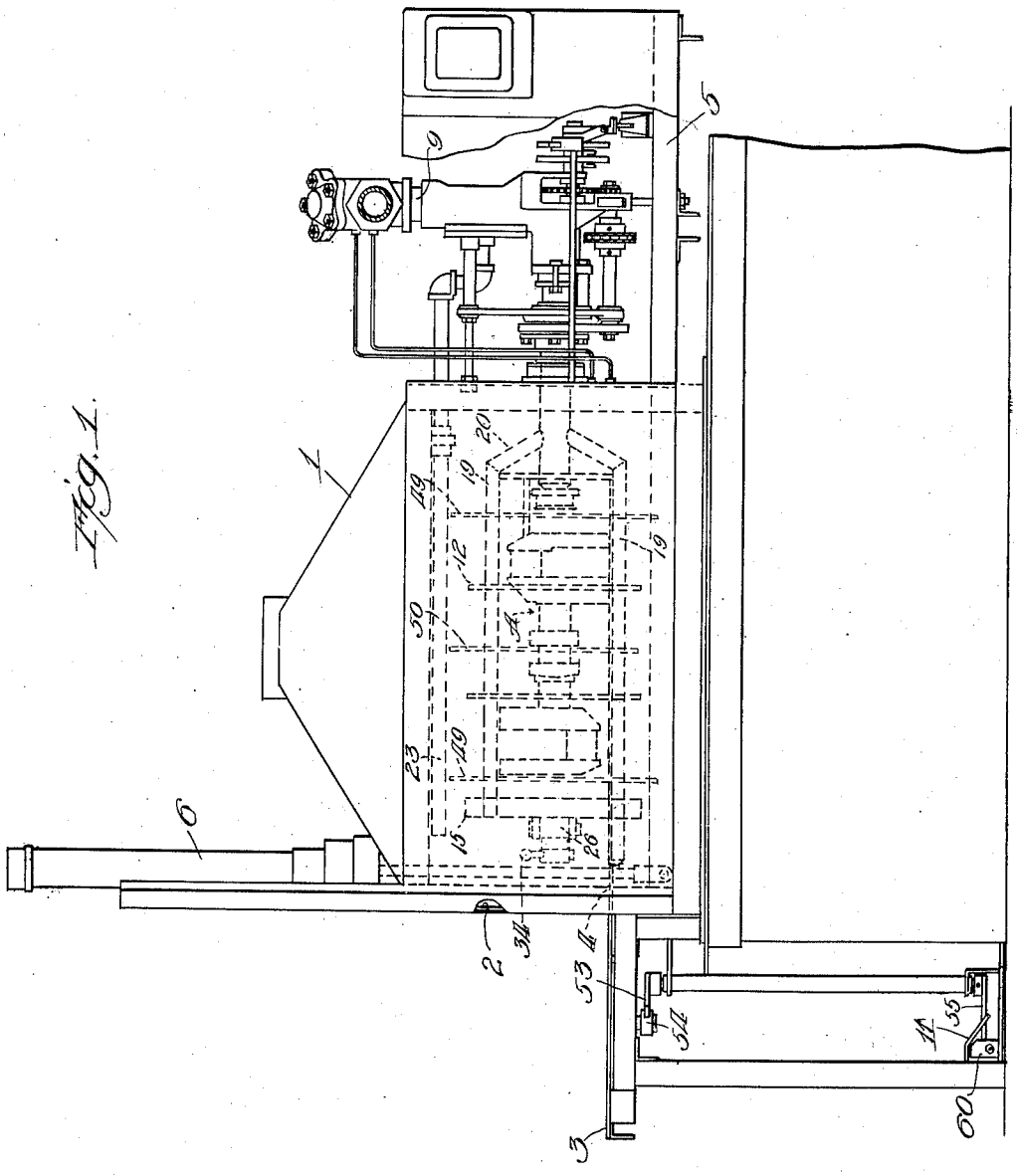
April 22, 1941. F. C. AREY ET AL 2,239,073

APPARATUS FOR CLEANING CRANKSHAFTS

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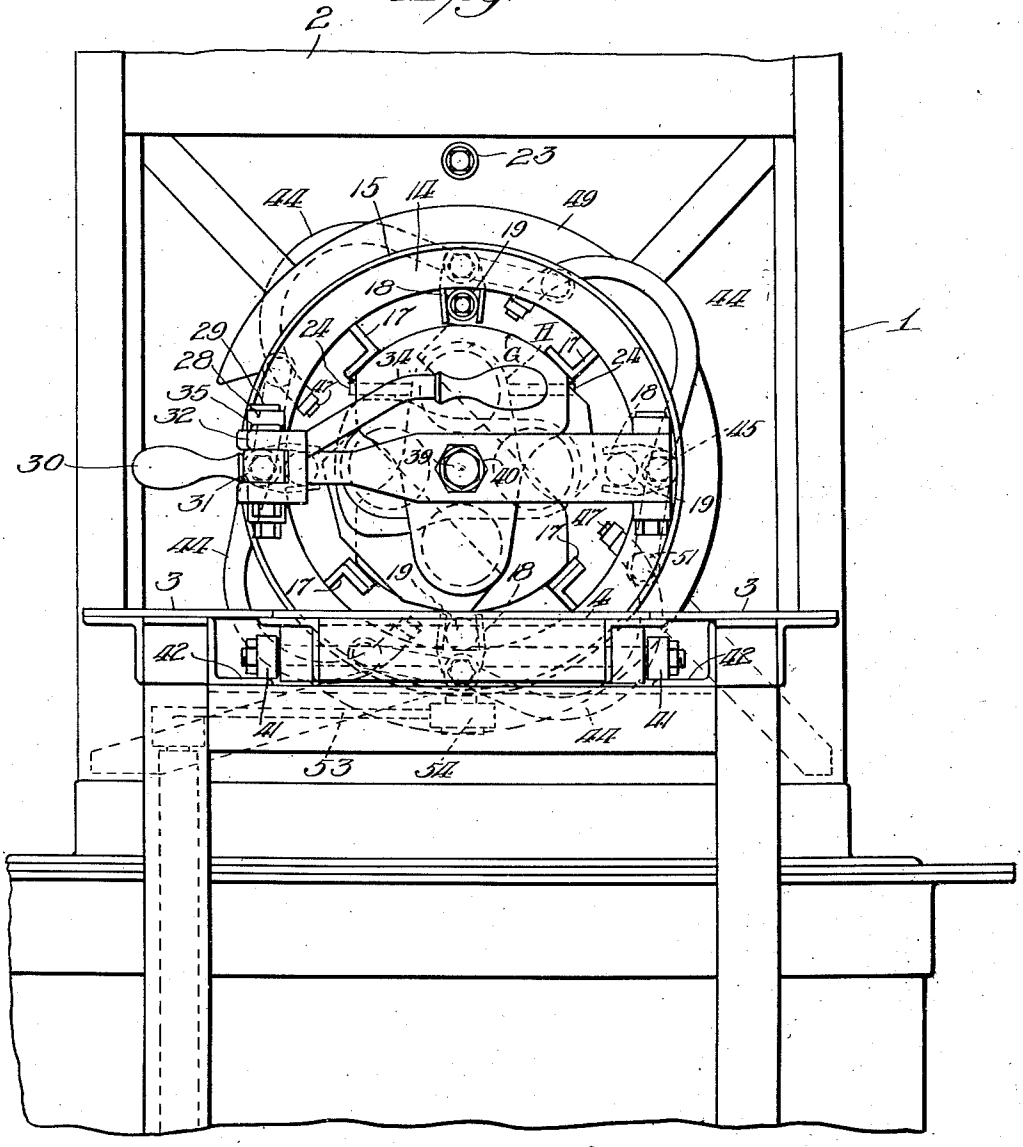
Inventors
F. C. Arey et al
by Wm. F. Frendenreich, Atty.

