July 8, 1941. L. DE FLOREZ 2,248,903

REMOVING COKE FROM COKE STILLS

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FIG.5.

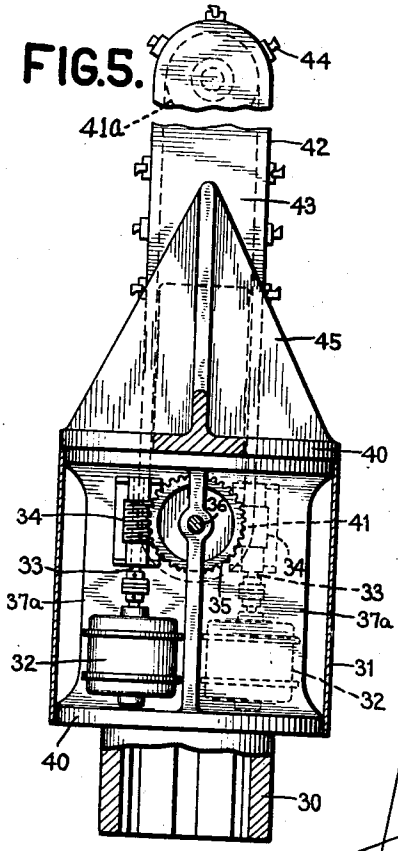


FIG.1.

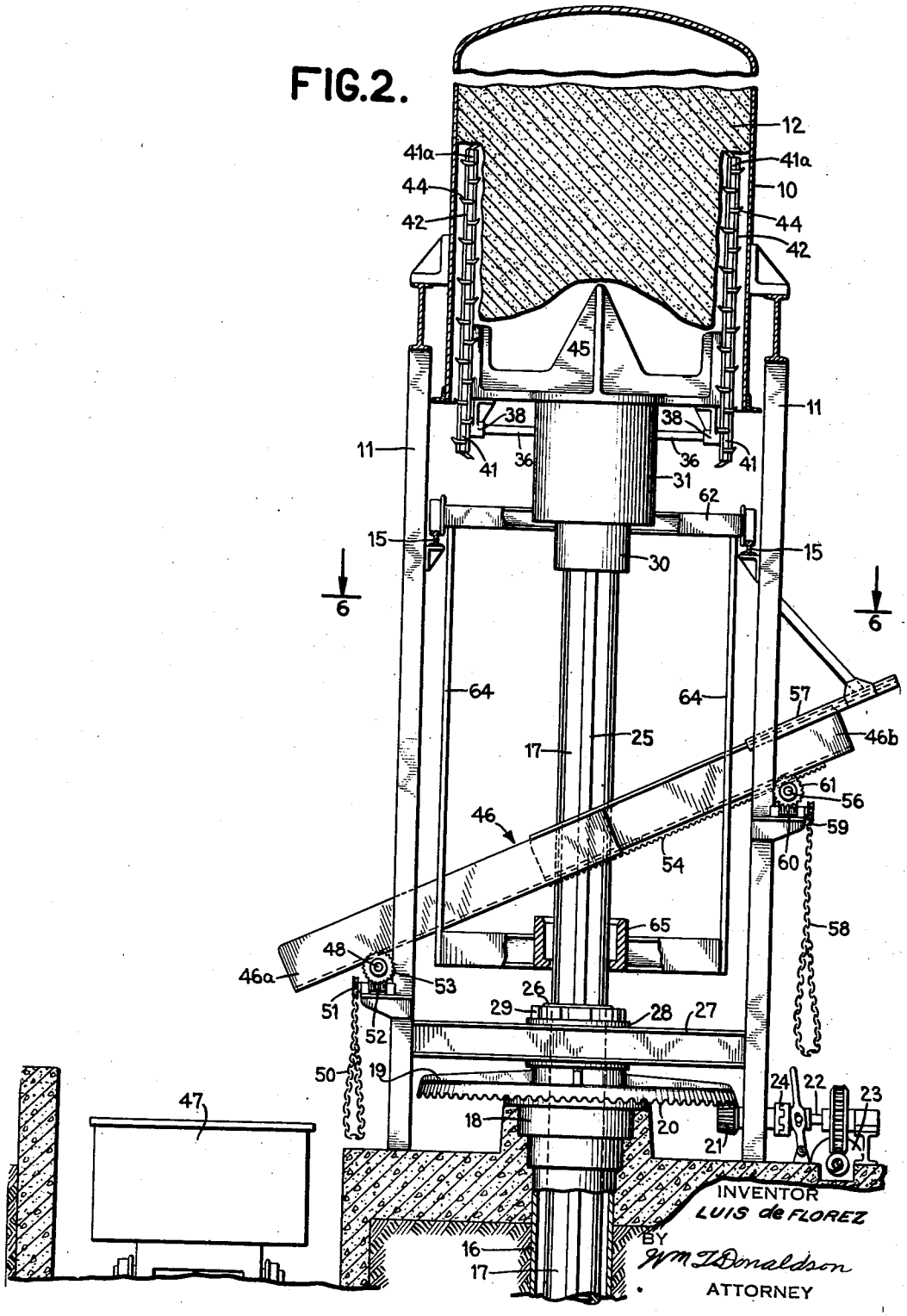
INVENTOR
LUIS de FLOREZ
BY
Wm T Donaldson
ATTORNEY

