Aug. 14, 1928. 1,680,541

W. T. HANCOCK ET AL

OIL CRACKING STILL

Filed Sept. 20, 1926

Fig. 1.

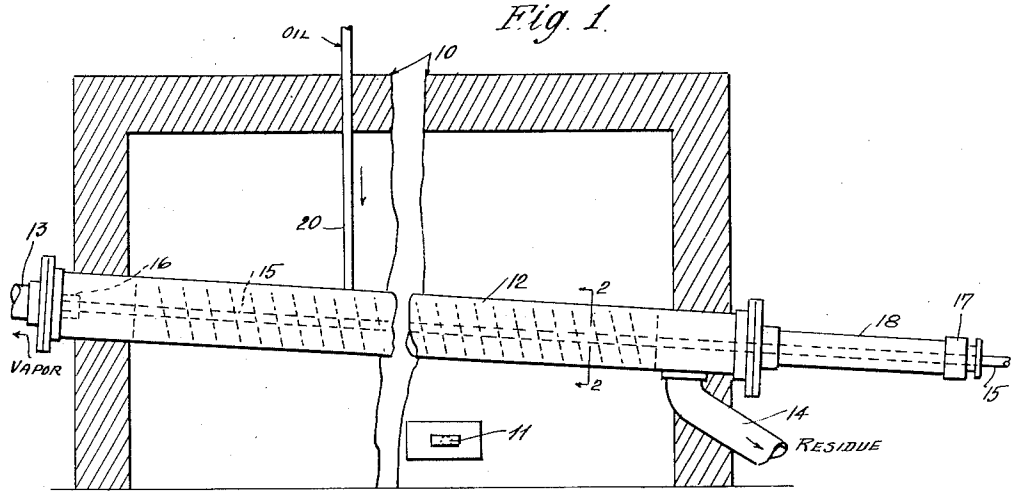


Fig. 3.

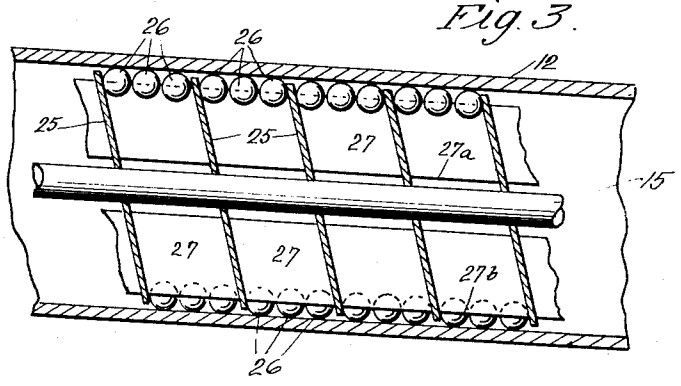
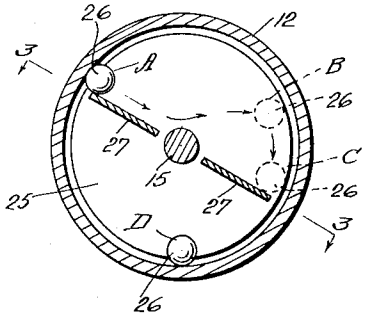


Fig. 2.



Inventors
William Thornhill Hancock
John Walker Hancock

Attorney.

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WILLIAM THORNHILL HANCOCK AND JOHN WALKER HANCOCK, OF LONG BEACH, CALIFORNIA.

OIL-CRACKING STILL.

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This invention has to do with oil cracking stills and the like, the major object being to provide a mechanism whereby the heavy and more or less solid residue or deposit that results from cracking operations will be prevented from lodging in the still. It has been a common experience in the operation of oil cracking stills that heavy, tarry or carbonaceous deposit or residue forms a more or less solid cake against the side wall of the still, choking the still and also greatly reducing the heat conductivity of its wall. It has been necessary in the past to clean out such deposit from time to time by hand or with a mechanism which will scrape out the deposit.

Our invention provides a simple, inexpensive device which prevents the heavy, tarry or carbonaceous matter from forming a solid or semi-solid cake, keeping the heavy substances in suspension in the liquid residue, thus allowing those substances to be withdrawn continuously with the residue. In its present specific and preferred form the device, as applied to a cylindrical still, takes the form of a series of disks set at angles on a longitudinal central shaft. Balls are confined between these disks, whose peripheries are close to the inner surface of the still, and radial plates extending between adjacent disks carry the balls around in such a manner that they roll over the bottom part of the still wall and, at some point in their travel, drop against the still wall with a hammering effect; and at the same time the balls are moved back and forth longitudinally by the action of the angularly set plates. The balls thus have both scrubbing and hammering action on the still with the result that any solid matter which would otherwise set as a solid cake is kept in suspension in the liquid residue. This liquid residue, which is the unvaporized part of the oil being treated, flows in one direction through the still, preferably tilted to a suitable angle, while the vapors flow in the opposite direction; the vapors and residue thus coming constantly into contact with each other. The construction is also such that, in their opposite longitudinal flow through the still, the residue and vapors are constantly brought to points close to the wall of the still, so that they are both entirely and uniformly heated to the predetermined temperature at which the still wall is maintained.

We proceed to a detail description of a specific and illustrative form of the invention, reference for this purpose being had to the accompanying drawings, in which—

Fig. 1 is a sectional elevation showing our improved still and simple form;

Fig. 2 is an enlarged cross section on line 2—2 of Fig. 1; and

Fig. 3 is a longitudinal section on line 3—3 of Fig. 2.

Although for the sake of simplicity, we show in the drawings a still comprising a single tube, it will be readily understood that our mechanism may be applied to a still of any number of tubes, and that the arrangement and interconnection of such tubes and their relation to other parts of a refinery plant may be as desired.