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APPARATUS FOR CLEANING CRANKSHAFTS

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Fig. 2



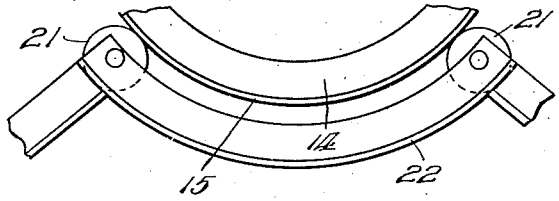


Fig. 3.

Inventors
F. C. Arey et al
W. E. Flipper,
By Wm. F. Frendenreich
Atty.

April 22, 1941. F. C. AREY ET AL 2,239,073

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Fig. 5.

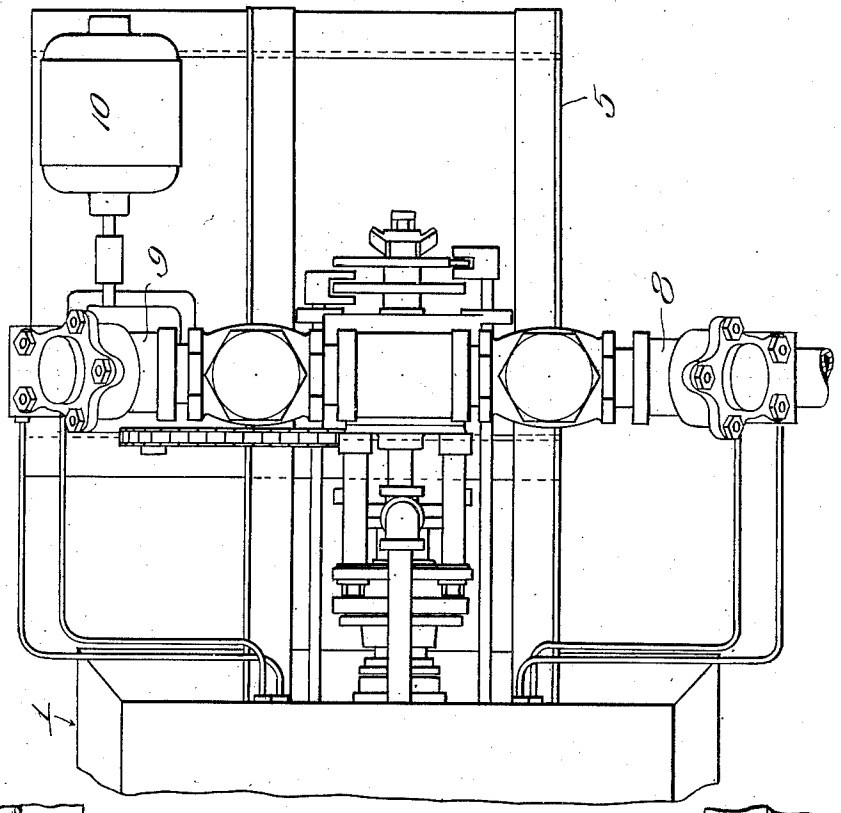
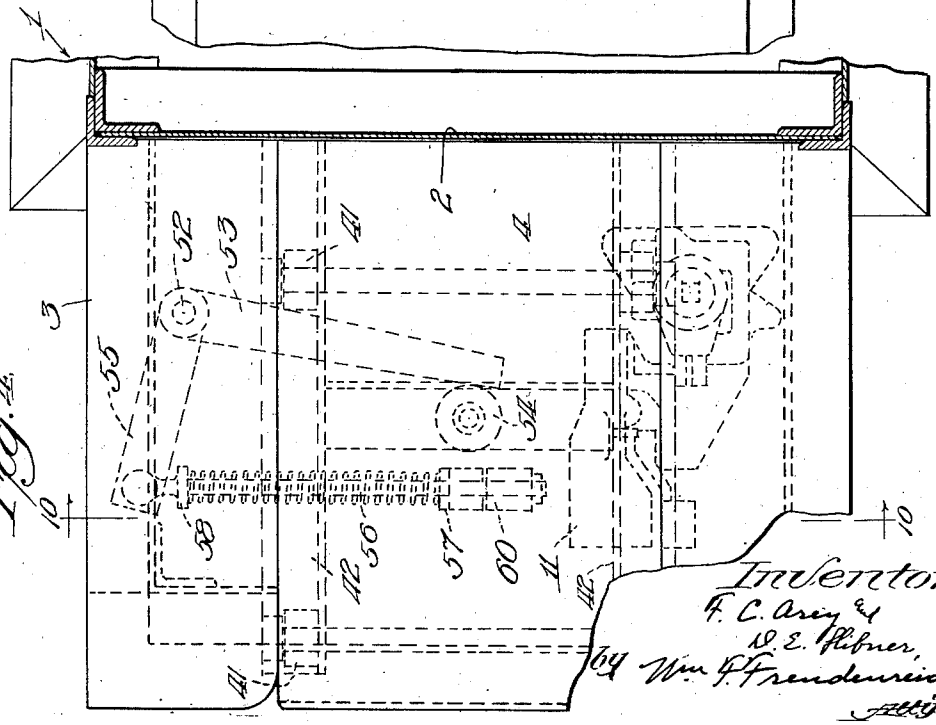


Fig. 4.



