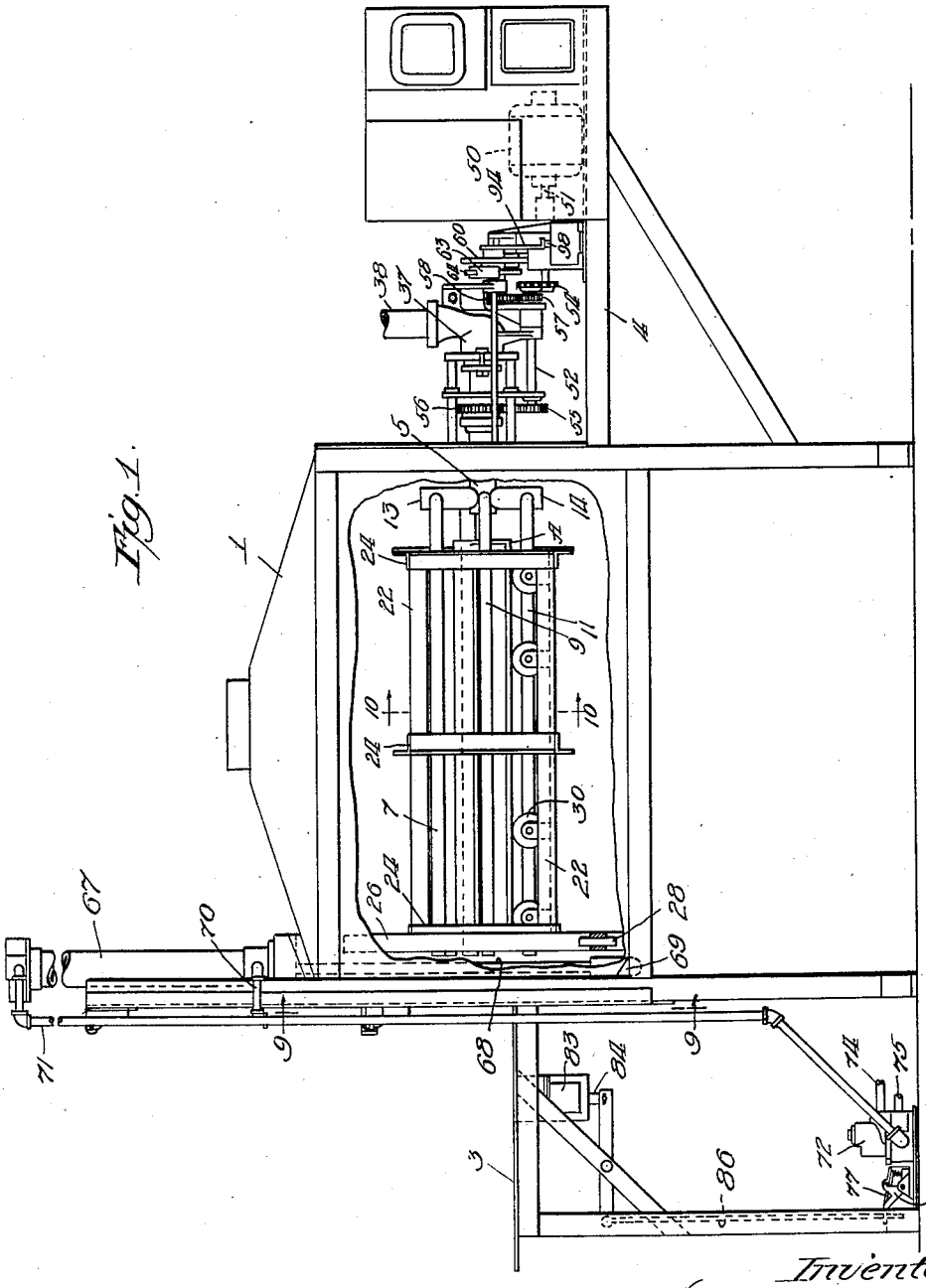
Dec. 24, 1940. F. C. AREY 2,225,946

APPARATUS FOR CLEANING CYLINDER HEADS OR THE LIKE

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Fig. 1.



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APPARATUS FOR CLEANING CYLINDER HEADS OR THE LIKE

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Fig. 3.

