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COKE CLEANING APPARATUS
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The present invention relates to a method and apparatus for removing solidified materials from the interior of containers and particularly to the removal of coke from horizontal reaction chambers employed in the pyrolysis of petroleum. In the latter case, the accumulation of coke is sometimes permitted to proceed until the entire reaction chamber has been substantially filled with coke and flow therethrough completely blocked.

Prior to the development of the method and apparatus according to this invention much apparatus has been designed for the purpose of removing the hard deposited materials, but with such little success that the prevailing custom is to send men into the reaction chamber with pneumatic tools or picks to loosen the coke and remove it by hand. Such a procedure is both hazardous and time consuming.

The present invention eliminates the need for a substantial portion of the manual labor required and shortens the time interval between periods of operation to a considerable extent.

The invention may be fully understood from the following description read in conjunction with the accompanying drawings in which:

Figure 1 is a side elevation of a longitudinal section of a reaction chamber showing one portion of the apparatus in use;

Figure 2 is a similar view showing the second portion of the apparatus in use;

Figure 3 is a longitudinal sectional view of the cutting head shown in Figure 2;

Figure 4 is a sectional view of the cutting head taken along the line 3-3; and

Figure 5 is a perspective view from above of the driving mechanism for the apparatus.

Referring now to the drawings and particularly to Figure 1 the numeral 1 denotes a horizontal reaction chamber having flanged end openings 2 and 3 normally closed by covers secured to the flanges 4 and 5. A mass of accumulated solidified material 6 is to be removed from the chamber 1.

For this purpose a bit 7 carried by a drill stem 8 and rotatably driven by a driving means 9 carried on a stand 10, has been inserted in one end of the chamber and rotated so as to cut into the material 6. The driving means 9 and the stand 10 are equipped to provide for advancement of the bit as the work progresses as is indicated at 11. The drill stem 8 carries a scroll knife 12 which terminates at the forward end in a cutter 13. The scroll form of the knife member provides for removal rearwardly of material loosened by the bit 1 and cutter 13 and for smoothing the walls of the bore 14 as well as to aid in maintaining the alignment of the bit and stem substantially concentric with the chamber 1.

As the work progresses additional drill stem sections may be added from time to time which may or may not be provided with scroll members 12. However when it is desirable to provide a central passage of large diameter through the material in the chamber it is preferable to accomplish it in successive stages. In that event, at least one of the added drill stems is of the type indicated at 15 having cutters 16 at the forward end and carrying a scroll member 12. The cutters 16 are preferably disposed at the circumference of the bit 17 having an angular inclination in the reverse of cutter 16 may be disposed at the rearward end of the drill stem 19 to facilitate removal of the equipment. The drill stems 18 and 19 as well as other sections such as 19 are preferably hollow and the bit 1 provided with an opening 19 so that a solvent or flushing liquid may be used to assist in removing cuttings and to cool the bit.

The size of the central bore cut in the material 6 is governed almost entirely by the diameter of the head of the cutting tool used in the second stage of the operations and is only limited in maximum diameter by the diameter of the openings 2 and 3.

The second stage of the cleaning operation is illustrated in Figure 2. As shown a bore 14 has been cut through the material 6 from end to end of the chamber 1 concentric therewith. A cutting head 20 having extensible cutting arms 21 has been inserted in the bore, the arm extended and the head rotated by means of the hollow drive shaft or boring bar 22. The bar 22 may be made up of a number of sections some of which may contain scroll members, such as shown at 12 in Figure 1, in order to prevent packing of the space behind the cutter head with loose cuttings.

When the chamber is of considerable length it is necessary and at other times desirable to provide means for maintaining the alignment of the cutting head in the bore 14. This may be done as shown by means of a guide shaft 23 threaded into the inner face of the head concentrically thereof and extending outwardly through a plate or spider 24 secured to the flanged opening 3 and having a concentric hub 25 adapted to provide a bearing for the shaft.
which extends therethrough. If desired the shaft 23 may also be sectional so that portions may be detached as they pass beyond the hub 25. The same driving means may be utilized in this stage as the stage 22. The housing provides for a pressure chamber 26 opening outwardly through the upper end of the housing and through a passageway 28 in the threaded portion 27. The upper end of the housing carries a part-flanged portion 30 forming a plurality of outwardly extending arms 31 braced by webs 32 between the lower surfaces thereof and the side walls of the housing. As shown, there are three arms in the assembly.