Inventors
F. C. Arey et al
W. E. Pfibner,
by Wm. F. Frendenreich
Atty.

April 22, 1941. F. C. AREY ET AL 2,239,073

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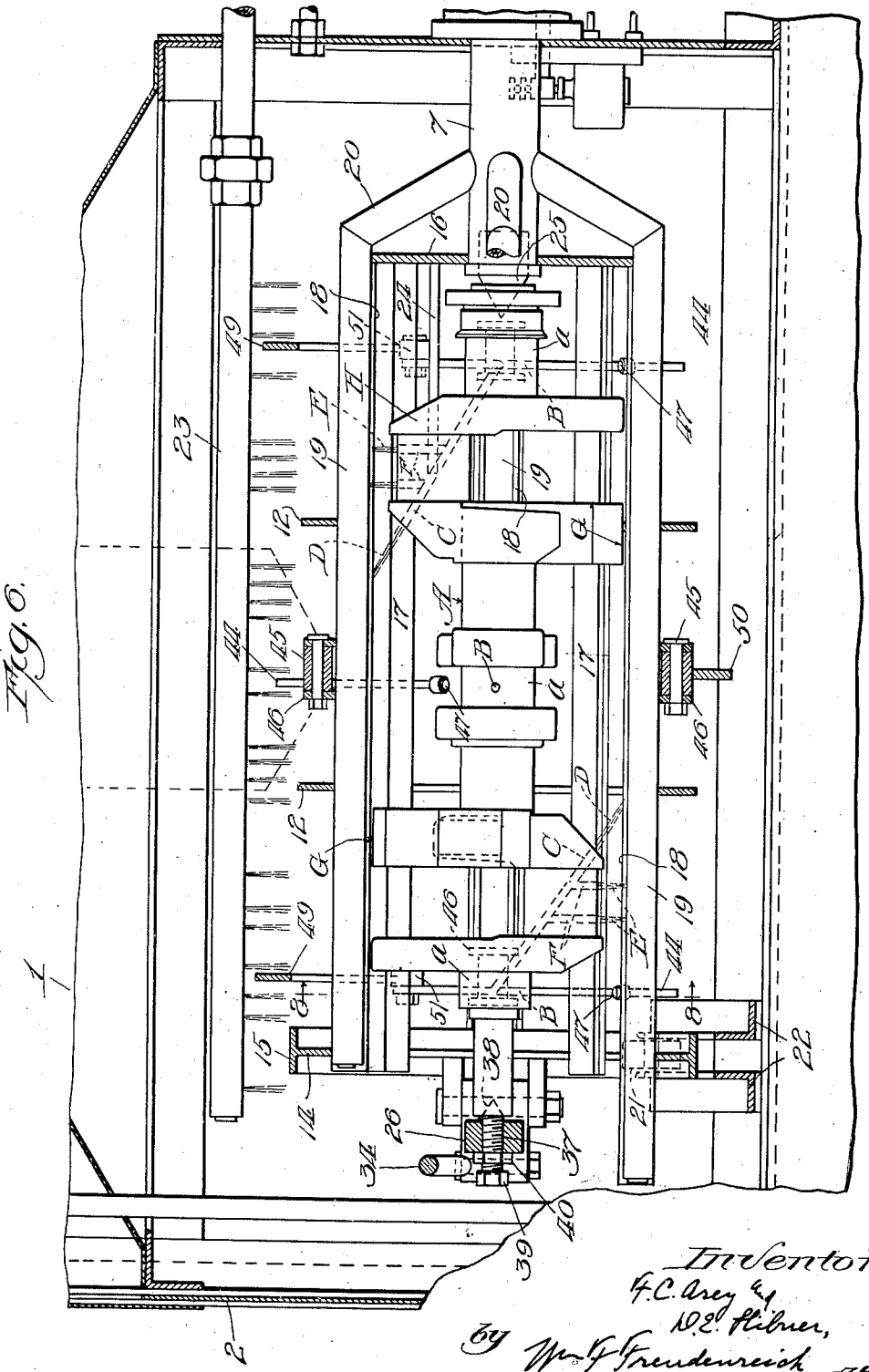


Fig. 6.

Inventors
F. C. Arey et al
by Wm. F. Freudenreich, Atty.

