P. J. DARLINGTON.

ROTARY MOTOR.

APPLICATION FILED JUNE 17, 1907.

1,041,040.

Patented Oct. 15, 1912.

3 SHEETS—SHEET 1.

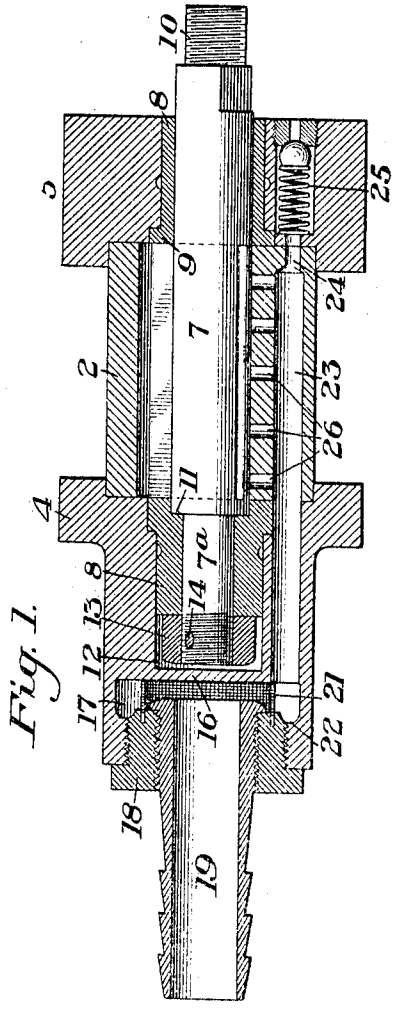

Fig. 1.

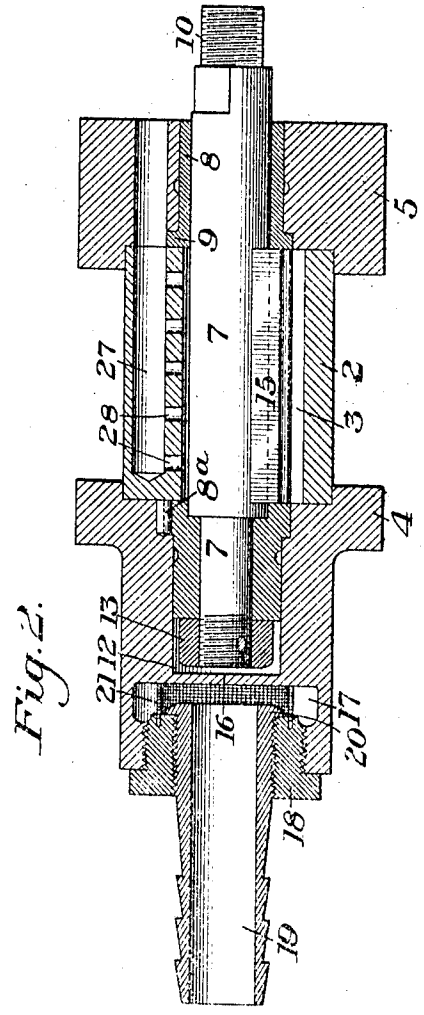

Fig. 2.

WITNESSES

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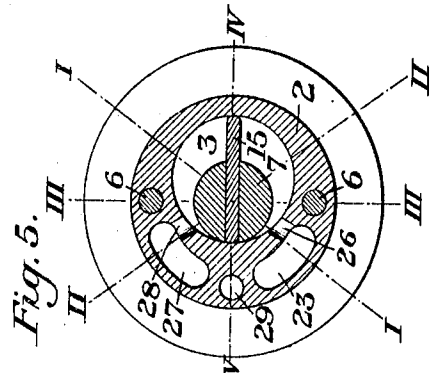

Fig. 5.

