

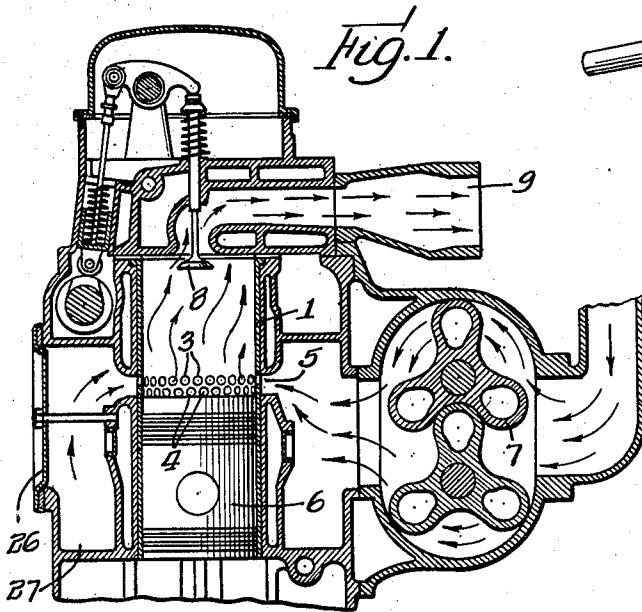
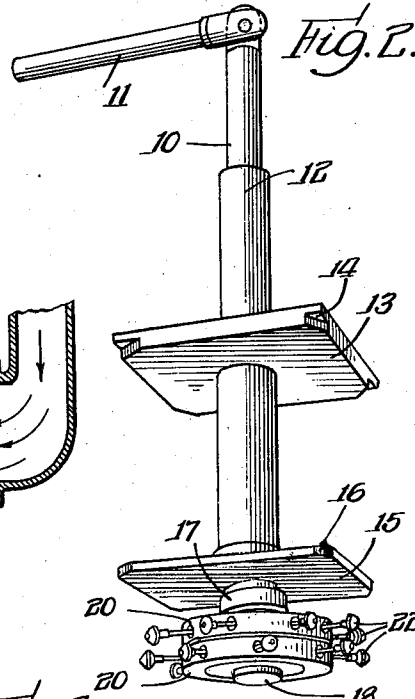
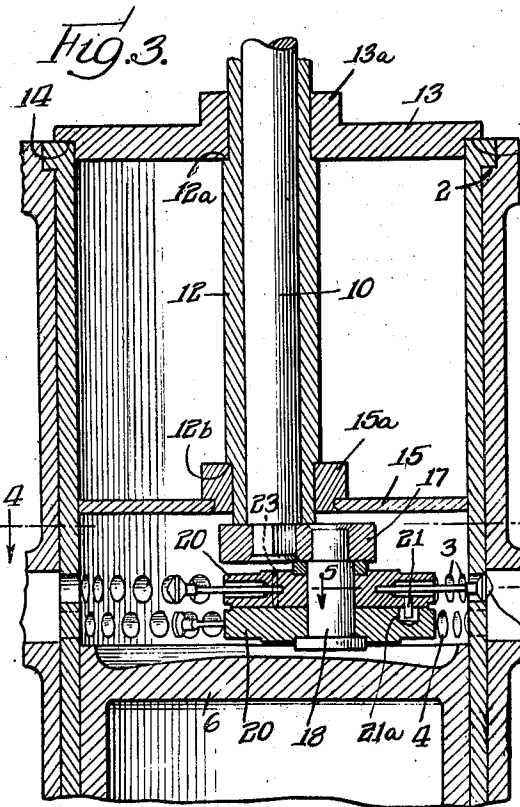
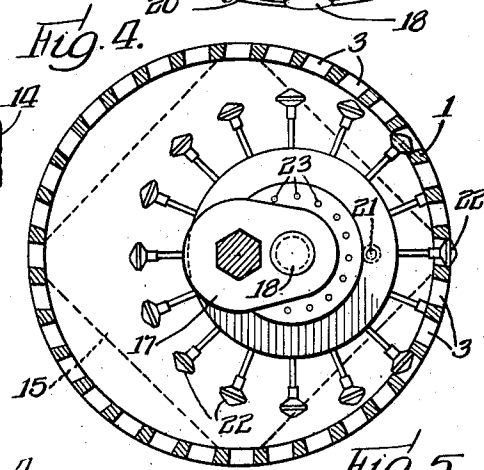
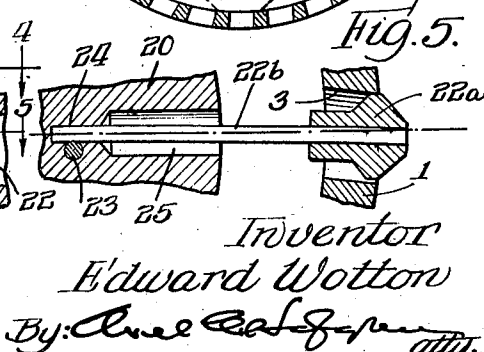
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DEVICE FOR CLEANING SIDE WALL PORTS IN CYLINDERS