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FIG.2.



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FIG.3.

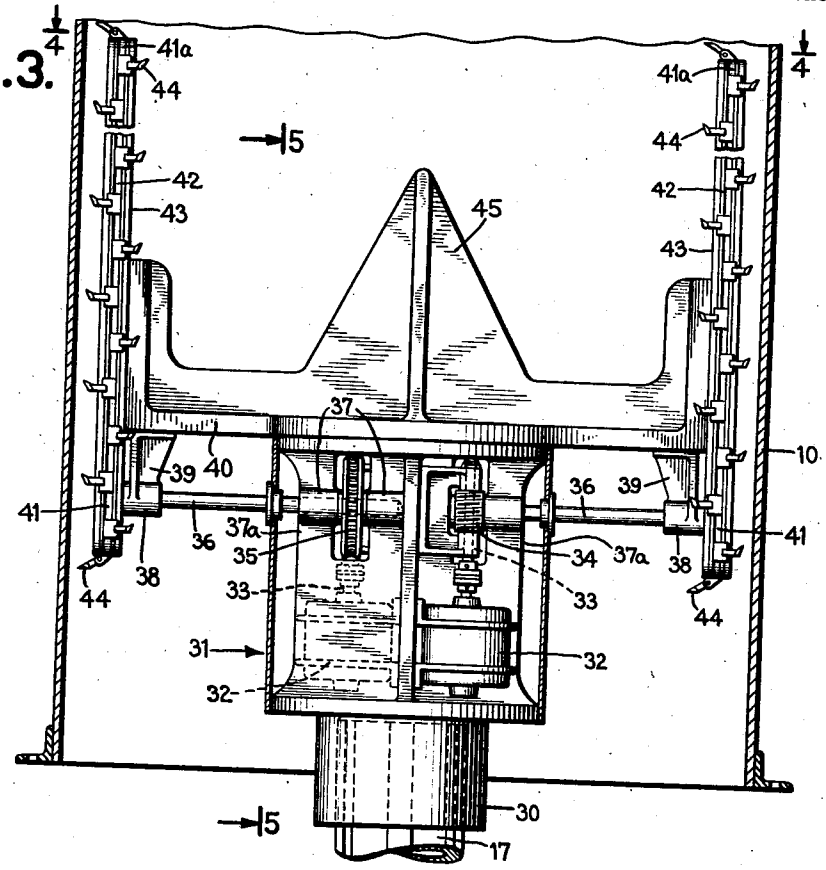
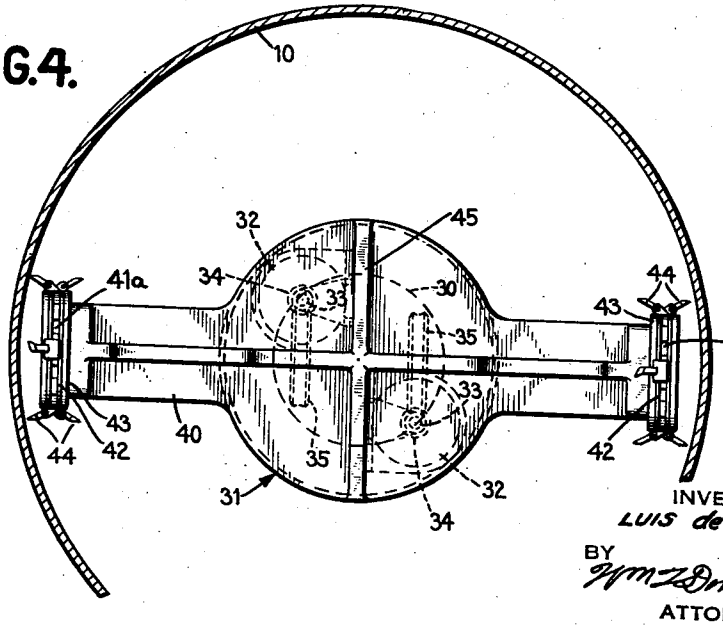