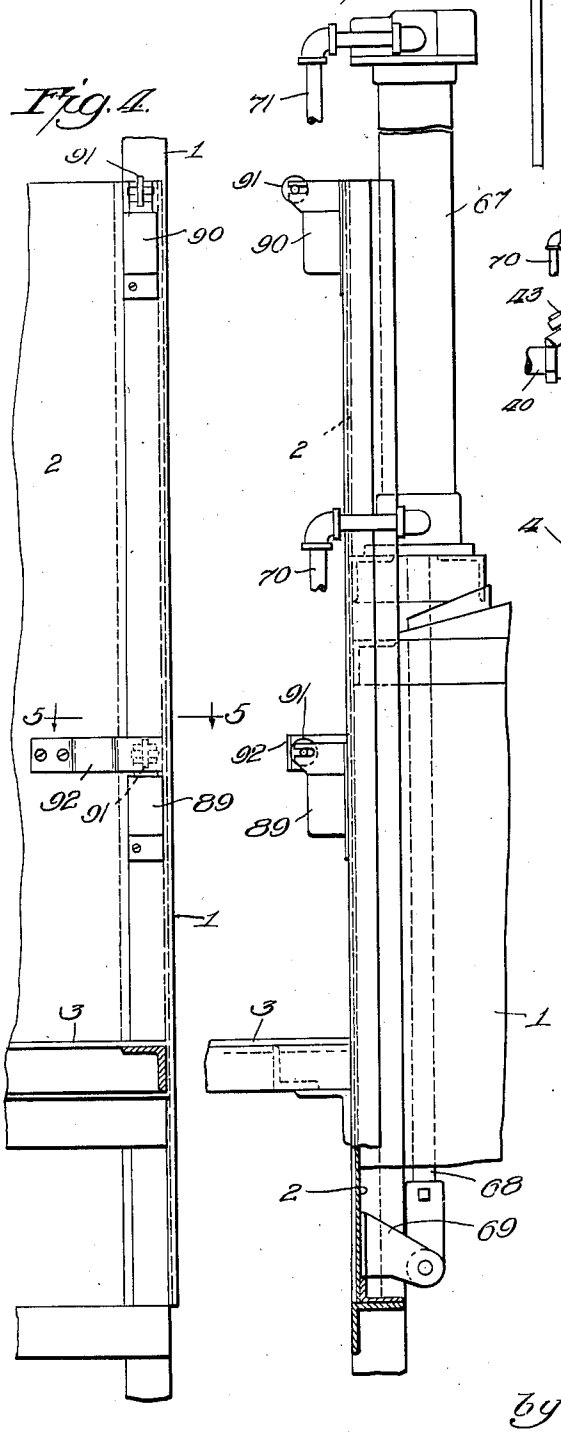



Fig. 4.




Fig. 2.

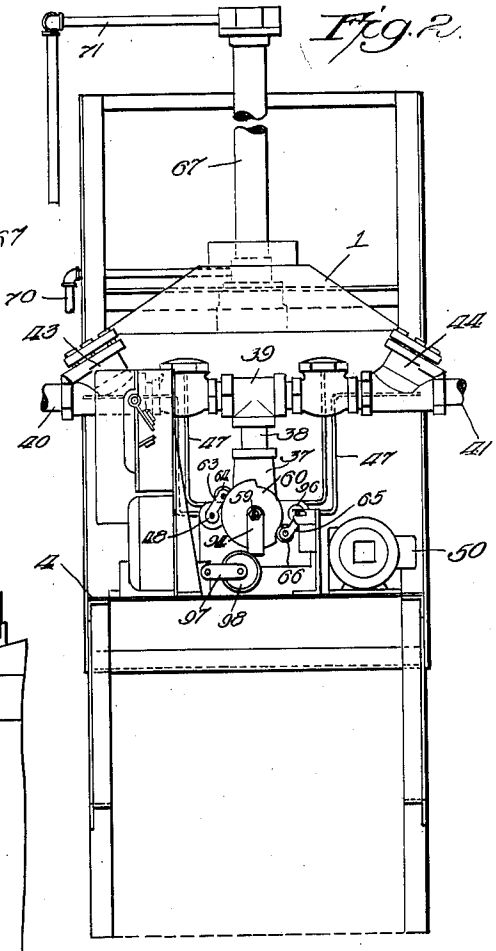
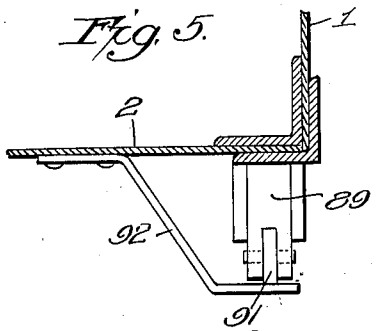



Fig. 5.




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APPARATUS FOR CLEANING CYLINDER HEADS OR THE LIKE

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Fig. 6

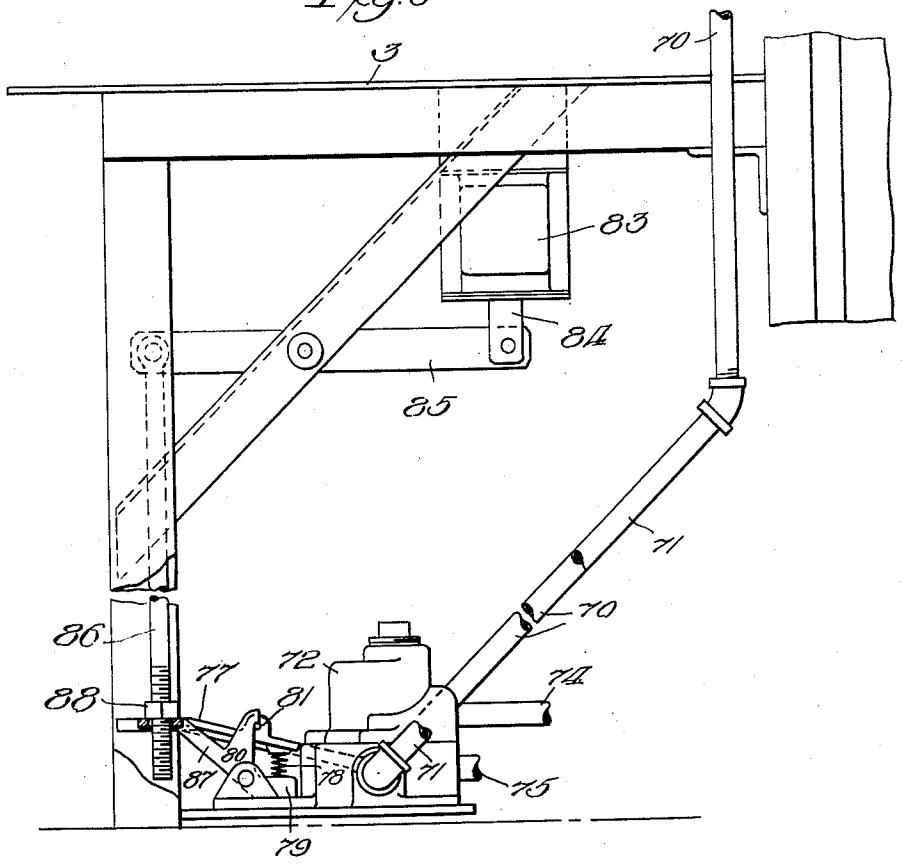



Fig. 7.