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DEVICE FOR CLEANING SIDE WALL PORTS
IN CYLINDERS

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12 Claims. (Cl. 15—104.01)

This invention relates to means for cleaning side wall ports in a cylindrical wall when they become clogged or plugged with foreign matter. One object of the invention is to provide a new and improved tool for this purpose.

The invention is shown embodied in a device especially designed for cleaning carbon deposit from the side wall ports in the liner sleeves which are employed in the cylinders of certain types of Diesel engines, and it is a specific object of the invention to provide a tool or device which can be so employed without completely dismantling the engine and without removing the liner sleeve from the cylinder.

Another object of the invention is to provide a device for forcibly punching out the slugs of carbon which tend to form in the side wall ports of the working cylinder wall of an engine, pump, or like mechanism.

It is also an object of the invention to provide a tool having a plurality of punches arranged to operate successively in rows of ports formed in a cylindrical wall, together with means for actuating the punches in the process of cleaning out deposits of foreign matter from such ports.

More specifically, the invention is designed to provide a rotatable shaft and means for supporting it temporarily in axial position within an engine cylinder, said shaft having a crank portion at its lower end with a tool head rotatably carried on the crank and with radially projecting punches on the tool head dimensioned to be projected through a row of ports extending around the cylinder wall when the shaft is rotated so as to cause the tool head to traverse the row of ports.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the drawing, in which:

Fig. 1 is a partial vertical cross section of a Diesel engine structure showing the liner sleeve of the engine cylinder provided with circumferentially extending rows of ports which are to be cleaned by a tool or device embodying the present invention.

Fig. 2 is a perspective view of the tool showing the several parts in assembled relation.

Fig. 3 is an axial sectional view showing the tool in the position of use within the cylinder.

Fig. 4 is a transverse section taken as indicated at line 4—4 of Fig. 3.

Fig. 5 is a fragmentary detail section taken as indicated at line 5—5 on Fig. 3.

While I have shown in the drawing and shall herein describe in detail a preferred form of the invention, it is to be understood that I do not intend to limit the invention to the specific form or application disclosed, but aim to cover all modifications and alternative constructions fall-

ing within the scope of the invention as expressed in the claims.

In certain types of Diesel engines the working wall of each cylinder consists in a metallic sleeve 1 which is inserted in the cylinder, as shown in Fig. 1, and which has a flange or shoulder 2 at its upper end (Fig. 3) to position it therein. The sleeve 1 is provided with a plurality of circumferentially extending side wall ports or apertures which are shown in the present instance as consisting of two rows of ports 3 and 4, and which register with an annular port or opening 5 in the cylinder casting. The ports 3 and 4 are so located that they will be uncovered when the piston 6 reaches the lower limit of its stroke, and at this time an air pump or blower 7 operated by the engine forces a blast of air into the ports 3 and 4 and upwardly through the cylinder, to scavenge it and carry out the dead gases past the exhaust valve 8 and into the manifold 9. Ports 3 and 4 are placed at about 16° to the radius. The angle of the intake ports imparts a rotational motion to the intake air as it enters the cylinder. This rotation persists throughout the compression stroke and improves the combustion. As the piston 6 moves upwardly, it covers the ports 3 and 4 and its continued upward travel operates to compress the air and the charge of fuel which is injected into it in accordance with the well known Diesel principle.

One difficulty experienced with this construction is that the ports 3 and 4 tend to accumulate deposits of carbon and to become partially or wholly clogged by slugs or plugs of carbon which are built up therein during operation of the engine, and which tend to adhere to the metallic walls of the ports rather firmly so that the air flow from the pump 7 is not sufficient to dislodge them. Periodically, therefore, the carbon slugs must be cleaned out in order that the ports may perform their scavenging function properly and also to insure that they shall efficiently furnish an adequate supply of air for combustion of the fuel, since in this engine there are two exhaust valves 8 but no intake valves in the head of the cylinder, and the side wall ports 3 and 4 must furnish the air supply for this purpose. Heretofore this cleaning has been a tedious and relatively awkward operation, sometimes even requiring removal of the sleeves 1 from the engine cylinders; but the present invention provides a tool by which the work may be accomplished easily and expeditiously.

As shown in Fig. 2, the tool includes a shaft 10 having a hinged handle portion 11 and journaled in a sleeve 12. The sleeve 12 is fitted with a square plate 13 having portions cut away at its corners to form lodgment shoulders 14 adapted to rest on the upper end of the sleeve 1 when the tool is set up in the engine cylinder, as shown

in Fig. 3. Near its lower end the sleeve 12 is fitted with a second plate 15 which may be of square form with its corners rounded off, as shown at 16, so as to fit snugly within the sleeve 1 and thus center the shaft 10 for axial rotation therein.

At its lower end the shaft 10 carries a short crank arm 17 with a headed crank wrist 18 on which there is rotatably mounted the tool head which is shown herein as comprising two relatively flat, cylindrical members or disks 20, 20 connected together by a pin 21 for operation as a unit. The pin 21 is fixed in one of the disks and engages in a hole 21^a in the other disk, said hole being slightly larger than the pin to provide limited rotative play between the disks for a purpose which will presently be explained. Each disk 20 of the tool head carries a plurality of radially projecting punches 22; in the structure illustrated, each disk 20 carries eight of these punches and the disks are relatively positioned so that the punches of one are staggered with respect to those of the other, as seen in Fig. 4. This arrangement is preferred by reason of the fact that the two rows of ports 3 and 4 are staggered relatively to each other, as seen in Fig. 1; and if the ports of one should not be spaced quite accurately in relation to those of the other row, the play between the disks which is provided by the loose fit of pin 21 in the hole 21^a will allow sufficient accommodation to insure entry of both sets of punches in the respective rows of ports.

The plate 13 is formed with a hub 13^a which is secured by forced fit onto the sleeve 12 and against a shoulder of the sleeve at 12^a, and the plate 15 may be similarly provided with a hub 15^a which is forced onto the sleeve 12 against its shoulder 12^b. The hinged arrangement of the handle 11 permits the handle to be aligned with the shaft 10 so that the shaft and its handle may be slipped out of the sleeve 12 when the tool head 20, 20 is to be inserted in working position in a cylinder sleeve 1. After the tool head has been thus placed with some of its punches 22 engaging in ports 3 and 4 of the cylinder sleeve 1, the bearing sleeve 12 will be slipped over the handle 11 and shaft 10 into working position, with the plate 15 entered in the cylinder 1 just above the crank arm 17 on the shaft 10 and with the plate 13 resting on the upper end of the sleeve 1, as seen in Fig. 3. The hinged handle 11 will then be swung to extend approximately at right angles to the shaft 10 so as to serve for rotating the shaft and causing the punches to be fed around the sleeve 1 for cleaning out the ports 3 and 4.