FIG.4.



INVENTOR
LUIS de FLOREZ
BY
Wm. L. Donaldson
ATTORNEY

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FIG.6.

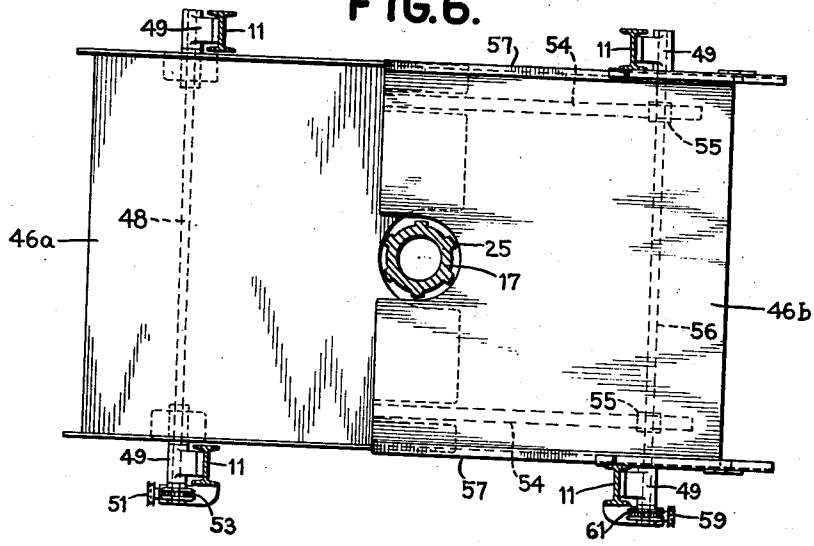


FIG.7.