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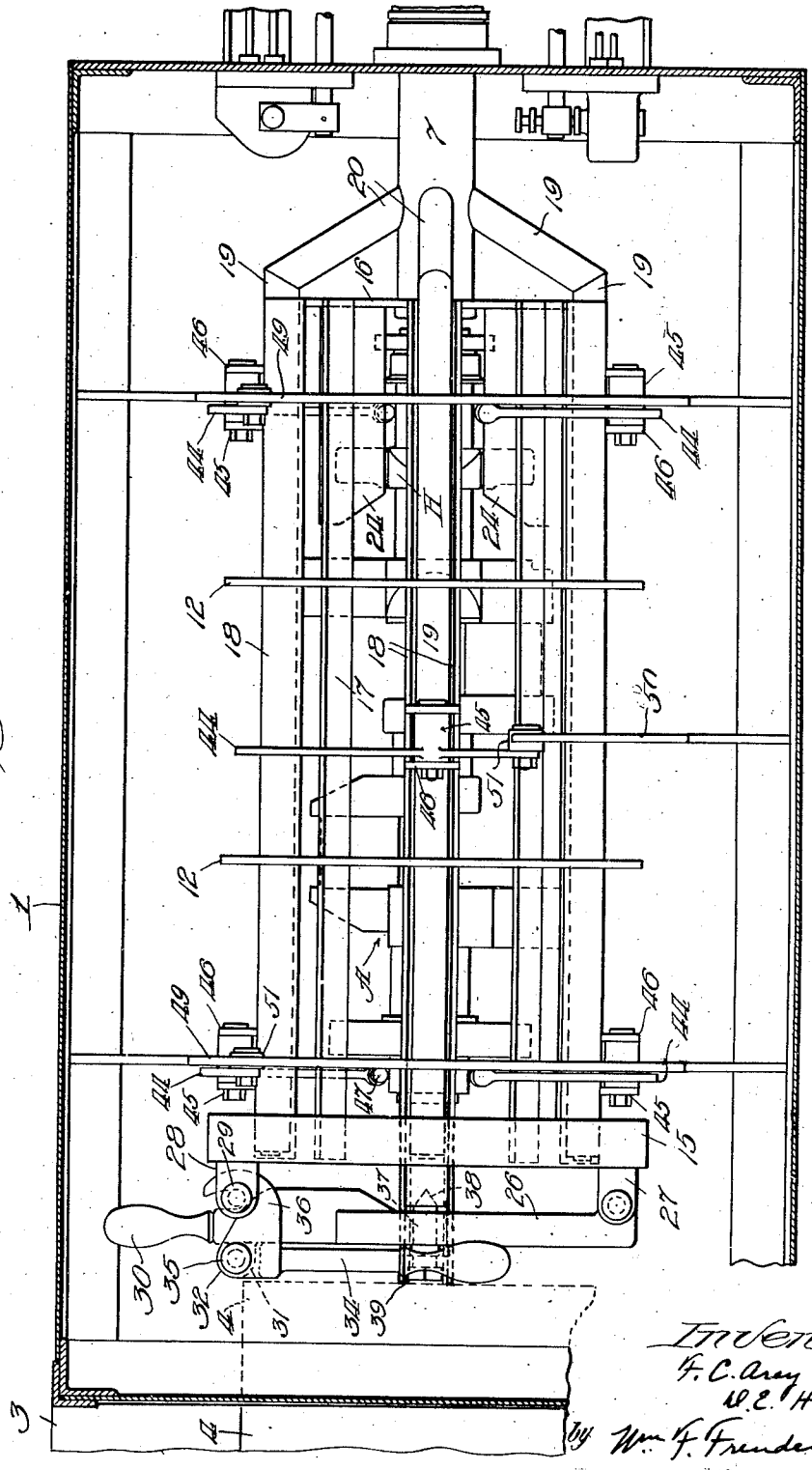


Fig. 7.

Inventors
F. C. Arey et al
W. E. Hiber,
By Wm. F. Frendenreich,
Atty.

April 22, 1941. F. C. AREY ET AL 2,239,073

APPARATUS FOR CLEANING CRANKSHAFTS

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Fig. 9.

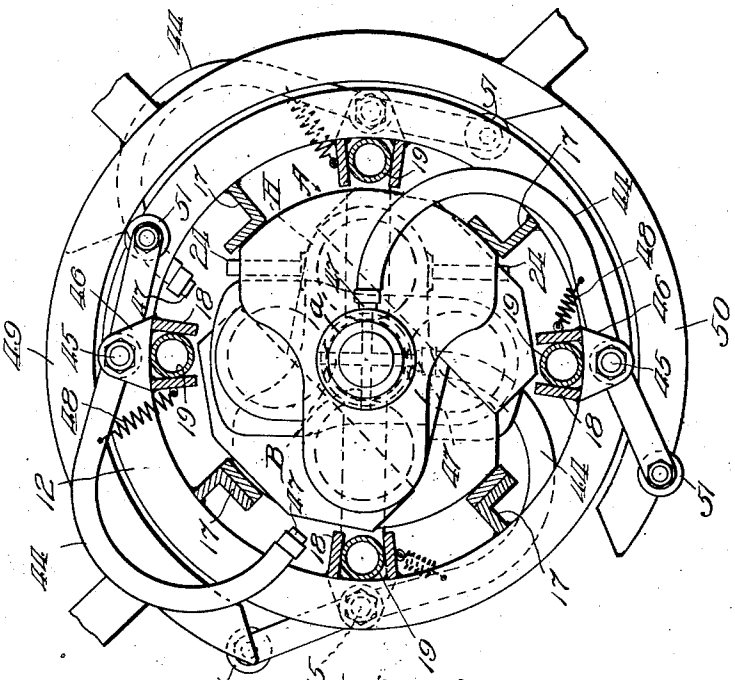
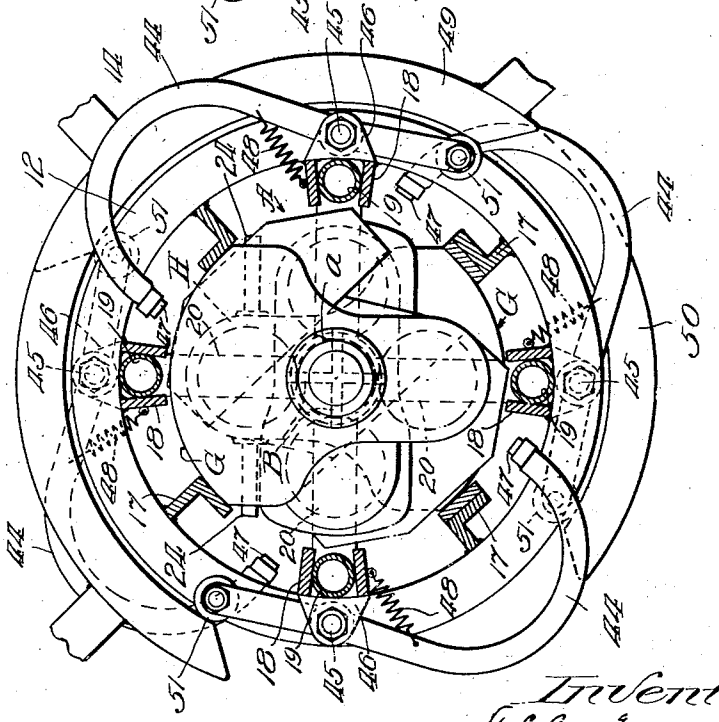


Fig. 8.