The punches 22 of the tool head are disposed within a circular outline of smaller diameter than the internal diameter of the cylinder sleeve 1, and the eccentricity of the crank wrist 18 is such that when the shaft 10 is rotated in its axial position within the sleeve 1 the tool head 20, 20 will be rolled around the inside of the sleeve with its punches 22 successively engaging the several ports 3 and 4 and being projected through said ports so as to dislodge and remove the slugs of carbon which may have formed therein. It is not required that the tool head be provided with enough punches to operate upon all the ports 3 and 4 in a single revolution, it being only necessary that the spacing of the punches in the tool head be such that they will register successively and eventually with all the ports. In the arrangement shown in Fig. 4, there are thirty-two of the ports 3 uniformly spaced around the sleeve

1, and there are likewise thirty-two of the ports 4 in the lower row which are similarly spaced, but in staggered relation to the ports 3. There are eight punches 22 mounted in each of the disks 20, 20 of the tool head. Considering the eight punches of the upper disk 20 and assigning numbers from 1 to 32 to the thirty-two ports 3 of the sleeve 1, it will be evident that these ports will be engaged by the punches in the following order as the tool head is rotated by the crank wrist 18: 1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31—2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32—3, 6, 9, 12, 15, 18, 21, 24, 27, 30, and then 1, 4, 7, etc., repeating the series. In other words, the punches will operate upon all the thirty-two ports of the series in three revolutions of the shaft 10, and similarly the eight punches of the lower section 20 of the tool head will operate in the ports 4 of the lower series.

Preferably the outer ends of the punches are of conical form so that if they should not register quite accurately with the ports in the sleeve 1, they will cam themselves into position and, to facilitate such action, each punch consists of a head portion 22^a and a somewhat flexible stem portion 22^b which may be of chrome vanadium spring steel wire, and which is anchored at its inner end in the tool head 20 by means of a cross pin 23. The inner end portion of the stem 22^b fits snugly in a radial hole 24 in the tool head 20, but the hole is counterbored at 25 to provide clearance in which the stem may flex, as shown in Fig. 5, to accommodate its head to the exact position of the port 3 or 4. The punch heads 22^a may be made of hardened drill rod.

As already mentioned the ports 3 and 4 are not strictly radial, but are placed at about 16° to the radius. By reason of the obliquity of the ports the punch stems 22^b are necessarily forced out of their normal radial positions as the punch heads 22^a move through the ports, but, whether these ports 3 and 4 are exactly radial or not, it will be evident that the path of each punch as it enters and leaves a port will be of a cycloidal nature similar to the path of a gear tooth meshing with an internal gear, and accordingly, the flexibility of the stems 22^b will facilitate the operation of the punches while permitting the heads 22^a to approximate the size of the ports 3 and 4 which they are to clean out. The full diameter of each punch head 22^a is limited to a comparatively narrow band, and the punch head is undercut at 22^c to further facilitate its actuation in entering and leaving the ports of the sleeve 1.

After several turns of the shaft 10 with the punches operating in the ports 3 and 4, it is only necessary to swing the handle 11 again into alignment with the shaft 10 and remove the sleeve 12 with the plates 13 and 15 from the engine cylinder so as to permit removal of the shaft and tool head 20 therefrom. Then upon removal of the cover plate 26 the carbon which has been forced into the wind chest or air chamber 27 surrounding the engine cylinder can be blown out or washed out by any suitable means, such as a blast of air from a high pressure hose line ordinarily available in service stations and garages.

With a device of this character, it becomes possible to clean out the accumulation of carbon upon merely removing the cylinder head from the engine and without otherwise dismantling the structure and, in view of the facility of the operation, it becomes practicable to attend to the removal of carbon more frequently than heretofore; and each cleaning operation is performed with a

very substantial saving of time as compared with that required when previous methods and devices were employed.

I claim as my invention:

1. A tool for cleaning ports which are disposed circumferentially at intervals in a cylinder, said tool including a shaft, means to support said shaft for rotation at the axis of the cylinder, a tool head provided with radially projecting punches disposed within a circle smaller than the internal diameter of the cylinder, said head being eccentrically mounted for rotation on said shaft with its punches nearest the cylinder wall projecting into the ports thereof, said punches being spaced from each other more widely than the ports and being numerically so related thereto that in one revolution of the shaft the punches enter certain ports and in the next revolution said punches enter certain other ports of the series.

2. A tool for the purpose indicated including a rotatable tool head with punches projecting radially therefrom at uniform intervals, each punch comprising a head portion of approximately conical form with the apex pointed outwardly from the axis of rotation of the tool head, and a relatively slender stem capable of lateral flexure secured rigidly in the tool head at a distance from the head portion of said punch.

3. A tool for the purpose indicated including a rotatable tool head with punches projecting radially therefrom at uniform intervals, each punch comprising a head portion having a limited zone of maximum diameter with adjoining portions tapering outwardly and inwardly therefrom, and a relatively slender stem capable of lateral flexure secured rigidly in the tool head at a distance from the head portion of said punch.

4. A tool for the purpose indicated including a tool head of circular outline with a series of radially disposed recesses at regular intervals in its periphery with punches secured in said head and projecting from said recesses, each punch having a relatively slender stem of smaller cross section than the recess with its inner end rigidly anchored in the head said stem being capable of lateral flexure and the recess affording clearance which limits such flexure, the outer end of the punch comprising a head portion of greater cross section than the stem.

5. A tool for cleaning ports in a cylinder wall, said tool including a shaft, a journal sleeve for said shaft with a centering plate on said sleeve dimensioned to fit the cylinder and a second plate on the sleeve dimensioned to rest against one end of said cylinder and formed to engage the cylindrical wall in position to center the sleeve in the cylinder, and a tool head provided with radially projecting punches and eccentrically mounted for rotation on said shaft with one or more of said punches entered in registering ports of the cylinder.

6. In the combination defined in claim 5, said tool head being carried at one end of said shaft, the other end projecting from the sleeve and including a portion hinged to extend transversely to serve as a handle for rotating the shaft and alignable with the remainder for removal of the journal sleeve.

7. A tool for cleaning ports which are disposed at intervals in two circumferential rows in a cylinder wall, the ports in one row being staggered in relation to the ports in the other row,

said tool including a shaft, means to support said shaft for rotation at the axis of the cylinder, a tool head comprising two parts each provided with radially projecting punches disposed within a circle smaller than the diameter of the cylinder, the shaft having an eccentric portion on which both parts of the tool head are journaled, the punches being spaced at intervals such that those of one part will register successively with ports in one row and those of the other part will register with ports in the other row in the cylinder wall when the shaft is rotated, the punches of one part being staggered in relation to those of the other part, and means connecting the two parts of the head with capacity for limited relative play about the axis of said eccentric portion of the shaft.

8. In the combination defined in claim 7, said connecting means comprising a pin fixed in one part and projecting into a recess in the other part, said recess fitting the pin loosely to provide said play.

9. A tool for cleaning ports in a cylinder wall, said tool including a shaft, a journal sleeve for said shaft with a centering plate on said sleeve dimensioned to fit the cylinder and a second plate on the sleeve dimensioned to rest on the upper end of said cylinder and formed to engage the cylindrical wall in position to center the sleeve in the cylinder, and a tool head eccentrically mounted for rotation on said shaft, said tool head comprising a body of circular outline with a series of radially disposed recesses at regular intervals in its periphery with punches secured in said head and projecting from said recesses, each punch having a relatively slender stem of smaller cross section than the recess with its inner end rigidly anchored in the head beyond the inner end of the recess, said stem being capable of lateral flexure and the recess affording clearance which limits such flexure, the outer end of the punch comprising a head portion of greater cross section than the stem.

10. A portable tool for cleaning ports which are disposed circumferentially at intervals in a cylinder, said tool including a shaft, a pair of centering members spaced apart along the shaft and removably fitted to the internal diameter of the cylinder, supporting the shaft for rotation at the axis of said cylinder, and a tool head provided with radially projecting punches and eccentrically mounted for rotation on said shaft with one or more of said punches entered in registering ports of the cylinder.

11. In the combination defined in claim 10, at least one of said centering members being shiftable along the shaft away from said tool head to facilitate removal of the punches from the cylinder ports.

12. A portable tool for cleaning ports which are disposed circumferentially at intervals in a cylinder, said tool including a shaft, a pair of centering members spaced apart along the shaft and removably fitted to the internal diameter of the cylinder, said shaft having a crank at one end, a cylindrical tool head smaller in diameter than the cylinder journaled on said crank and provided with radially projecting punches spaced around the head at intervals to register successively with the ports in the cylinder wall as the shaft is rotated.

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