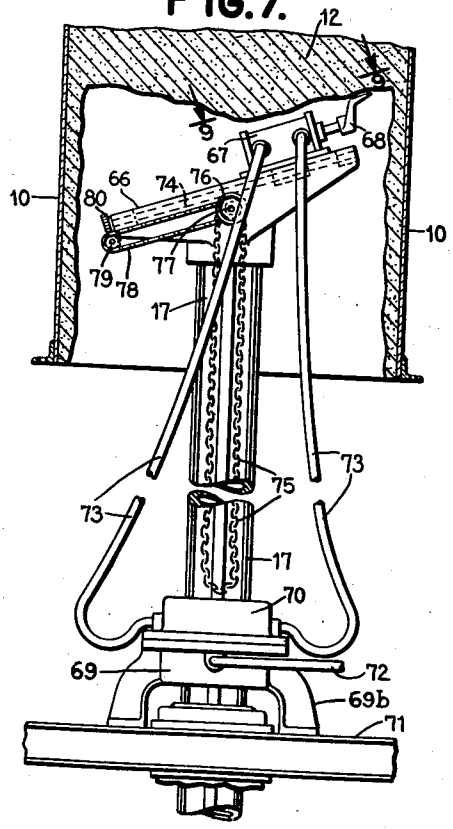


FIG.8.

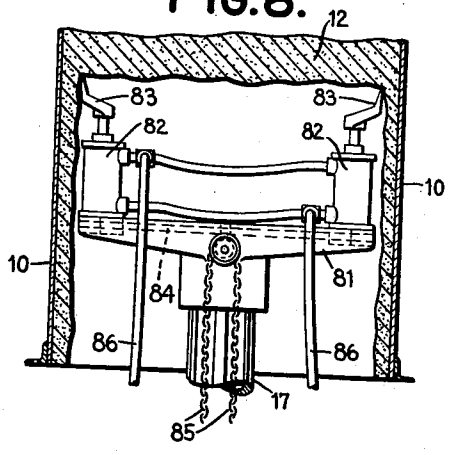
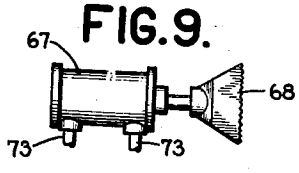


FIG.9.



INVENTOR
LUIS de FLOREZ
BY
Wm I Donaldson
ATTORNEY

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UNITED STATES PATENT OFFICE

2,248,903

REMOVING COKE FROM COKE STILLS

Luis de Florez, Pomfret, Conn., assignor to De Florez Engineering Co., Inc., Hartford, Conn., a corporation of Connecticut

Application July 22, 1938, Serial No. 220,714

2 Claims. (Cl. 83—6)

This invention relates to certain new and useful improvements in effecting the removal of coke from cracking or coking stills.

A primary object of the invention is to provide for expeditiously and efficiently removing coke formed in stills or reaction chambers wherein hydrocarbon or petroleum oils are reduced to coke.

The invention contemplates the application to the mass in the coking drum, under an applied hydraulic pressure, of a plurality of power-actuated coke cutting or boring elements. In accordance with the invention a rotary hydraulic pressure plunger carries a plurality of cutting or boring elements provided with actuating means in addition to, and separate from, the rotary plunger. Thus the invention contemplates the provision of a rotary hydraulic pressure plunger provided with a head carrying one or more cutting or boring elements each of which is provided with separate power-operated actuating means.

In a preferred embodiment of the invention, the rotary hydraulic pressure plunger carries a cutting or drilling head provided with chain-driven cutting elements which, due to the rotation of the plunger, operate to produce an annular bore in the coke mass. The invention further contemplates the provision of such cutting head with additional boring, reaming or cutting mechanism adapted to break up the coke mass within the annular bore simultaneously with the operation of the chain cutters.

For the purpose of more fully disclosing the invention, reference will now be had to the accompanying drawings wherein:

Figure 1 is an elevation, partially in section, of apparatus constructed in accordance with the invention and constituting an embodiment thereof with certain operative elements of the mechanism in disengagement.

Figure 2 is a similar elevation partially in section showing the apparatus as applied in the coke removing operation.

Figure 3 is an enlarged partial view of the upper portion of the apparatus of Figure 2 showing the coke cutting head.

Figure 4 is a horizontal cross-section taken on the line 4—4 of Figure 3.

Figure 5 is a vertical cross-section taken on the line 5—5 of Figure 3.

Figure 6 is a horizontal cross-section taken on the line 6—6 of Figure 2.