On the upper surface of each arm 31 are disposed upwardly spaced trunnion posts 33 having aligned bearing openings 34. The posts 33 and arms 31 are preferably preformed so as to provide an upwardly and outwardly sloping surface 34a between the posts and above the bearing face of the arm. The outer edges of the posts are spaced from the edge of the arms so that with a downwardly and outwardly extending projection 35 on each arm a step like edge 36 is produced at the end of each arm. Within the pressure chamber 28 is disposed a piston 37 having a head 38 provided for a sliding fit with the chamber walls and carrying a piston seal assembly 39 which may either be of the washer type as shown or may consist of conventional rings fitted in grooves provided in the head. A piston rod 40 is preferably formed integral with the head, with an annular flange 41 in spaced relation to the outer end thereof. A recess 42 is preferably formed integral with the head, with an annular flange 41 in spaced relation to the outer end thereof. A recess 42 is provided in the outer end of the piston and paired spaced wing lugs 43 having slots 44 therein extending outwardly from the piston rod above the flange 41 with their ends in spaced relation to the other edges of the posts 33.

Cutter blades 45 are carried between the trunnion posts 33 on each arm by means of trunnion pins 45a insertable through the openings 34 and an opening 46 in the cutter blades. The blades 45 are of any convenient form but have at their juncture extensions 47 insertable between the paired wing lugs 43 and maintained in operative relation thereto by means of trunnions 48. In order that the blades 45 may when at rest extend upwardly about the axis of the housing 26 and substantially parallel thereto and when in operation extend outwardly at substantially right angles to said axis, the center lines of said extensions should intersect those of the blades to form angles of approximately 135°.

Over the assembly as described above is fitted a cap 49 having slots 50 in number equal to the arms 31 of the part-flange 30. The slots 50 extend from a point in spaced relation to the top center of the cap to a point on the side wall spaced from the lower edge by an amount equal to the height of the outer edge of the bearing surface 34a. Within the cap, spaced from the cap lower edge, is an annular inwardly projecting portion 51 the upper edge of which is flush with the bottom of slots 50. The portion 51 with the lower edge of the cap provide bearing surfaces coinciding with the step like portion 36. Set screws 52a maintain the association between the cap 49 and the balance of the assembly.

Within the cap 49 an enlarged lug 53 depends from the cap 49 and extends therethrough. The lug 53 contains a downwardly opening stepped recess 53 adapted to receive the upper end of a spring 54 the lower end of which extends into the recess 42 in the upper end of the piston rod 40. If desired a suitable guide rod may be disposed within the cap 49 and the recesses 42 and 53. An interiorly threaded recess 56 is provided in the upper surface of the cap 49 for engagement with the guide shaft 23 illustrated in Fig. 2.

As shown in Fig. 5, the driving mechanism 9 is disposed on a suitable platform or stand 10. The mechanism may be composed of an electric or fluid motor 55 mounted on a table 56 so as to provide a direct drive to the drill stems sections 18 or the bearing bars 22. Drilling assembly are means for introducing liquid under pressure into either the drill stem or boring bar assemblies as indicated at 57. This means may be any conventional arrangement available to the art. Mounted on the table 56 at right angles thereto is a tool carrier 58, one on either side, which may be motor driven or manually actuated. The gears 59 engage racks 59 disposed on opposite sides of the platform 10 so that rotation of the gears may effect forward or backward movement of table 56 and the drill stem or boring bars. A bearing member 60 is provided on the forward end of the platform 10 to aid in aligning the stems or bar whichever may be used.