Inventors
F. C. Arey et al
W. F. Hübner,
By Wm. F. Freudenreich, Atty.

April 22, 1941. F. C. AREY ET AL 2,239,073

APPARATUS FOR CLEANING CRANKSHAFTS

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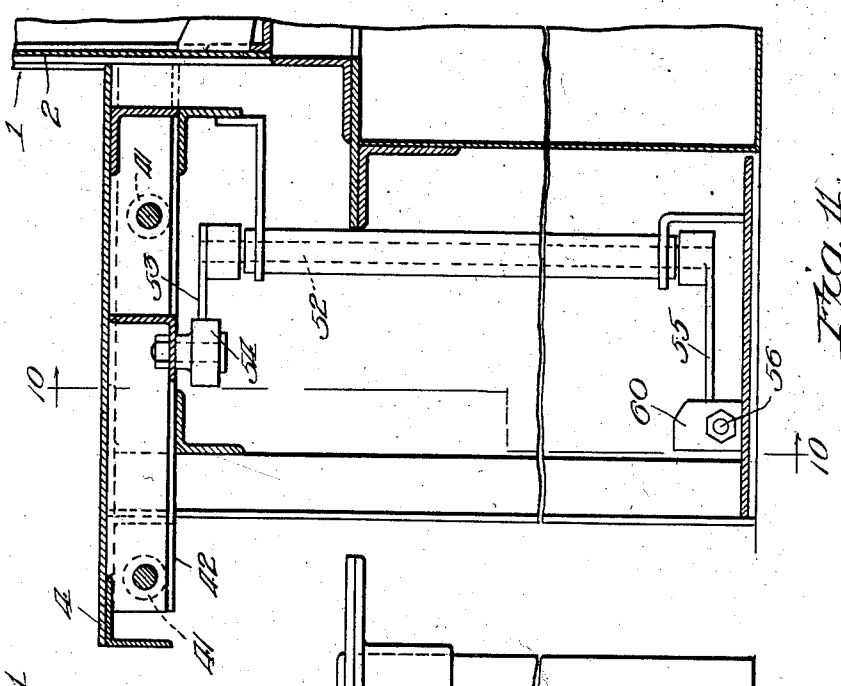


Fig. 11.

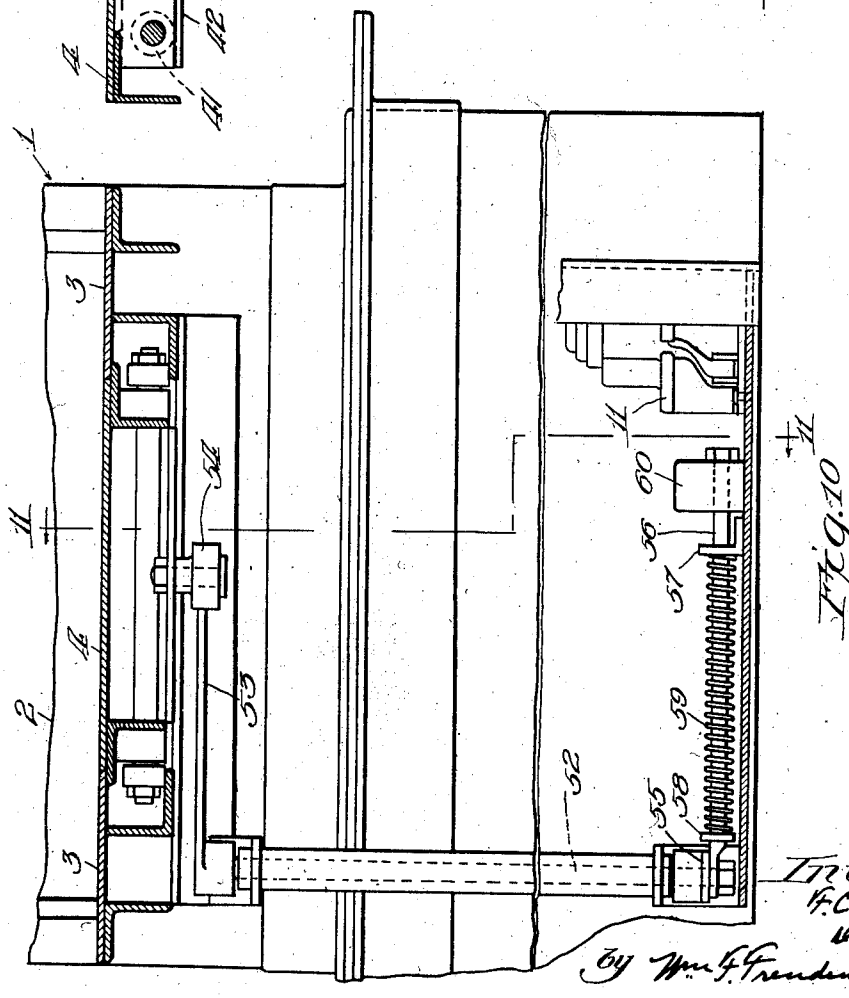


Fig. 11A.

Inventors
F. C. Arey et al
W. E. Hibner,
By Wm. F. Trendenreich, Atty.

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UNITED STATES PATENT OFFICE

2,239,073

APPARATUS FOR CLEANING CRANKSHAFTS

Fred C. Arey, Freeport, and De Los E. Hibner, Du Bois, Pa., assignors to Vulcan Soot Blower Corporation, a corporation of Pennsylvania

Application August 21, 1939, Serial No. 291,128

7 Claims. (Cl. 141—1)

In the prior application of Fred C. Arey, filed January 17, 1938, Serial No. 185,292, there is illustrated an apparatus for removing from cylinder heads for internal combustion engines the oil and chips remaining thereon after the machining operations. The present invention has for its object to modify the apparatus of the aforesaid application in such a manner as to permit the cleaning of crankshafts.

As in the aforesaid application, the present apparatus includes a cage in which the work is held and rotated while being subjected to the action of jets of cleaning fluids in a manner to accomplish the intended results. One of the objects of the present invention is to produce a novel form of cage, together with means for controlling the flow of fluids entering oil passages after jets of fluid have entered the latter.