Figure 7 is a view of a modified form of cutting head.

Figure 8 is a view of another modification of the cutting head.

Figure 9 is an enlarged view of the cutting tool and the cylinder for operating it taken on line 9—9 at Figure 7.

Referring to the drawings, and particularly to Figure 1, a coking drum 10 is supported on a framework 11 and is adapted for accomplishing the coking of hydrocarbon oils into a solid residue or coke mass 12. The coking drum is provided with a manway, preferably of relatively large diameter, to accommodate the entrance of the coke removal apparatus. As illustrated, the coke drum is provided with a bottom manway cover 13 which is of the same diameter as that of the coking drum. A manway cover carriage 14, riding on tracks 15, supported by the framework 11, is provided so that when the cover is removed from the drum it may readily be shifted from beneath the drum so that the coke removal apparatus may be positioned and applied to the coke mass in the drum.

A well or hydraulic casing 16 is provided for applying hydraulic pressure to a plunger 17. The hydraulic casing is equipped with a stuffing box 18. The plunger 17 is rotated by means of a turntable 19 formed with bevel gear 20 meshing with pinion 21 mounted on shaft 22 suitably geared to a motor 23 and provided with a clutch 24. The plunger 17 is formed with a plurality of splines 25 for engagement with the hub 26 of the turntable 19 so that a rotary movement may be imparted to the plunger 17 while permitting longitudinal movement of the plunger through the turntable 19. A bearing framework 27 supports a bearing 28 secured by a threaded collar 29.

The drill head or cutting head assembly carried by the plunger 17 includes a tubular member 30 (Fig. 2 and Fig. 3), interiorly formed for engagement with the splines 25 of the plunger 17, to provide for rotary movement of the cutting head. The tubular member 30 supports a motor housing 31 in which are mounted motors 32. The housing 31 is provided for keeping the powdered coke away from the motor mechanisms. The motors may be supplied with electric energy by means of a commutator (not shown) which may be suitably mounted on the tubular member 30. Each motor has a shaft 33 carrying a worm gear 34 (Fig. 5) meshing with worm wheel 35 mounted on a shaft 36 which extends through bearing supports 37 in the frame of the motor housing 31 and is also supported in a bearing 38 in a bearing bracket 39 secured to the base or frame 40 of the cutting head which is suitably

mounted on the motor housing frame 37a. The outer end of each shaft 36 carries a drive sprocket 41 adapted to operate a sprocket chain 42 riding on idler sprocket 41a and mounted on a bar or frame 43 carried on the cutter frame 40. The cutter bar 43 is conveniently disposed in a plane approximately parallel to the axis of the plunger 17. The endless chain 42 carries a plurality of knives or cutting elements 44. The cutting head assembly includes a reamer or boring element 45 of general pyramidal configuration and preferably disposed in a central portion of the cutting head. As the plunger 17 is rotated, the cutting head, including the cutter bars 43 and the central boring element 45, is applied under hydraulic pressure to the coke mass and the chain cutting elements 44, being operated by the motors independently of the movement of the plunger 17, cut into the coke mass and due to the rotation of the plunger 17, produce an annular bore therein. Simultaneously the reamer 45 operates to produce a central bore in the coke mass and, due to the annular bore being made in the coke mass, operates to cause a breaking of the intervening coke so that as the cutter head moves upwardly, the coke is effectually broken up and the lumps of coke drop through openings in the cutting head frame and out of the coking chamber. By forming the element 45 of a plurality of triangularly shaped vanes intersecting in the axis, as illustrated, the upward thrust movement of the plunger, as well as the rotary movement thereof, is utilized very effectively to break up the coke mass intervening within the annular bore.

In practice it is desirable to provide a manway for the coke drum having a diameter approximating the diameter of the drum and to dispose the cutter bars 43 for operation along the side wall of the coke drum or closely adjacent thereto so that the cutting head will operate to remove substantially the entire mass of coke as it progresses upwardly within the coking drum.