In operating according to the present invention, the covers are removed from the openings 2 and 3 respectively and the stand 10 aligned with the chamber so that a drill stem may be directed along the axis of said chamber. The stand is spaced from the opening so that with the driving mechanism 9 fully withdrawn on the racks 16 there is sufficient space for attachment of a drill stem 12 and bit 1. The pinion gears are then rotated to bring the bit in contact with the material 6 within the chamber and drilling begun. As the work progresses drill stem sections are added. As has been illustrated a drill stem section 8 having a scroll member 12 and cutters 15 usually follows the bit 7 provide one stage of enlargement of the bore and if desired another stem 15 carrying an enlarged scroll member and cutters 16 and 17 may be added to provide another stage of enlargement. Usually additional drill stem sections will be plain sections such as 16. When the bore is complete sections are removed piece by piece and the cutting head 20 and bore bars 22 substituted.

The head 20, with cutter blades 21 vertical, is secured to a hollow boring bar 22 and inserted in the bore 10 within the chamber. Fluid pressure is applied through the hollow bar 22, and passageway 28 to force the piston 27 forward thereby extending the cutter blades 21. By applying such pressure in a pulsating form the cutter blades may be caused to chip out the material around the opening until the blades may be fully extended. The driving means may then be turned off and the normal cap 49 displaced from the blades. By gradually advancing the table 56 and adding bore bar sections the cutting head may be advanced as the work progresses. As previously described, the alignment of the head
may be maintained by means of the guide shaft 23 and plate 24.

It should be obvious from the foregoing description of the apparatus and operation that the method may be varied in several ways and may be made substantially continuous by introducing the cutting head following a drill stem section after at least one stage of the bore has been completed. In this case the drill stem sections may act as a guide shaft. In any event this invention is not to be limited by the foregoing description given for the purpose of illustration, but only by the following claims in which it is intended to claim all novelty as broadly as the prior art permits.

I claim:

1. In an apparatus for removing a mass of solidifiable material from a container, the mass having a central bore therein, a cutter head comprising a body member, and a radially flanged portion on said body; a cap member peripherally engaging said flanged portion, and a boss disposed interiorly of the cap in coaxial relation to said body, said cap having a plurality of spaced slots extending through the top and side walls radially from adjacent said boss; a plurality of cutter arms disposed in circumferentially spaced relation on said flanged portion, said arms extending through the cap slots normally in parallel relation to the body axis; fluid pressure means disposed within said body and extending into said cap, said means engaging the cutter arms to extend them angularly through the cap slots; resilient means disposed between said cap boss and pressure means, for returning the arms to their normal position when pressure is released, and means for aligning said head in the central bore.

2. In an apparatus for removing a mass of solidifiable material from a container, the mass having a central bore therein, a cutter head comprising a body member, a radial part-flanged portion on said body, trunnion post and pin members supported in circumferentially spaced relation on said flanged portion and a plurality of cutter arms normally supported by said posts and pins in parallel relation to said body. A cap member peripherally engaging the flanged portion, said cap having a plurality of spaced slots extending through the top and side walls, through which the cutter arms project, fluid pressure means disposed within said body, extending into said cap, angular extensions on said cutter arms extending inward into sliding engagement with said fluid pressure means, whereby the arms may be extended angularly from the body through the cap slots, resilient means between said cap and pressure means, for returning said arms to their normal position when pressure is released, and means for aligning said head in the central bore.

3. In an apparatus for removing a mass of solidified material from a container, the mass having a central bore therein, a cutter head comprising a body member, and a radially flanged portion on said body; a cap member peripherally engaging said flanged portion, said cap having a plurality of spaced slots extending through the top and side walls radially from adjacent the center thereof; a plurality of cutter arms disposed in circumferentially spaced relation on said flanged portion, each arm having an angular lower end portion extending inwardly toward said body member, and trunnion means normally supporting the arms in parallel relation to said body member, extended through the cap slots, a centrally disposed pressure chamber opening downwardly through the outer end of said body member, a piston and rod in said member, the rod projecting beyond the inner end thereof, and having a recess in its projecting end, a flange adjacent said rod end limiting movement thereof into the pressure chamber, slotted wing flanges disposed in pairs about said rod end above the flange, the slots receiving trunnion pins on the angular end portions of said cutter arms, means for supplying fluid pressure to said pressure chamber, a spring member disposed in the recess of said rod, extending upwardly into engagement with the inner face of the cap for the assembly, and means for aligning said head in the central bore.

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