In the drawings the furnace indicated at 10 may be heated by any suitable means, as by an oil burner at 11. The inclined still tube is shown at 12 with its vapor discharge pipe 13 leading from its higher end and a residue discharge pipe 14 leading from its lower end. The longitudinal central shaft 15 may be carried in the tube in any suitable bearings, as by a bearing 16 at one end, and at the other end by a bearing 17 which may, at the same time, constitute a stuffing box. This stuffing box may be carried on the end of a pipe or tube 18 of reduced diameter which projects some distance beyond the lower end of the still tube 12 outside the furnace, so that the stuffing box may be maintained at a substantially lower temperature than it would be if it were mounted directly in or at the end of the still tube. The original oils to be treated may be introduced at any suitable point in the still tube, as for instance, at a medial point where feeder pipe 20 is shown in Fig. 1. From this point the oils flow downwardly along the length of the tube, the final residue flowing out through pipe 14; while the vapors and gases

flow longitudinally toward the higher end of the tube and out through the vapor outlet as at 13. The downwardly flowing oils and residue are constantly coming into contact with the upwardly flowing gas and vapor. And furthermore, residue and gas and vapor are being constantly agitated and carried through circuitous paths; so that the result is to free all proper gases and vapors from the residue and also to prevent the gases and vapors from carrying off in suspension any liquid or solids. These operations, together with prevention of solid deposit, are accomplished by the devices now to be described.

The central longitudinal shaft 15 has rigidly mounted on it a plurality of disks 25, set in planes making a somewhat acute angle with the shaft, as shown in Fig. 3. These disks are of such diameter that their peripheries do not quite touch the tube wall but come close to it. Between adjacent disks a number of balls 26 is confined, preferably a large enough number to make two rows of balls between adjacent disks. For instance, if balls of one inch diameter are used, with three in each row between adjacent disks, the distance between adjacent disks may be a little more than three inches. The distance between ball centers being thus something more than an inch, the disks 25 are preferably set at such an angle that they will, in their rotation, give the balls as they rest in a row at the bottom wall of the still, a longitudinal movement of something more than the distance between adjacent ball centers.

Between adjacent disks there are arranged radial plates 27 which act to carry the balls around the inside of the still tube. The inner edges 27^a of these plates do not quite contact with shaft 15, leaving space for passage of vapors from one side of the plates to the other. And the outer edges 27^b of these plates do not quite contact with the still wall, these edges 27^b preferably being a little inside the peripheries of disks 25.

The action of all these parts will be readily understood from a consideration of Figures 2 and 3. In the first place it will be noted that the residue in travelling toward the lower end of the still tube must travel around the edge of each disk 25 and therefore must travel in a comparatively thin body directly against the heated tube and thus periodically and repeatedly receive the full effect of that heat. And the gases and vapors in travelling toward the upper end of the still tube must also periodically and repeatedly pass around the edges of the disks and thus come into intimate contact with the heated tube. At the same time both the gases and vapors and the liquids are constantly moving in circuitous paths and are constantly intermingled, so that all parts of the liquids and gases and vapors come into repeated contact with each other and also into repeated contact with the still tube. And rotation of the balls has much to do with the intermingling of the liquids and gases, as well as performing the particular functions now to be described.

From a consideration of the structure described, it will be readily seen that on relatively slow rotation of the shaft a line of balls that may be temporarily resting at the bottom of the still will be picked up by a plate 27 and moved up along the wall of the still until they reach a position somewhat as shown in full lines at the position A in Fig. 2. From this position the balls will roll down plate 27, and usually striking shaft 15, will bounce off and strike the opposite wall of the tube at such a position as shown at B, thence falling down the wall onto plate 27 to such a position as shown at C. Then the rotation of plate 27 will allow the balls to roll down the tube wall to reach the lowermost position D, where the balls will remain until picked up by the next plate. At the same time that the balls are thus carried around, scrubbing the tube wall in rotation, and also striking it and the plates 27 with a hammering effect, the balls are more or less moved back and forth longitudinally of the tube by reason of the fact that disks 25 are set at angles. By all these combined actions the balls scrub the inner surface of the tube thoroughly, and particularly the lower part where heavy residue or deposit would otherwise collect, and also continuously hammer the tube so as to loosen any deposit which may become more or less attached to it. The heavy or solid matter is thereby kept free and worked up in the liquid residue and continuously flows out with the residue.

A still, equipped with the devices herein explained, has been found to operate continuously without the formation of any deposit on its inner surface. Such a still is therefore capable of continuous operation without having to be shut down for cleaning; and moreover, it is kept at the highest point of heat transfer efficiency.

We claim:

In combination with a sloping still tube having a vapor outlet at its higher end and a residue outlet at its lower end, a rotatable shaft arranged centrally longitudinally in the tube in suitable bearings, a tube of reduced diameter extending centrally from one end of the still tube, a stuffing box at the end of said smaller tube, and the shaft extending out through said stuffing box, a plurality of ball confining disks set rigidly on said shaft and longitudinally spaced from each other, said disks lying in parallel planes making acute angles with the shaft,

pairs of ball carrying plates set between adjacent disks in a radial longitudinal plane, the plates of each pair being at opposite sides of the shaft, the inner edges of the plates being spaced from the shaft and the outer edges of the plates and the peripheries of the disks being slightly spaced from the tube walls, and sets of free balls in the spaces between adjacent disks and at opposite sides of the pairs of plates.

In witness that we claim the foregoing we have hereunto subscribed our names this 9th day of September, 1926.

WILLIAM THORNHILL HANCOCK.
JOHN WALKER HANCOCK.