKEWELL.