P. J. DARLINGTON.

ROTARY MOTOR.

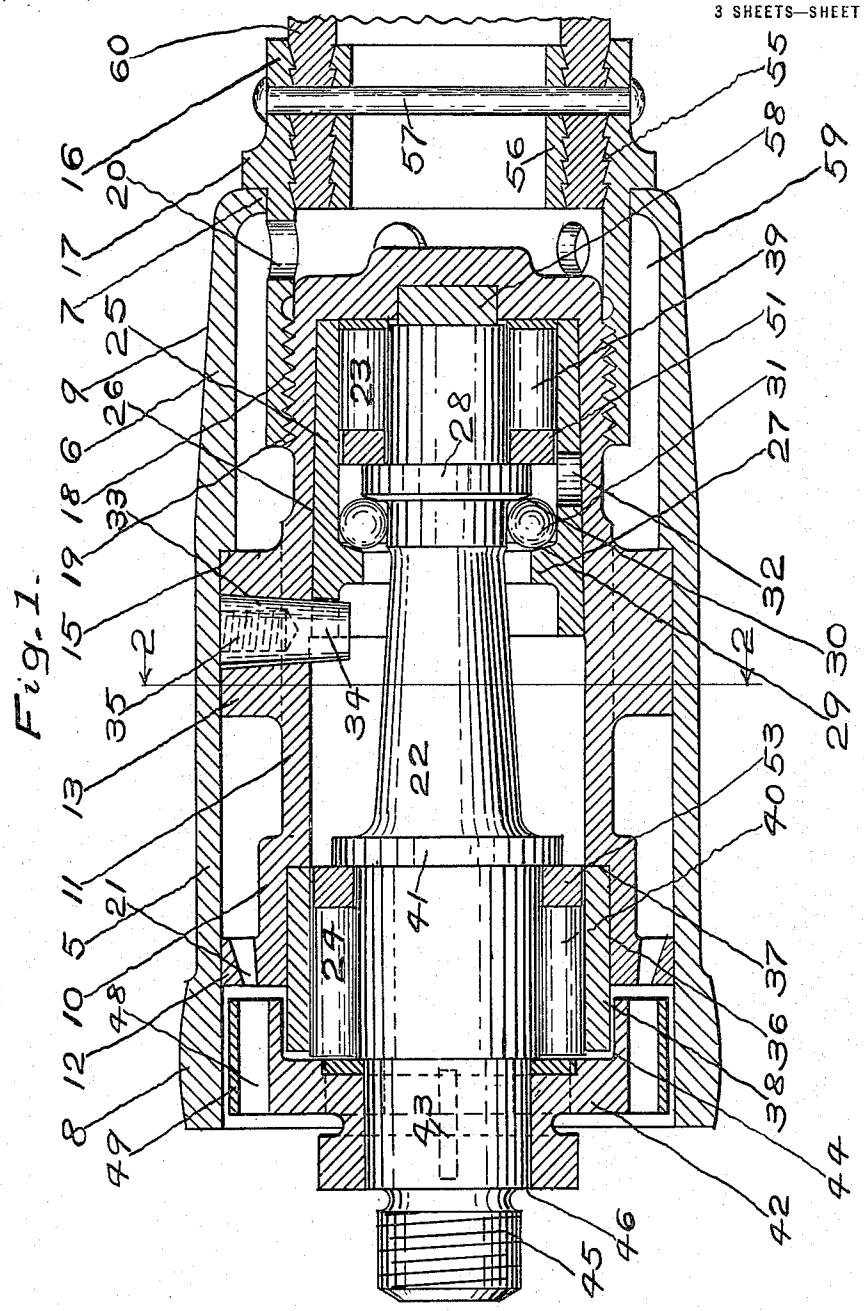
APPLICATION FILED MAY 10, 1915.

1,163,642.

Patented Dec. 14, 1915.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

B. J. Mohr

P. C. Smith

INVENTOR

Philip J Darlington

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

P. J. DARLINGTON.

ROTARY MOTOR.

APPLICATION FILED MAY 10, 1915.

1,163,642.

Patented Dec. 14, 1915.