The present apparatus also includes a receiving platform or table just outside of the doorway through which the work is introduced into the housing that contains the supporting cage. A further object of the present invention is to provide a novel form of receiving platform or table to facilitate the entry of the more or less unwieldy crank shafts into the cage.

The various features of novelty whereby our invention is characterized will hereinafter be pointed out with particularity in the claims; but, for a full understanding of our invention and of its objects and advantages, reference may be had to the following detailed description taken in connection with the accompanying drawings, wherein:

Figure 1 is a side elevation of an apparatus embodying the present invention; Fig. 2 is an elevational view showing, on a larger scale, a portion of the front end of the apparatus, with the door of the housing open; Fig. 3 is a detail view showing the roller support for the front end of the work-supporting cage; Fig. 4 is a top plan view, on the same scale as Fig. 2, of the receiving table, a fragment of the front end of the housing being shown in section; Fig. 5 is a top plan view of the rear portion of the apparatus, showing the rear end of the housing and the parts behind the latter; Fig. 6 is a vertical longitudinal section through the housing, the work-supporting cage being shown partly in section, and a crank shaft being shown in elevation within the cage; Fig. 7 is a horizontal section through the housing, the cage and its contents being shown in plan, and the receiving table being shown in dotted lines as pushed into the housing; Fig. 8 is a section taken on line 8—8 of Fig. 6, showing the cage in a work-receiving position; Fig. 9 is a view similar to Fig. 8, showing the cage turned through an angle of 270° in the counter-clockwise direction from the position illustrated in Fig. 8; Fig. 10 is a section taken on line 10—10 of either Fig. 4 or Fig. 11; and Fig. 11 is a section on line 11—11 of Fig. 10.

Referring to the drawings, 1 represents a housing having at the front end a vertically slidable door 2 through which the work is inserted and removed. In front of the housing is a horizontal platform 3 having a central section 4, which will be referred to as the receiving table, which is movable back and forth into and out of the door opening. In rear of the casing is a second platform 5 on which are supported the operating motor and the controlling mechanism. The door is intended to be raised and lowered by means of a piston in a vertical cylinder 6 mounted on top of the casing; the entire operating and controlling mechanism being, therefore, electro-pneumatic, as in the aforesaid application. Within the housing, above the level of the receiving table, is a long horizontal cage open at the front end; the cage being supported at its rear end upon a tubular shaft or journal 7 extending through the rear wall of the housing. This shaft is supplied alternately with a cleaning liquid, which may be soda water, kerosene, or other suitable cleaning liquid, and with air under pressure; these two fluids being supplied through large pipes or mains 8 and 9 arranged above the rear platform 5. The shaft 7 is adapted to be driven by a suitable motor 10, mounted on the rear platform; the motor simultaneously driving suitable control mechanism to operate the valves in the supply pipes or mains 8 and 9. As in the aforesaid application, a cycle of operations is started by the operation of a valve below the receiving table; the valve being provided with a pedal 11 that is pressed down by the workman's foot.

The cage comprises a number of vertical ring-like members 12 and 14, lying in planes at right angles to the axis of the shaft 7, extended, and distributed along this axis; the forward ring being provided with a wide rim 15. Fixed to the forward end of the short shaft or journal 7 is a disk 16 parallel to the rings. A number of rigid longitudinal members, conveniently pieces of structural steel, extend from this disk through the rings, being fixed to both the disk and the rings so as to tie the whole into a rigid, cage-like structure.

dinal members depends upon the character of the crankshaft to be washed. In the arrangement shown, the crankshaft is provided with four cranks and, therefore, the longitudinal members are arranged in one or more groups of four; there being four angle irons 17 spaced 90° apart and, alternating with the angle irons, pairs of flat bars 18, 18 arranged on edge in radial planes. The bars 18 of each pair are equally spaced with respect to the angle irons between which they lie, and the spacing between the bars of each pair is just sufficient to permit a jetting pipe 19 to be placed between them. Thus there are four of these jetting pipes spaced 90° apart, as are the four cranks on the crank shaft A. Each of the pipes 19 extends throughout the length of the cage and, at its rear end, is connected with a more or less radial pipe section 20 fixed to the tubular shaft or journal 7 so as to receive cleaning fluid from the latter.

Each of the jetting pipes is so designed as to deliver jets of cleaning fluid into the various drilled holes in one of the crank units. In the arrangement shown, the crankshaft has three main bearings *a*, each provided with an oil passage B extending diametrically through the same. As best shown in Fig. 6, there is a passage C extending diagonally through the arms and crank pin of a crank unit adjacent to each of the main bearings and intercepting the oil passage B in that bearing. The jetting pipes are so designed that during a jetting operation there is a jet D of cleaning fluid discharged into each of the passages C, the fluid finally reaching the oil passage B and being adapted to escape from either end of the latter. Other jets E may be discharged into radial passages F in the crank pins; the inner ends of the passages F communicating with the corresponding passage C.

There is located above the cage, within the housing, a fifth jetting pipe 23 which is fixed in a position parallel to the other jetting pipes and is adapted to discharge cleaning fluid down upon the crankshaft as a whole.

The front end of the cage may conveniently be supported by means of a pair of rollers 21 mounted on the ends of a fixed support 22 so as to underlie the rim 15 of the forward ring 14, as best shown in Figs. 3 and 6.

The particular crankshaft for which the cage is designed is such that two of the crank units have peripheral edges which, together, form oppositely-disposed sections of the surface of a cylinder whose axis coincides with that of the cage; the radius of this cylinder corresponding to the radial distance between the axis of the cage and the near flanges of the angle irons 17. Therefore, these angle irons serve as supporting guides for a crankshaft moving into and out of the open end of the cage in such angular position that each of its arc-shaped peripheral surfaces G spans the distance between a pair of the angle irons. As best shown in Figs. 2, 6 and 7, there are two sturdy guide plates 24, 24 fixed to the disk 16 and projecting forwardly just below one of the pairs of angle irons 17 that is spanned by one of the arc-shaped edges G. The members 24 are spaced far enough apart so that one of the endmost crank arms, indicated at H, is a sliding fit between the same; this being one of the arms of a crank unit provided with the segmental edge G, so that whenever the crank is properly positioned, angularly, to be slid into the cage, the crank arm H moves into the space between the members 24, 24 as the advance end of the crankshaft approaches the rear end of the cage, and holds the shaft against turning movement relatively to the cage when the cage is rotated.