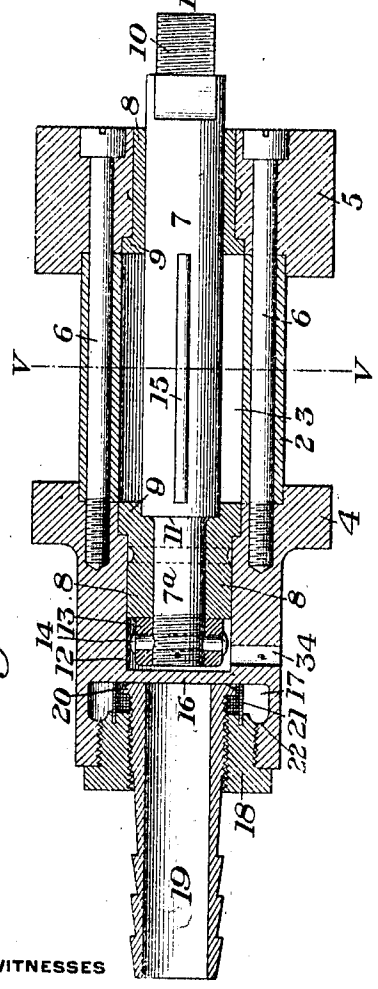

Fig. 3.

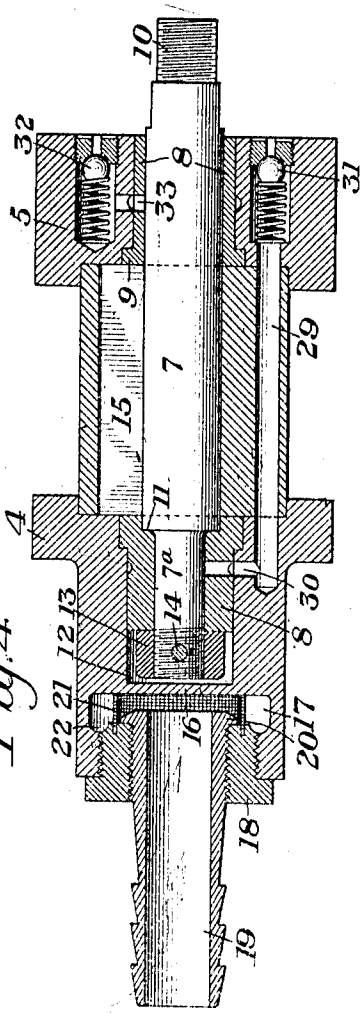

Fig. 4.

WITNESSES

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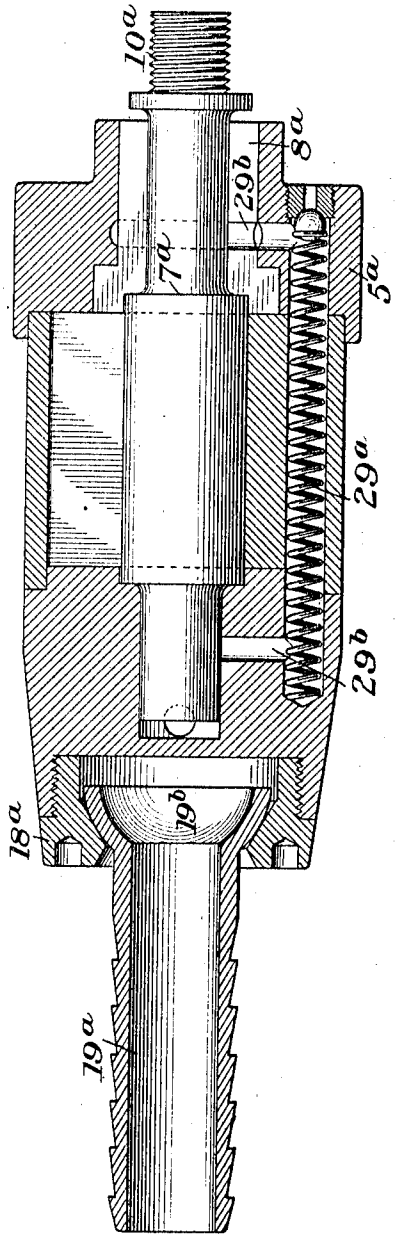

Fig. 6.

WITNESSES

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UNITED STATES PATENT OFFICE.

PHILIP J. DARLINGTON, OF PITTSBURGH, PENNSYLVANIA.

ROTARY MOTOR.

1,041,040. Specification of Letters Patent. Patented Oct. 15, 1912.

Application filed June 17, 1907. Serial No. 379,408.

To all whom it may concern:

Be it known that I, PHILIP J. DARLINGTON, of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Rotary Motors, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figures 1, 2, 3 and 4 are longitudinal sections of one form of motor embodying my invention, taken on the lines I—I, II—II, III—III and IV—IV, respectively of Fig. 5; Fig. 5 is a cross-section on the line V—V of Fig. 3; and Fig. 6 is a longitudinal section showing a modified form of the motor.

My invention relates to the class of rotary motors, and more particularly to a motor of this kind designed to be passed through boiler tubes to actuate a drill or other tool for the removal of scale from the interior of the tubes, although it may be used for other purposes.

The object of my invention is to provide a motor of this character which is simple and inexpensive in its construction; which can be readily adapted to different sizes of boiler tubes; and which can be readily and cheaply inspected and repaired.

A further object is to increase the efficiency and durability of the motor, and to provide means whereby it can be readily started and stopped without the necessity for signaling an assistant at some distant point.

Other important advantages and objects of my invention will be hereinafter pointed out.

With these objects in view, the invention consists in various novel features of construction, combinations and arrangement of the parts which will be best understood from the following description, it being premised, however, that various changes may be made in the details of construction and arrangements of the parts by those skilled in the art, without departing from my invention.

Referring to the accompanying drawings, the numeral 2 designates the cylinder of the motor, having an eccentrically located piston-chamber 3. The cylinder 2 has open ends, and is seated between the front and rear heads 4 and 5 which are formed with recesses to receive the cylinder, the whole being rigidly secured by means of the long screws 6, which extend through the front head 5 and through the wall of the cylinder into the rear head 4, as best shown in Fig. 3.

7 designates the rotary piston shaft which is journaled at its end portions in bushings 8, which are seated in the front and rear heads. These bushings are flanged at their inner ends, as indicated at 9, and are inserted into the heads from the inner sides, the flanges seating in annular recesses of the heads. The forwardly projecting end of the shaft 7 is threaded as indicated at 10, or is otherwise formed, to permit of the attachment of the tool to be operated by the motor. Its rear portion has a shoulder 11 which fits in the recess in the end of the rear bushing 8. The reduced end portion 7^a of the shaft extends through the rear bushing 8 into a chamber 12, and is secured against forward endwise movement by a nut or collar 13 formed therein, or fastened thereon by a pin 14.

15 designates the piston blade which is seated in a slot extending through the piston shaft. This shaft is journaled eccentrically in the chamber 3 and contacts with the wall thereof at one side, between the admission and exhaust ports, as shown in Fig. 5, the edge of the piston blade maintaining contact with the wall of the said chamber at all times.

16 designates a wall or partition in the rear head 4, said partition forming the rear wall of the chamber 12 and the front wall of a chamber 17 also formed in said head.

18 is a reducing nut or bushing which is removably screwed into the rear end of the rear head, and into which is threaded a hose-shank 19, which carries the motor and supplies it with its motive fluid, preferably air. This shank has a flanged end or head 20 which is arranged to be screwed forward into contact with the wall or partition 16 to make an air-tight joint therewith.

21 is a straining cylinder which is located between the inner end of the reducing nut 18 and the wall or partition 16, around the delivery end of the hose-shank within the chamber 17, the latter being preferably cupped or hollowed out to form an annular depression or groove 22.

23 designates an admission port which extends through the thickened wall of the

cylinder 2 and through the rear head 4 into the chamber 17, as most clearly shown in Fig. 1, the forward end of said port being closed except for a communicating oil-passage 24, which extends into and through the front head and is normally closed by a spring-seated valve 25. The admission port 23 is connected with the cylinder chamber 3 by a plurality of cross-ports 26.

27 is an exhaust port also formed in the thickened wall of the cylinder 3, said port being closed at its rear end and being continued at its forward end through to the front face of the front head 5, as most clearly shown in Fig. 2. This port communicates with the cylinder chamber 3 by means of a plurality of cross-ports 28.

29 (see Fig. 4) is a lubricant passage, which extends through the front head, through the cylinder wall, and into the rear head, where it communicates with the rear bearing of the shaft 7 by a passage 30. This passage 29 is normally closed by a spring-valve 31. 32 is a similar valve also seated in the front head, and which normally closes the lubricant passage 33 leading to the front bearing of the shaft 7.

34 is an escape opening leading to the atmosphere through the rear head from the chamber 12. This opening permits the escape of any air that may leak past the rear journal of the shaft 7 and which would otherwise cause forward pressure on the rear end of the shaft and undue friction between the nut or collar 13 and the rear bushing 8.

The operation of the motor is as follows: The hose-shank 19 being screwed forwardly against the partitions 16, thereby cutting off the supply of air to the admission port, the motor is started by holding said shank in one hand and rotating the motor with the other hand in a direction opposite to that of the normal running of the shaft 7. This moves the motor forward on said shank and admits air to the admission port. This position of the motor will be maintained by its reaction while working. The air enters the chamber 17 through the strainer cylinder 21, and thence passes to the admission port 23 and through the cross-ports 26 into the chamber 3, from which it escapes by the rotation of the piston blades through the piston exhaust ports 27 and 28. The motor stops by holding the hose-shank and rotating the motor in the opposite direction to that in which it is rotated in starting, thereby bringing the flange end of the hose-shank against the partition 16 and cutting off the air supply.

To lubricate the motor, it is held with its front end up, and oil is poured in through the valves 25, 31 and 32. The oil introduced at the valves 31 and 32 flows to the front and rear journals or bearings of the shaft 7, while that admitted by the valve 25 flows through the passage 24 and admission port 23 into the chamber 17, from which it is blown into the cylinder by the air. This method of lubricating the cylinder avoids all possibility of oil getting into the hose and damaging the same. The front head 5 is made to fit neatly in the cleaned section of the boiler tube, so that the motor cannot be advanced until all scale has been removed in front of it. For use in straight boiler tubes the rear head is made the same size as the front head to hold the motor parallel and central in the boiler tube.

In Figs. 1 to 5, inclusive, I have shown the two heads as being of considerably larger diameter than the cylinder 2. This permits the use of the same sized cylinder for cleaning many different sizes of boiler tubes, by assembling the cylinder with heads of different diameters. An assembled motor may be also readily reduced to fit tubes of smaller diameter by turning down their heads, which are preferably of soft steel. Worn down heads can be reclaimed by being turned down for use in smaller tubes. The enlarged heads also protect the cylinder, which is preferably of hard steel and is expensive, from wear and injury while at work in the boiler tubes. The force of the blows caused by the reaction of the tool is transmitted from the piston shaft directly through these heavy end heads without strain and without wear or loosening of the joints or of the screws which hold the heads and cylinders together. A further important advantage, due to the use of these heavy end heads is that a large proportion of the weight of the motor is thus caused to be located near its ends, which increases the moment of inertia about a transverse axis and enables the motor to meet the reaction of the tool with less movement of and damage to the motor, and with a corresponding increase in the movement and effectiveness of the tool.

The use of long screws for connecting the cylinder and heads obviates the necessity for threads in the hard steel cylinder, where they would be difficult to form; and the entire construction is such that it is almost impossible for any of the parts to work loose in operation, while at the same time the motor can be very quickly taken apart with no other tools than a screw driver.

A further advantage of my invention is due to the ability to shut off the air at the machine and so stop the motor in changing from tube to tube without depending upon signaling an assistant operator. This also effects both a saving in time and in labor.

The straining cylinder 21 acts to catch all pieces of hose lining or other objects which might clog the ports or block the

piston blades. This cylinder can be readily removed for cleaning.

A further advantage results from the construction whereby endwise movement of the piston shaft is prevented, and from the provision of the air-vent 34 for relieving pressure from behind said shaft, which would otherwise tend to cause serious friction and heating.

The rear bushing 8 may be conveniently secured by means of a dowel pin 8^a seated partly in the rear head and partly in the flanged end of the bushing, as shown in Fig. 2.