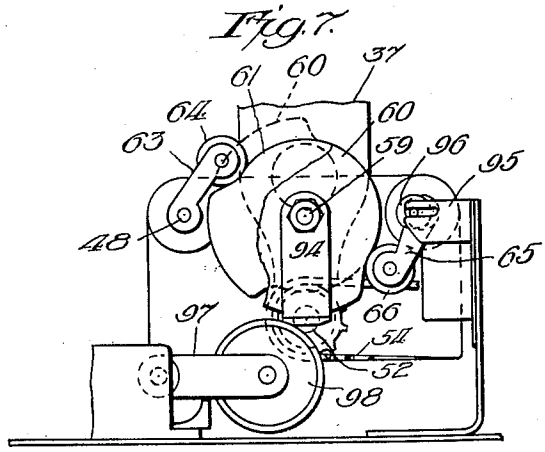
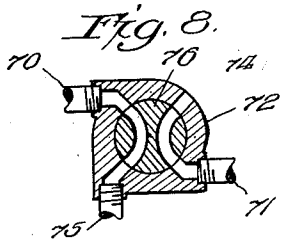



Fig. 8.




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APPARATUS FOR CLEANING CYLINDER HEADS OR THE LIKE

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Fig. 9.

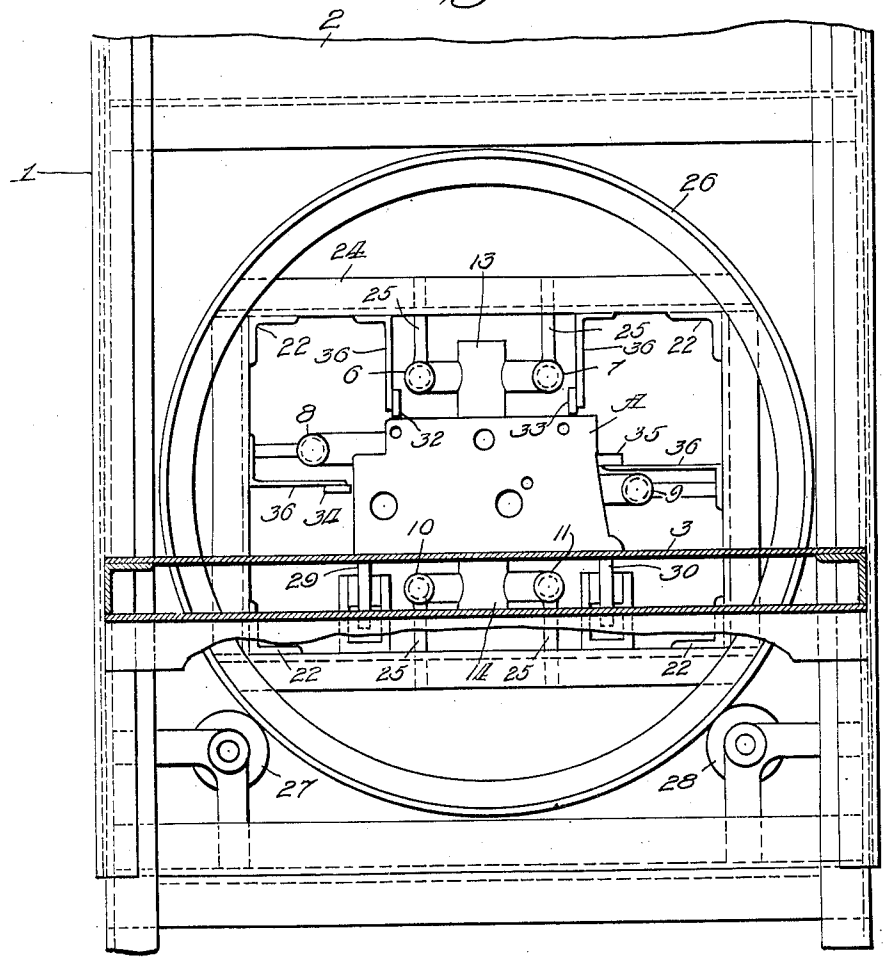
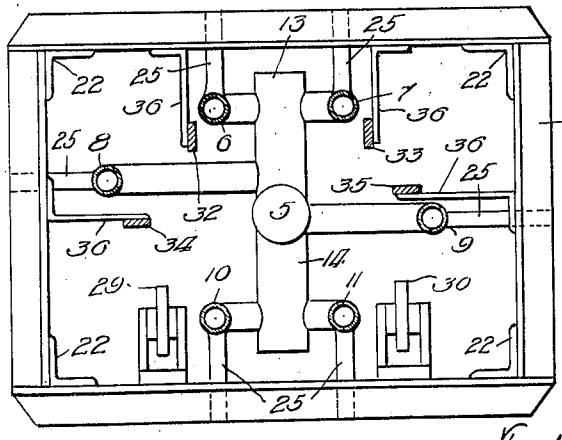



Fig. 10.




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APPARATUS FOR CLEANING CYLINDER HEADS OR THE LIKE

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Fig. 11.

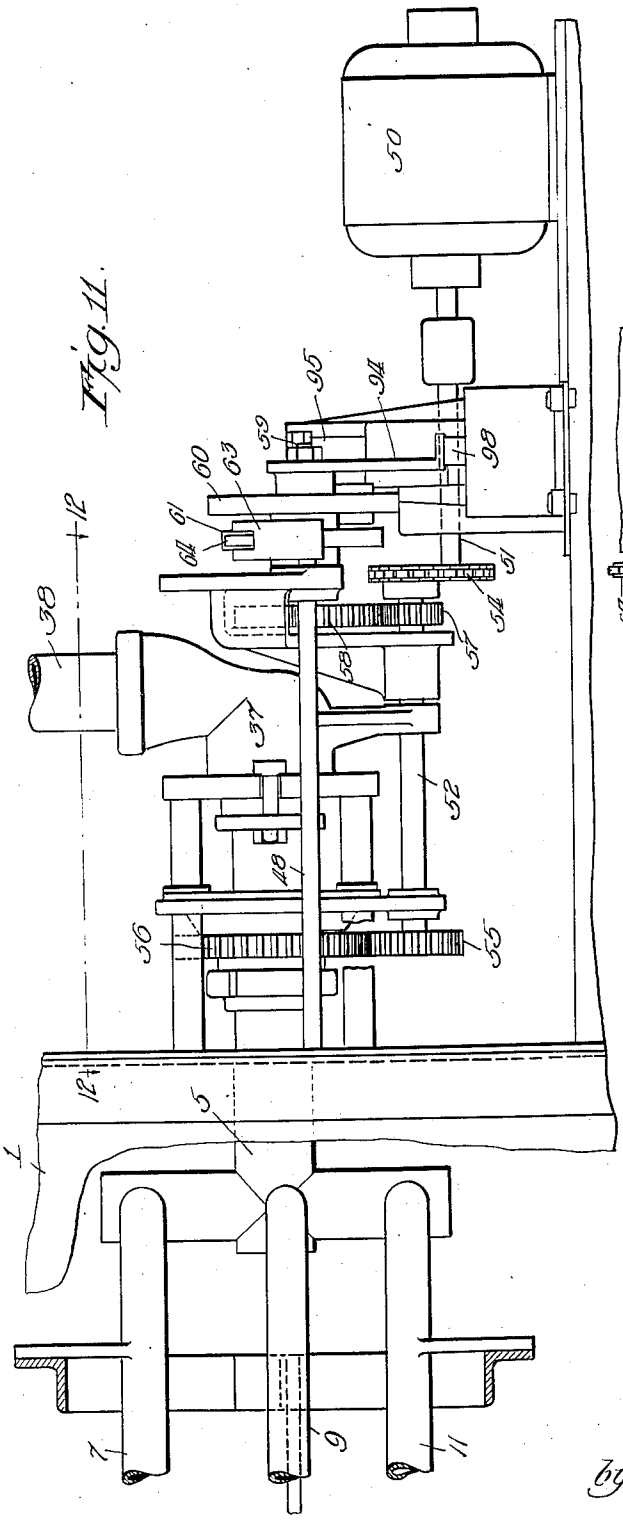
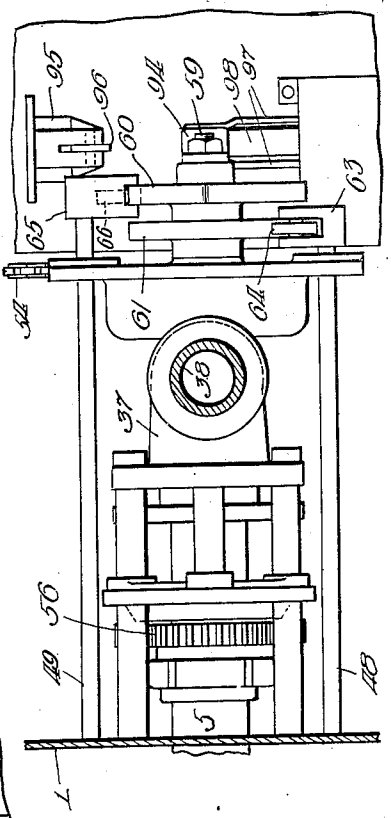



Fig. 12.




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APPARATUS FOR CLEANING CYLINDER HEADS OR THE LIKE

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Fig. 13.

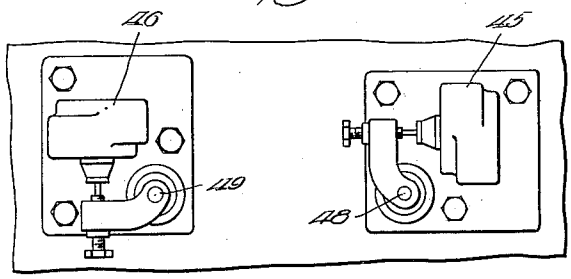



Fig. 14.

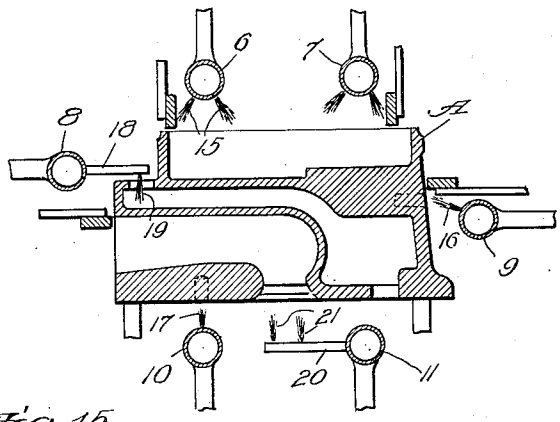
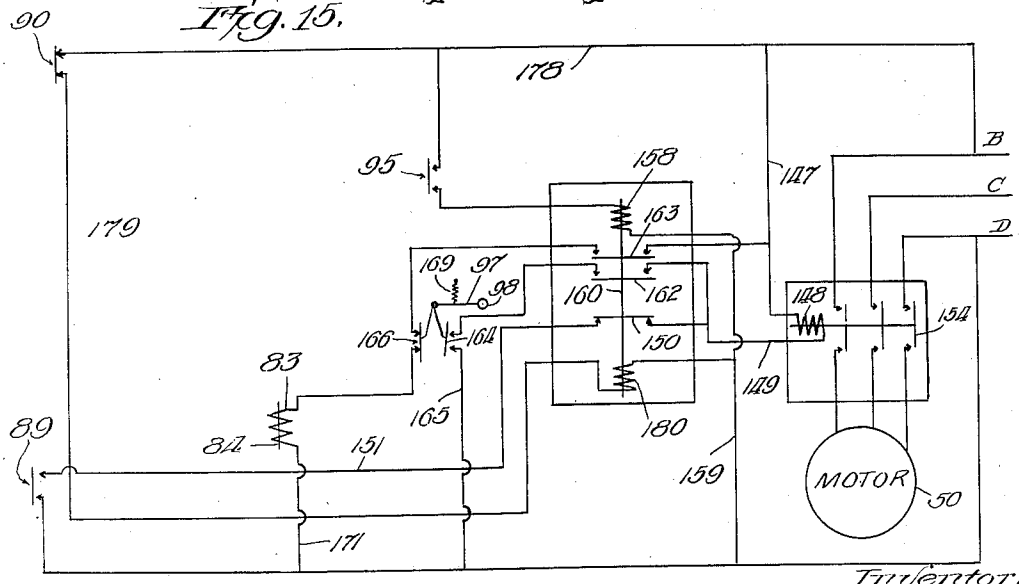



Fig. 15.




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# UNITED STATES PATENT OFFICE

2,225,946

## APPARATUS FOR CLEANING CYLINDER HEADS OR THE LIKE

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Application January 17, 1938, Serial No. 185,292

5 Claims. (Cl. 141—1)

In the Arey and Hibner application, Serial No. 141,484, there is disclosed an apparatus for cleaning the oil and metal chips from motor blocks; and in another Arey and Hibner application, Serial No. 183,760, filed on the 7th day of January, 1938, entitled Automatic motor block cleaner, there is illustrated a similar apparatus which automatically performs a cleaning cycle following a single manual controlling operation.

The object of the present invention is to apply the principles embodied in the apparatus of the aforesaid applications to an apparatus handling objects that require a somewhat different treatment from cylinder blocks.

For example, a cylinder head in the form of a hollow casting, the interior of which constitutes a water chamber, may require not only the removal of oil and chips, after the machining operation, but also a thorough washing out of the interior. One of the purposes of the present invention is to provide means for quickly and effectively to wash objects such as a cylinder head of this kind, and like things, as well as remove oil and chips left by machining operations.

The various features of novelty whereby my invention is characterized will hereinafter be pointed out with particularity in the claims; but, for a full understanding of my 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 view of an apparatus embodying the present invention, a portion of the side wall of the housing in which the cleaning is done being broken away; Fig. 2 is a rear elevation of the apparatus on a somewhat smaller scale than Fig. 1; Fig. 3 is a view similar to Fig. 1, showing only a small fragment of the apparatus, but on a larger scale than Fig. 1; Fig. 4 is a front view of one corner of the apparatus on the same scale as Fig. 3, being a view looking toward the right from the lefthand side of Fig. 3; Fig. 5 is a section on line 5—5 of Fig. 4, but on a still larger scale; Fig. 6 is a side view of the receiving station at the front end of the apparatus, on a larger scale than Fig. 1; Fig. 7 is a rear view, similar to Fig. 2, but on a larger scale and showing only a small fragment of the apparatus; Fig. 8 is a diagrammatic view of the controlling valve which causes the door of the housing to open and close; Fig. 9 is a section on line 9—9 of Fig. 1, on an enlarged scale and showing the door of the housing open; Fig. 10 is a section on the same scale as Fig. 9, taken on line 10—10 of Fig. 1, but showing only the cage that holds the work which is being cleaned; Fig. 11 is a view similar to Fig. 1, showing only the rear portion of the apparatus, on an enlarged scale, and omitting the switch boxes; Fig. 12 is a section on line 12—12 of Fig. 11 and constitutes a plan view of the greater part of the operating mechanism in rear of the housing; Fig. 13 is a view looking from the front at the rear wall of the housing, showing a fragment of this wall and the pilot valves that control the delivery of the two different cleaning fluids that are employed; Fig. 14 is a section through a cylinder head positioned in the cage in which it is held while being cleaned, and showing cleaning jets being discharged upon the head; and Fig. 15 is a diagram of electrical connections.

Referring to the drawings, 1 represents a casing or housing, similar to those in the aforesaid applications, whose front side is open and is provided with a vertically slidable door 2. In front of the housing is a receiving station having a horizontal platform 3. In rear of the housing is another horizontal platform 4. Within the housing is a holder in the form of a cage extending from front to rear and rotatable about a horizontal axis at right angles to the rear wall of the housing. The front end of the cage is open, and the parts are so arranged that when the door is raised a piece of work can be slid from the receiving station directly into the cage or from the cage back upon the receiving station.

The cage is composed partly of tubular jetting elements and partly of a framework. The rear end of the cage is carried by a conduit 5 of considerable diameter which may be regarded as a hollow journal or shaft for the cage. As will hereinafter be explained, the cleaning fluids are delivered through the member 5. In the particular arrangement shown, there are six tubular jetting elements, as indicated at 6, 7, 8, 9, 10 and 11. These are all horizontal and parallel to each other, namely parallel to the axis of rotation of the cage. The end of the hollow journal 5 within the housing has two oppositely disposed radial arms or branches 13 and 14. The rear ends of the elements 6, 7 and 8 are bent laterally and joined to the arm 13, while the rear ends of the elements 9, 10 and 11 are bent laterally and joined to the arm 14. The elements 6 to 11, inclusive, may be provided with nozzles, orifices or other jetting devices to provide for the delivery of jets of cleaning fluid at every point desired. For example, as shown in Fig. 14, the tubes 6 and 7 may each have orifices so arranged as to discharge

diverging jets 15 toward a cylinder head A arranged in the cage; the tubes or pipes 9 and 10 may each discharge a single row of jets toward the cylinder head, as indicated at 16 and 17; the member 8 may have small radial extensions 18 adapted to discharge jets 19 into the chamber *a* in the head; and the member 11 may have projecting, finger-like tubular elements 20 adapted to discharge rows of jets 21 in the direction of the work.

Surrounding the group of tubular members 6 to 11, is an open-work frame structure comprising four longitudinal bars 22 and transverse connecting pieces; the latter being arranged in groups each of which constitutes a rectangular frame 24 surrounding and engaging all four of the longitudinal bars. In the arrangement shown there are three of these rectangular frames, one at each end of the cage and one in the middle. The rearmost frame 24 is supported from the jetting elements 6, 7, 10 and 11; each of these elements having a rigid rod or arm 25 welded thereto and to the adjacent member of the frame 24. The front end of the framework of the cage is supported externally, the front frame 24 carrying a large ring 26 whose center is at the axis of the cage. In the bottom of the housing, near the sides, are two rollers 27 and 28 whose axes are parallel to the axis of the cage. The ring 26 rests on both of these rollers, being held down by the weight of the cage and the work therein and being held against lateral displacement by reason of the fact that the lower side of the ring extends well below the two rollers.

Means must be provided to permit the cylinder head to be easily moved into and out of the cage and to be properly positioned in the latter relatively to the jetting devices. In the arrangement shown, there are two rows of rollers 29 and 30, extending from front to rear of the cage; these rows being so located that in one angular position of the cage the plane of the top of the receiving station 3 is tangent to all of these rollers at the highest points on the latter. Thus, a cylinder head may be slid off the receiving station onto the rollers 29 and 30.

Within the cage I have shown four longitudinal guiding and locating bars 32, 33, 34 and 35. Each of these bars is supported from the corresponding members of the frames 24 by suitable brackets 36. The arrangement is such that the bars 32 and 33 engage with the opposite face of the head from that which rests on the rollers 29 and 30, while the bars 34 and 35 lie on opposite sides of the head.

In the use of the apparatus, a piece of work is placed in the cage, the door of the housing is closed, and the cage with its contents is rotated; cleaning fluid being delivered to the jetting elements through the hollow journal and discharged against the work. Where one of the fluids is a liquid, the turning of the work insures the emptying of the liquid from any chambers or pockets which may exist in the work. Where one of the cleaning fluids is a liquid, it should be delivered first so that when followed by compressed air or other gaseous material, a complete drying of the dampened surface will be effected. After the cage has made a predetermined number of revolutions, the door of the housing is preferably opened automatically, so that the work may be withdrawn to the receiving platform. The entire cycle of operations, after the closing of the door upon the manipulation of a manual controller, to the subsequent opening of the door, should be automatic, and mechanisms have been provided to this end. These mechanisms are only slightly different from those disclosed in the more recent of the aforesaid applications and will therefore be described only briefly except where differences exist.

The hollow journal 5 is supported for rotation by a head 37 in rear of the housing and above the rear platform 4, in a manner common in well known forms of soot blowers. A short section of pipe 38 of large diameter rises from the head and is connected at its upper end through a T 39 with supply pipes 40 and 41, respectively. The pipe 40 may be assumed to supply water under a sufficient head and the pipe 41 to deliver air under pressure. The pipe 40 contains a main valve 43, and the pipe 41 a main valve 44. These main valves are controlled respectively by pilot valves 45 and 46 within and at the rear of the housing, and shown in Fig. 13; the casing of each pilot valve being connected to the corresponding main valve casing by piping 47. These features, including the rock shafts 48 and 49 for controlling the pilot valves, are the same as the corresponding features in our last mentioned application. The rock shafts 48 and 49 are actuated, as is the rotatable cage, by energy derived from an electric motor 50 mounted on the platform 4; the shaft 51 of this motor driving a counter-shaft 52 through a suitable sprocket chain drive 54. The counter-shaft has thereon a pinion 55 that meshes with a gear wheel 56 surrounding and fixed to the hollow journal 5, so that whenever the motor is running, the work-holding cage is caused to revolve. The counter-shaft has thereon a second pinion, 57 that meshes with a gear wheel 58 fixed to a cam shaft 59. This cam shaft, as shown in Figs. 11 and 12, and also in Fig. 7, has thereon two cams 60 and 61. These cams are simply plates, each of such a contour that its edge consists of two arc-shaped sections of different radii, namely high and low cam sections. The rock shaft 48, which controls the delivery of water, has on its rear end a radial arm 63 provided with a roller 64 that rests on the periphery of the cam 61, while the other rock shaft is provided at its rear end with a radial arm 65 having thereon a roller 66 that rests on the edge of the cam 60. When the cam rollers are engaged with the portions of small radii of their respective cams, as shown in Fig. 7, both of the main valves are closed, but as soon as either cam roller rides up upon the high section of its cam, the corresponding main valve is caused to open. It will be seen that the section of large radius of the cam 61 is short, while the corresponding section of the cam 60 is quite long. It will also be seen that while the two cam rollers may both rest on the low portions of their cams at the same time, they cannot both rest on the high portions of their cams at the same time.

Assuming that the cam shaft revolves in the clockwise direction, as viewed in Fig. 7, when the motor is running, it will be seen that the cam roller 64 rides up on the high portion of the cam 61 as soon as the motor starts, while the cam roller 66 remains on the low section of its cam. After the cam shaft has turned far enough to permit the roller 64 to drop down on the low part of the cam 61, the roller 66 rides up on the high section of cam 60 and remains there until the cam shaft has completed a revolution and the motor stops. It will thus be seen that because the high section of the cam 61 is short, the main valve in the water pipe remains open for a shorter

time than it remains closed. On the other hand, the high section of cam 60 is longer than the low section, and therefore the main air valve remains open for a greater part of a revolution of the cam shaft than the part during which it remains closed. In the mechanism illustrated, the air valve remains open twice as long as does the water valve, but this proportion may be varied at will by suitably shaping the cams.

The motor must not start while the door of the housing remains open and should start automatically upon the closing of the door. Likewise, the door should open automatically when the cleaning operation has been performed.

The door is operated by a piston within a vertical cylinder 67 rising from the top of the housing behind the plane of the door. The piston has a rod 68 extending downwardly behind the door and secured at its lower end to a bracket 69 fastened to the lower end of the door. The lower end of the cylinder may be supplied with air under pressure or exhausted through a pipe 70 while the upper end of the cylinder may be energized or exhausted through a pipe 71. These two pipes are connected to a valve casing 72 below the platform of the receiving station. Air under pressure is admitted from any suitable source into the valve casing through a pipe 74, and there is also an exhaust pipe 75 connected to the casing.

In the drawings the door is shown closed, there now being pressure in the upper end of the cylinder and the lower end being connected to the exhaust. This is accomplished by the valve which is now in the condition illustrated diagrammatically in Fig. 8 which illustrates the valve casing as having a rotatable plug 76 provided with suitable passages cooperating with suitable ports in the casing. With the member 76 in the position shown in Fig. 8, the pipe 71 and the air supply pipe are connected together and the pipe 70 is connected to the exhaust pipe. Upon turning the valve member clockwise through an angle of ninety degrees, pipe connections are reversed so that pipe 70 receives air under pressure and pipe 71 exhausts. The movable member of the valve is adapted to be turned in one direction by a pedal 77, and in the other direction by a spring 78 underlying the same. The spring may rest on a toe 79 projecting from a pivoted catch 80 which is adapted to hook over a pin 81 on the pedal when the pedal is pressed down. The spring thus serves both to raise the pedal when the latter is freed from the catch and to force the catch into its locking position when not restrained from doing so.

The catch may be tripped by the energization of the coil 83 of a solenoid whose core or plunger is indicated at 84. This solenoid is mounted on the under side of the receiving platform 3 and the lower end of the plunger thereof is connected to one end of a horizontal rocker member 85. From the other end of the rocker member depends a rod 86 whose lower end extends freely through a hole in a tail piece 87 projecting forwardly from the catch. On the rod, above the tail piece, is a nut 88 adapted to engage with the latter. While the solenoid remains deenergized, the tripping device has no effect on the catch; but upon energizing the solenoid, the rod is forced down and the nut thereon presses the catch back into its release position. When that occurs, the spring pushes the pedal up and operates the valve into its door-raising position. As will hereafter appear, the solenoid is energized when a cleaning operation has been completed and the motor stops.

Thus, when the motor stops, the catch associated with the valve 72 is tripped and the door is raised, permitting the work to be removed and a new piece of work to be inserted in the cage. Then the operator need only press the pedal down into the position indicated in Fig. 6 to cause the door to be closed and be held closed; the valve 72 being locked in the new position by the catch 80 until the solenoid is again energized.

Since there should be not jetting of cleaning fluids while the housing door is open, we provide a door-operated switch for controlling the motor. In fact, two of these switches are necessary, one operated by the door at the lower limit of its movement and the other when the door is up. The first of these two switches is indicated at 89 and the other at 90. Each of these switches has a movable member provided with a roller 91 adapted to be energized by a Z plate 92 on the door. When the door is just about to become fully closed, the Z plate engages the roller of the lower switch 89 and actuates that switch. When the door reaches its upper limit the Z plate presses on the roller of the upper switch 90 and operates that one. The reason for having two of these limit switches will be apparent from an examination of Fig. 15 which is a wiring diagram identical with that in our last-mentioned application.

With the various switches in the positions illustrated in Fig. 15, a circuit may be traced from one of the main line wires B through wire 147, solenoid 148, wire 149, switch 150, wire 151, switch 89 and wire 153, back to the main line wire D; switch 150 being normally closed as will hereinafter be explained. Solenoid 148 operates the main motor switch 154, so that the motor is energized upon the closing of the door.

After the motor has started, it continues to run until a cycle of jetting operations has been completed. Thereupon, the motor must stop, and the door be opened again. The switch 89, controlled by the door, does not open until the door itself has been opened, and therefore, some other means must be provided to open the motor circuit. Accordingly, there is secured on the rear end of the cam shaft 59 a radial arm 94, as best shown in Figs. 7, 11 and 12; and, mounted on a stationary support in the same transverse plane as the arm 94, is a switch 95 provided with a lever or the like ending in a roller 96 which projects out far enough to be engaged by the outer end face of the arm 94 at a predetermined point in the rotation of the cam shaft. The switch 95 is normally open as indicated in the diagram, and is closed by the action of the arm 94. This closing of the switch 95 occurs after the cam shaft has completed the larger part of a revolution. From an inspection of the diagram, it will be seen that upon the closing of the switch 95, current flows from line wire B through the same, through the coil 158 of a solenoid and through wires 159 and 153 to line wire D. The core 160 of the solenoid 158 is connected to the movable element of the switch 150 and to the movable elements of a double switch 162 and 163. The energization of the solenoid 158 causes the switch 150 to open, and the switches 162 and 163 to close. The energizing circuit for the main switch 154 of the motor is now from line wire B, through wire 147, coil 148, wire 149, switch 162, a switch 164, which is in its closed position, through wire 165 and wire 153 to line wire D. Switch 164 is