A chute 46 is provided for directing the coke into a car 47. The chute is formed of two sections, 46a and 46b. The one section 46a is pivotally mounted on a shaft 48 journalled in bearing brackets 49 secured to the frame 11. The shaft 48 is conveniently rotated by hand by means of a chain 50 and flanged sprocket 51 which operates worm 52 meshing with worm gear 53 carried on the rotatable shaft 48. The other section 46b of the chute is provided with gear racks 54 meshing with rotatable pinion gears 55 mounted on a shaft 56. Guide members 57 suitably secured to the frame 11 are provided for guiding the section 46b of the chute. The shaft 56 is conveniently hand-operated by means of a chain 58 and flanged sprocket 59 which operates worm pinion 60 which meshes with a worm gear 61 on the shaft 56. Thus by means of the hand-operated chains 50 and 58 the chute may readily be moved to and from the operating position, the section 46a being swung on its pivotal mounting outwardly from the frame 11 and the section 46b being moved outwardly from the frame, to provide clearance when necessary for mechanism underneath the coke drum, and being moved into position for receiving the coke when the drill head is applied to the coke mass in operating position. The center portion of chutes 46a and 46b overlap and have been cut away to clear the plunger 17.

A movable carriage 62 riding on the rails 15 supported by the frame 11 is provided for the drill head. The carriage is formed with a depending frame 64 carrying a socket member 65 adapted to receive the tubular member 30 and to thus support the drill head.

In operation, at the completion of a coking run in the coking still 10, the manway cover 13 is removed from the still and lowered onto the carriage 14 and the carriage is moved on the track 15 from under the still to a distant position. The drill head carried on the carriage 62 is then positioned in alignment with the still 10. The valve on the hydraulic system is opened to actuate the plunger 17 which is moved upwardly and engages with the socket member 30 of the drill head assembly. When the drill head reaches the bottom of the coke mass 12 the upward movement of the plunger 17 may be stopped and the chutes 46a and 46b are positioned as shown in Figure 2. The clutch 24 is then engaged to rotate the plunger 17. The hydraulic pressure is applied to impart an upward thrust to the plunger and the motors 33 are started to operate the cutting elements 44.

After the coke has been removed from the still, the clutch 24 is disengaged and the motors 33 are stopped. The chutes 46a and 46b are moved into the position shown in Figure 1. The hydraulic pressure is released to permit the plunger 17 and drill head to descend, the member 30 seating itself in the socket 65 in the frame of the drill head carriage 62 and the plunger descending to the position shown in Figure 1. The drill head is then moved away by the carriage 62 and the manway cover 13 is moved into position under the still 10 and secured to the still ready for the next run.

Referring now to Figure 7, the modified cutting elements illustrated therein are adapted to be operated by fluid pressure, such as air or steam. The plunger 17 carries an inclined platform 66 on which is mounted a steam cylinder 67 adapted to actuate a cutting element 68. A steam valve for controlling the admission of steam to the cylinder 67 includes a stationary chamber 69 and a rotating chamber 70. The stationary chamber 69 is supported by a bracket 69b fixed to a cross-bar 71 which may be suitably secured to the frame 11. Steam under pressure is admitted through pipe 72 to the stationary chamber 69. The rotating chamber is carried by the splined plunger 17 and rotates therewith. Flexible hose connections 73 establish communication with the cylinder 67 for operating the piston therein. The steam cylinder 67 rides a screw-threaded shaft 74 supported on the table 66 so that the cutting element may be moved back and forth transversely of the table 66. For operating the screw-threaded shaft 74 by hand a sprocket chain 75 and flanged sprocket 76 are provided. The sprocket 76 is mounted on a shaft 77 which is provided with a chain drive 78 for operating a shaft 79 having a worm pinion (not shown) in mesh with a worm gear 80 mounted on the shaft 74. As shown in Figure 9 the cutting element 68 may be formed with a knife-like serrated edge. With the hydraulic pressure applied to the rotating shaft 17, the reciprocating cutting element 68 operated by the steam cylinder 67 serves to break and chip the coke. By moving the cylinder 67 by means of the threaded screw 74, the position of the chipping element 68 may readily be shifted as desired.