The modification shown in Fig. 6 is more particularly designed for use in curved tubes. In this form, the hose-shank 19^a is connected to the reducing bushing 18^a by a ball-and-socket connection 19^b, the air cut-off at this point not being present in this form. Instead of two separate passages for conveying lubricant to the front and rear bearings, a single passage 29^a is provided, having branches 29^b, leading respectively to the two bearings. The thrust, instead of being received upon a rear collar as in the form first described, is taken care of by the integral shoulder 7^a on the piston which bears in a recess in the front bushing 8^a, which is formed in two sections or split. In this form, the front head 5^a is made of such diameter as to fit neatly the interior of the cleaned tube, but the rear head is made of the same exterior diameter as the cylinder where the two come together, and is formed with a reduction or taper toward its rear end to give it sufficient clearance in the tube to permit the motor to pass a curve therein.

What I claim is:—

1. A rotary motor having an air chamber in its rear head communicating with the admission port of the motor, and a supply pipe or shank rotatably secured in said head and arranged to be turned into and out of contact with the inner wall of said chamber; substantially as described.

2. A rotary motor having an air chamber in its rear head communicating with the admission port of the motor, a threaded bushing in the rear end of said chamber, and a threaded supply pipe or shank seated in the said bushing and having a valve end arranged to be screwed into and out of contact with the inner wall of said chamber; substantially as described.

3. A rotary motor having an air chamber in its rear head, an admission port communicating with said chamber, a bushing closing the rear end of said chamber, a supply port through said bushing and leading into said chamber, and an annular strainer carried by said bushing and located in said chamber surrounding the delivery of the supply passage.

4. A rotary motor having a rear head provided with a shaft bearing, a front head also having a shaft bearing, and lubricant passages in the front head, said passages communicating with the front shaft bearing, and one of them extending through the motor cylinder and into the rear head to the rear shaft bearing; substantially as described.

5. A rotary motor having front and rear heads, and a cylinder secured between said heads, the rear head having a chamber communicating with the air supply for the motor and also with the interior of the cylinder, and the front head having a lubricant passage extending therethrough and through the cylinder wall and rear head to the said chamber; substantially as described.

6. A rotary motor having a cylinder, a head closing an end of said cylinder, a piston shaft extending through said cylinder, and a removable bushing in said heading forming a bearing for said shaft, said bushing having a flanged or shouldered inner end lying in a recess of the head and extending radially under the end face of the cylinder.

7. A rotary motor having a cylinder, a head closing an end of said cylinder, a piston shaft extending through said cylinder, a removable bushing in said head forming a bearing for said shaft, said bushing having a flanged or shouldered inner end lying in a recess of the head and extending radially under the end face of the cylinder, and a dowel fitting in matching grooves in the head and bushing and having its inner end covered by the end face of the cylinder.

8. A rotary motor having front and rear heads, a cylinder between said heads, long screws connecting the cylinder and heads, a piston shaft extending through the cylinder, and removable bushings in said heads forming bearings for the said shaft, said bushings having flanged or shouldered inner ends engaging recesses of the head and extending radially under the end faces of the cylinder; substantially as described.

9. A rotary motor having front and rear heads, a cylinder secured between the heads, a piston shaft journaled in the heads, a collar on the rear end of said shaft behind its bearing, an air-chamber surrounding said collar, and means for venting the air chamber; substantially as described.

10. In a rotary motor, a piston shaft, a rear bearing for said shaft, and an air-space adjacent to said bearing, said shaft having a shoulder forming a thrust bearing against the front wall of said air-space; substantially as described.

11. In a rotary motor, a piston shaft, a rear bearing for said shaft, an air-space adjacent to said bearing, said shaft having a shoulder forming a thrust bearing against

the front wall of said air-space, and means for venting said space; substantially as described.

12. In a motor, a cylinder having a longitudinally extending admission port, a head at one end of the cylinder having an admission chamber therein, a supply pipe extending into the admission chamber, and means for filtering the air entering said chamber from said pipe; substantially as described.

In testimony whereof, I have hereunto set my hand.

PHILIP J. DARLINGTON.

Witnesses:

GEO. B. BLEMING,

GEO. H. PARMELEE.