one member of a double switch whose other member is indicated at 166. Thus, the circuit for the motor switch is now independent of the switch 89 which is controlled by the door. The movable members of the switches 164 and 166 have a common operating arm or lever 97 arranged in the same plane as the arm 94 on the cam shaft. On the free end of the arm 97 is a roller 98 adapted to be engaged by the outer end of the arm 94. Normally, as indicated in the diagram, a spring 169 holds the arm 97 with its roller raised, so that the switch 164 is closed and the switch 166 is open. However, when the cam shaft is just about to complete a revolution, the arm 94 depresses the roller 98, so that the switches 164 and 166 are placed in the positions shown in the diagram and held in those positions because of the stopping of the motor. The motor stops because the switches 150, 162 and 163 remain in the positions which they occupied after the closing of the switch 95, even after that switch is again opened. Consequently, the opening of the switch 164 at the end of a revolution of the cam shaft causes the motor switch to be deenergized and open, because both of the energizing circuits for the main switch coil 148 are now open, one at the switch 150 and the other at the switch 164.

When the motor stops, it is time to open the door of the housing to permit the removal of the cylinder block which has been cleaned. This is accomplished by energizing the solenoid coil 83 and thus releasing the catch that locks the valve 72 in the door-closing position and permitting it automatically to return to its normal position which allows air to flow into the lower end of the door cylinder and thus raise the door to open the same. The circuit for energizing the coil 83 is from line wire B through wire 147, switch 163, switch 166, coil 83, wire 171 and wire 153 to line wire D.

Since the motor cannot start again until the door is closed, at which time the circuit for the motor switch actuator can be completed only through the switch 150, means are provided to close this switch and open the switches 162 and 163 after the motor has stopped. To this end there is provided the second door-controlled switch 90.

In the diagram the switch 90 is illustrated as being closed when the door is up. It will thus be seen that current may now flow from line wire B through wire 178, switch 90, wire 179, solenoid coil 180 and wire 159 to line wire D. In this way the coil 180 is energized and, the opposing coil 158 being deenergized because the switch 95 is open, the switches 150, 162 and 163 are shifted into the positions which they occupy in the diagram. The system is now ready to cause the motor to start whenever the door is again closed and closes the switch 89.

It will thus be seen that I have produced a simple and novel apparatus by means of which a piece of work may be automatically cleaned, after being placed in a housing, by mechanism caused to operate through a predetermined cycle upon the pressing of a movable controlling member. Thus, the matter of cleaning a piece of work requires no attention or labor on the part of a workman than the placing of the work in and its removal from a housing, and the shifting of a lever or other manual controlling element from one position to another. It will also be seen that the cleaning may be done by the action of jets of two different fluids, or fluids possessing different characteristics, delivered one after the other. It will further be seen that the cleaning may be carried out while the piece of work is being turned over any desired number of times, thereby to get rid of liquid or other material that collects in pockets or chambers in the work and might otherwise remain there.

While I have illustrated and described with particularity only a single preferred form of my invention, I 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 my invention constituting the appended claims.

I claim:

1. In an apparatus of the character described, a housing, a horizontal conduit extending through and rotatable in a wall of said housing, a cage within the housing and fixed at one end to said conduit, a ring having its center at the axis of rotation of said conduit surrounding and fixed to the other end of the cage, rollers in the housing below and forming a rolling support for the ring, jetting devices on the cage communicating with the interior of said conduit and positioned to discharge jets of cleaning fluid upon a piece of work in the cage, means to turn the cage, and means to deliver cleaning fluid to said conduit.

2. In combination, a housing having a door opening, a door for said opening, a cage in said housing, a reciprocable pneumatic actuator for said door, apparatus for cleaning work in said cage, a two-position valve for controlling the said actuator to cause the latter to open the door in one position of the valve and to close the door when the valve is in the other of its positions, said valve tending constantly to assume one of its positions, a catch for holding the valve in the other of its positions, an electro-magnetic device to release the catch, and means controlled by said cleaning apparatus to cause said electro-magnetic device to be energized.

3. In combination, a housing having a door opening, a door for said opening, a reciprocable pneumatic actuator for said door, apparatus for cleaning work in said housing, a two-position valve for controlling the said actuator to cause the latter to open the door in one position of the valve and to close the door when the valve is in the other of its positions, said valve tending constantly to assume one of its positions, a pedal to move the valve into the other of its positions, a catch for holding the pedal down, an electro-magnetic device to release the catch, and means controlled by said cleaning apparatus to cause said electro-magnetic device to be energized.

4. In an apparatus of the character described, a housing, a horizontal rotatable conduit extending from the exterior of the housing through the rear wall of the latter and terminating a short distance inwardly from said wall, a group of horizontal, parallel jetting pipes extending from front to rear of the housing around and spaced apart from the axis of said conduit extended, a metal framework surrounding and secured to said pipes to form with the latter a cage open at the front end, said pipes being rigidly connected at their rear ends to said conduit in a manner to receive fluids therefrom and to cause the rear end of the cage to be supported by said conduit, a ring having its center at the axis of rotation of said conduit surrounding and fixed to the front end of the cage, a bearing in the housing for the ring to

support the front end of the cage, means to turn the conduit, and means to deliver cleaning fluid to said conduit.

5. In an apparatus of the character described, a cage open at one end and including a group of horizontal pipes provided with jetting devices 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 guides in the cage for engaging with the work to hold it against rotary movements relatively to the cage about the axis of said journal while permitting it to move into and out of the cage through said open end.

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