The apparatus shown in Figure 8 constitutes a modification of that shown in Figure 7. The plunger 17 carries a horizontal table 81 support-

ing a pair of cylinders 82 for operating cutting elements 83. The cylinders 82 are mounted on the table 81 on a right and left hand screw shaft 84 which may be operated by a sprocket chain 85 in a manner similar to that described for the apparatus of Figure 7. Flexible hose connections 86 which lead to a suitable valve similar to that described for the apparatus of Figure 7 serve to apply steam pressure to the pistons contained in cylinders 82.

In one modification of the invention, instead of movably mounting the actuating cylinders for the cutting elements, as in Figures 7 and 8, the actuating cylinders may have a stationary mounting on the rotating table carried by the hydraulic rotary plunger 17. It is advantageous for example, to provide the rotating table, such as table 81 of Figure 8, with a plurality of actuating cylinders disposed at selected points on the rotating table.

In a further modification of the invention the reaming or boring element 45, as shown in Figures 1, 2 and 3, may be omitted and one or more independently actuated cutting or boring elements may be substituted therefor. Thus while the chain-operated cutting elements 42 function to form an annular bore in the coke mass, one or more cutting or boring elements, actuated by air or steam independently of the plunger 17, serve to break up the intervening coke mass.

The invention is highly advantageous when applied to a plurality of coking drums. Thus a plurality of coke drums may be suitably mounted on supporting structure similar to the framework 11 illustrated herein and beneath each drum a hydraulic casing 16 and rotatable shaft 17 is provided. By means of the tracks 15 the drill head may readily be moved for operation to the drum desired and thus while coking may be carried on in certain of the drums, one or more of the drums may be opened for coke removal and the coke removing operation carried on as has been described herein. Thus in continuous combination cracking and coking processes, coking may be continuously carried on by carrying on coking in one or more drums while in other or others the coke removing operations may be conducted.

From the preceding description it will be seen that the invention contemplates the rapid breaking up of the coke mass in the drum by means of the combination of the simultaneously applied forces of the upward thrust of the hydraulic plunger, the rotating movement of the plunger and the individual movements of the several cutting elements carried by the plunger. By having one or more of the cutting elements mounted out of axial alignment with the plunger 17, the rotation of the plunger operates to move such elements in a circulatory path over the surface of the coke mass and by reason of the additional individual movements of the cutting elements the coke mass is rapidly broken up.

Although the preferred embodiment of the invention has been set forth in connection with apparatus having a particular construction and arrangement of parts and mode of operation, it will be seen that various changes and modifications may be made therein, while securing to a greater or less extent some or all of the benefits of the invention, without departing from the spirit and scope thereof.

I claim:

1. In combination with a coking drum having a bottom manway cover, a frame support for said drum, a track mounted on said support, a carriage adapted to travel on said track and adapted to receive the manway cover, a cutting head assembly provided with cutting elements, a second carriage adapted to ride on said track and adapted to receive said cutting head assembly, a plunger adapted to operatively engage said cutting head assembly, a casing adapted to supply hydraulic pressure to said plunger and means for rotating said plunger.

2. In combination with a coking drum, a frame support for said drum, a track mounted on said support, a cutting head assembly provided with cutting elements, a carriage adapted to ride on said track and to receive the cutting head assembly, a plunger adapted to operatively engage said cutting head assembly, a casing adapted to supply hydraulic pressure to said plunger, a chute mounted on said frame and adapted for movement to be positioned beneath said drum to receive the cuttings produced by the cutting mechanism and to be moved away from such position.

LUIS DE FLOREZ.