The hollow journal member 7 has at its forward end, just in front of the disk 16, a conical point or center 25 adapted to enter the usual center hole in the corresponding end of the crankshaft. The forward end of the crankshaft, when in the cage, is centered, and the crankshaft is prevented from moving lengthwise, by means of a suitable gate, carrying a centering point or element to engage with the usual center hole in the front end of the crankshaft. As best shown in Figs. 2, 6 and 7, this gate device comprises a sturdy lever 26 hinged at one end to an ear 27 fixed to and extending forwardly from the ring 14 and extending diametrically across the cage to the opposite side where there are another pair of ears 26 between which extends and to which is fixed a pin 29. The free end of the lever terminates in a handle 30 by means of which the lever may be operated. Close to this handle on the lever 26 is a forward projection 31 which is embraced in a jaw 32 on the end of a latching lever 34; the latching lever being secured to the lever 26 by a pin 35. A hook 36 is formed as a rearward projection on the jaw 32. The point or center which engages the front end of the crankshaft is in the form of a screw 37 extending through the lever 26 and having on the rear side of the lever a conical end 38. The screw has on its outer end a head 39 by means of which it may be turned, and is also provided, underneath the head, with a lock nut 40, adapted to be screwed tightly against the lever 26 and hold the point or center against turning after it has been properly adjusted.

The parts are so proportioned that after a crankshaft has been placed in the cage, with the gate swung back out of the way, the handle 30 may be grasped and the gate unit swung into working position, with the centering screw 37 engaged with the crankshaft. Then, the latching lever 34, which has been standing in such a position that the hook does not interfere with the swinging of the lever 26 until its movement is stopped by the crankshaft, is swung into parallelism with the lever 26, as indicated in Fig. 7; the hook 36 engaging behind the stationary pin 29 during such swinging movement of the latching lever, and holding the lever 26 in its working position until it is again unlatched.

A crankshaft to be washed is received on the front platform, either with its axis parallel to the axis of the cage, or requiring it to be turned so that it will lie on the receiving table 4 in that position. The housing door being raised, and the gate at the front end of the cage being swung back out of the way, the table may then be pushed rearwardly; the table being provided with rollers 41 resting on parallel, longitudinal tracks or rails 42 fixed on the stationary framework of the apparatus. By providing the cage with what may be termed a loading and unloading position, and placing the table at such an elevation that a crankshaft may be slid from the same upon supporting surfaces within the cage at the same level as the table; the moving of the table into the housing and against the end of the cage, while the latter occupies said position, prevents any part of the crankshaft from striking the ends of the supports in the cage. In Fig. 8 the cage is shown in its loading or unloading position, one of the pairs of longitudinal bars 18 being at the bottom, directly below the axis of the crankshaft, while two of the angle irons 17 lie

on opposite sides thereof and in work-receiving position. It will be seen that the lower of the two curved edges G, in Fig. 8, touches or practically touches the underlying bars 18. This pair of bars, as shown in Figs. 6 and 7, extend forwardly a considerable distance beyond the front end of the cage proper and serve as the actual stop for the inward movement of the receiving table, thereby making it unnecessary to push the receiving table very far into the housing. As shown in Fig. 2, where the cage is in its loading and unloading position, the pair of bars 18 which are now at the bottom of the cage, lie wholly below the plane of the top of the receiving table, so that when the first cylindrical edge section G of the crankshaft leaves the table, the crankshaft begins to ride on the underlying bars 18.

As heretofore stated, cleaning fluids entering the passages C finally escape through the passages B drilled diametrically through the main bearing portions of the crankshaft. Since the fluids can flow out of either end of each of these latter passages, we have found it advisable to control the direction of escape so as to insure that each passage will be effectively flushed in both directions. For this purpose we have provided means for, at times, closing each end of each of the passages in the main bearings, so that liquids are compelled to leave at the other end.

In the arrangement shown, the cage is provided with three pairs of movable stopper devices, one for each main bearing. Each of these devices comprises a rocker member 44 pinned, as indicated at 45, to a suitable bracket 46 spanning and welded to a pair of longitudinal bars 18. On one end of each of these members is a stopper or plug 47 of suitable yieldable material which is adapted to engage with the corresponding main bearing over one end of the oil passage B in the latter, when free to do so. This may be accomplished by means of a spring 48 acting on the member 44 and tending constantly to swing the latter into its working position. Two of these stopper devices are disposed symmetrically with respect to each main bearing, so that each cooperates with one end of the oil passage, to close the same. In order to cause the stopper devices to be swung into inoperative or idle positions, I provide stationary segmental tracks 49 and 50 close to the planes in which the rocker members lie; each of these tracks having an angular length of about 180°. Each rocker member has on its second end a roller 51 adapted to ride along the inner edge of the track provided for the pair of stopper devices to which that rocker belongs. It is desirable that all of the oil passages in the main bearings be open at both ends when the cage is in its loading and unloading position, so as to provide maximum facilities for drainage just before a crankshaft is removed from the cage. Therefore, as shown in Fig. 8, the tracks 49 and 50 are so disposed that the rollers on all of the rocker members are in engagement with the corresponding tracks and the plugs or stoppers are, accordingly, held clear of the crankshaft. It will be seen that the roller of one stopper device of each pair has just entered upon its track while the roller of the other stopper device is just about to leave the track. Therefore, when the cage revolves, say, in the counterclockwise direction, to the position illustrated in Fig. 9, one of the stoppers of each pair remains in its inoperative position while the other drops into engagement with the corresponding main bearing and closes one end of the oil passage in the latter. This condition continues for about one-half of a revolution of the cage, whereupon the stopped device that was locked in its idle position is released and drops against the main bearing and the other stopper device is lifted away from that bearing by reason of its rocker engaging with the track.

The cage may be caused to make any desired number of revolutions during each cleaning cycle, and then come to rest in its loading and unloading position. The present invention is not concerned with the mechanisms for producing the automatic cycle, since these may be identical with those disclosed in the aforesaid application. As in the aforesaid application, the receiving table is interlocked with the master controller, and we have therefore illustrated so much of the master controller as is necessary to explain the operation of the interlock which is somewhat different from that in the previous construction. As best shown in Figs. 4, 10 and 11, there is underneath the front platform a vertical shaft 52 having at the upper end a radial arm 53 projecting laterally to the middle of the table 4. On the under side of the table is a roller 54 that lies in front of the free end of the arm 53. On the lower end of the shaft is another radial arm 55 to the free end of which is pinned or hinged a long horizontal rod 56 which extends slidably through a stationary bracket 57. Surrounding the rod between the bracket and a collar 58 on the rod is a compression spring 59. On the free end of the rod, beyond the bracket, is a block 60. The parts are so proportioned that the spring acts constantly on the shaft to hold the arm 53 against the roller on the table. The spring is preferably powerful enough to return the table to its normal position upon being released by the workman after having been pushed partly into the housing in loading. In the normal position of the table the block 60 lies at some distance from the pedal 11. However, when the table is pushed into the door opening, the block is carried underneath the front end of the pedal and prevents it from being pressed down. In this way the starting of a cleaning cycle by closing the door of the housing is prevented until the table has been moved out of the door opening and no longer constitutes an obstruction in the path of the closing door.

It will thus be seen that we have produced a simple and novel holder for the work, including effective jetting means, together with a simple and novel means for bringing a piece of work to the holder, in order to load the latter, in order to permit effective and efficient cleaning of crankshafts in an apparatus wherein, starting with the closing of the door of a housing and ending with the subsequent opening of the door, an entire cycle of cleaning operations is performed upon the introduction of a crankshaft into the holder, followed by the manipulation of a pedal or other actuator for a master controller. In the case of an engine crankshaft, aside from washing foreign matter from the external surfaces, the only other cleaning that is required is to insure clear oil passages. Therefore, by discharging jets of cleaning liquid into these passages, while rotating the crankshaft, and simultaneously spraying cleaning liquid over the exterior of the crankshaft as a whole, all chips, oil and other foreign matter may be effectively washed away; particularly when the passages that extend diametrically through the main bear-

ings are opened and closed at one end while being closed and opened at the opposite end. Changing from a liquid cleaning fluid to a gaseous fluid at a predetermined point in the cycle insures the blowing away of any particles of foreign matter that may still remain, and dries up the moisture on the crankshaft, so as to protect the crankshaft against dusting.

While we have illustrated and described with particularity only a single preferred form of our invention, we do not desire to be limited to the exact structural details thus illustrated and described; but intend to cover all forms and arrangements which come within the definitions of our invention constituting the appended claims.

We claim:

1. In combination, a housing having a door opening in one side, a cage mounted in the housing for rotation about a more or less horizontal axis passing through the door opening and having longitudinal work-supporting elements, said cage being open on the side toward the door opening to receive work entered through the latter, a receiving table outside of the housing at the door opening and at the level of said work-supporting elements when the cage is in its charging position, and means supporting the table for movement through said door opening to bring the rear end thereof close to said work-supporting elements.

2. In combination, a housing having a door opening in one side, a cage mounted in the housing for rotation about a more or less horizontal axis passing through the door opening and having longitudinal work-supporting elements, said cage being open on the side toward the door opening to receive work entered through the latter, a receiving table normally positioned outside of the housing at the door opening and at the level of said work-supporting elements when the cage is in its charging position, means supporting the table for movement through said door opening to bring the rear end thereof close to said work-supporting elements, and a spring tending constantly to return the table to its normal position.

3. In combination, a housing having a door opening in one side, a cage mounted in the housing for rotation about a more or less horizontal axis passing through the door opening and having longitudinal work-supporting elements, said cage being open on the side toward the door opening to receive work entered through the latter, means on the cage to discharge jets of cleaning fluid against a piece of work in the cage, a receiving table outside of the housing at the door opening and at the level of said work-supporting elements when the cage is in its charging position, means supporting the table for movement through said door opening to bring the rear end thereof close to said work-supporting elements, a control member to be moved by an operator for controlling the turning of the cage and the supply of fluid to the jetting means, and an element operated by said table to lock said controlling member when the table is in said door opening.

4. In an apparatus of the character described, a cage open at one end and including a group of horizontal pipes provided with jetting openings adapted to discharge cleaning fluid upon a piece of work in the cage, a hollow journal at the other end of the cage communicating with said pipes to supply cleaning fluid thereto, and means including movable work-engaging elements mounted on the cage alternately to open and close certain of the openings in the work through which fluid from the jetting devices is adapted to pass.

5. In an apparatus for cleaning crankshafts having main bearing portions, holes extending transversely through said main bearing portions, and open-ended passages for cleaning fluid connected to said holes between the ends of the latter: a cage open at one end and including a group of horizontal pipes provided with jetting openings adapted to discharge cleaning fluid into said passages in a crank shaft positioned in the cage, means at the other end of the cage to supply cleaning fluid to said pipes, and means including movable work-engaging elements mounted on the cage, alternately to open and close said holes.

6. In an apparatus for cleaning crank shafts having main bearing portions, holes extending transversely through said main bearing portions, and open-ended passages for cleaning fluid connected to said holes between the ends of the latter: a cage open at one end and including a group of horizontal pipes provided with jetting openings adapted to discharge cleaning fluid into said passages in a crankshaft positioned in the cage, means at the other end of the cage to supply cleaning fluid to said pipes; and means including stationary tracks and movable work-engaging elements mounted on the cage and having parts adapted to ride on said tracks during a portion of each revolution of the cage, alternately to open and close said holes.

7. In an apparatus of the character described, a cage open at one end and including a group of horizontal pipes distributed about a common axis and provided with jetting openings adapted to discharge cleaning fluid against a crankshaft arranged in the cage with its axis coincident with the aforesaid axis, a hollow journal at the other end of the cage communicating with said pipes to supply cleaning fluid thereto, means on the journal to hold one end of the crankshaft centered in the cage, and gate means at the open end of the cage having thereon a centering and holding device for the other end of the crankshaft.

FRED C. AREY.
DE LOS E. HIBNER.