3 SHEETS—SHEET 2.

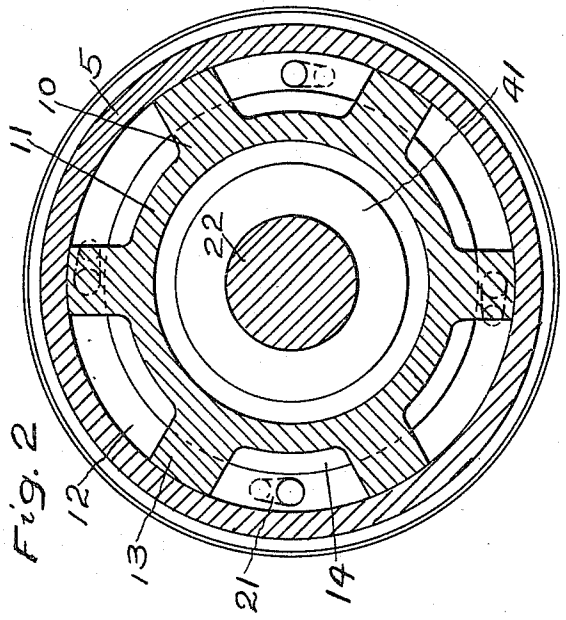


Fig. 2

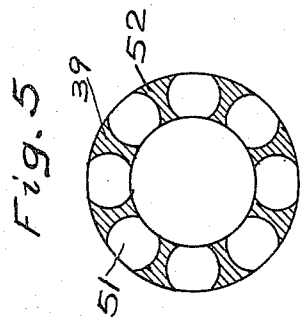


Fig. 5

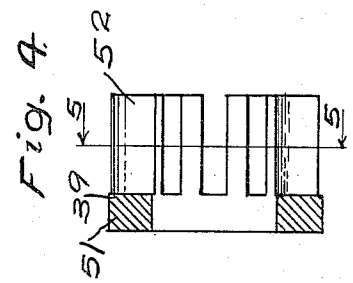


Fig. 4

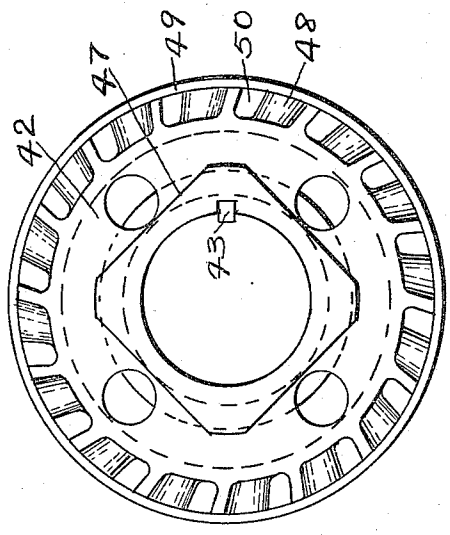


Fig. 3

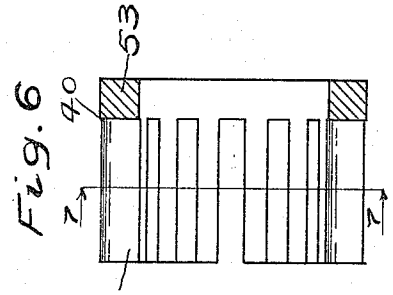


Fig. 6

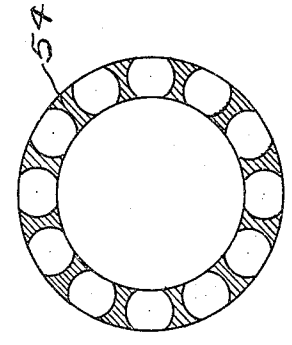


Fig. 7

WITNESSES

B. J. Mohr

P. C. Smith

INVENTOR

Philip J. Darlington

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

P. J. DARLINGTON.

ROTARY MOTOR.

APPLICATION FILED MAY 10, 1915.

1,163,642.

Patented Dec. 14, 1915.

3 SHEETS—SHEET 3.

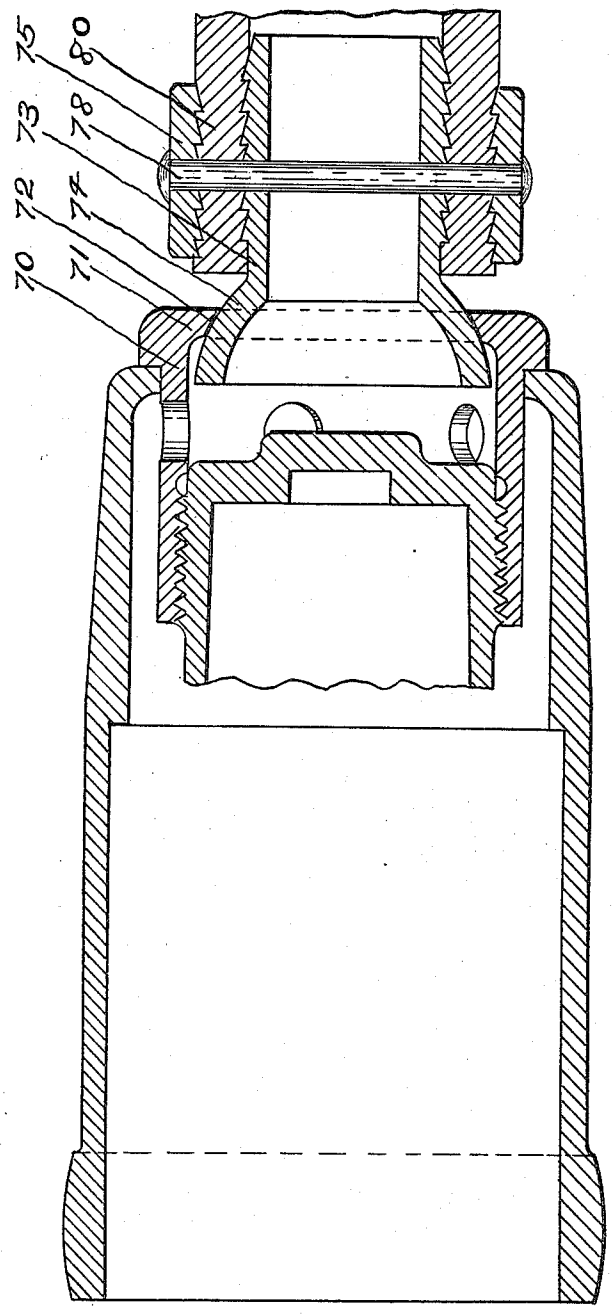


Fig. 8.

WITNESSES

B. J. Mohr

R. C. Smith

INVENTOR

Philip J. Darlington

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

PHILIP J. DARLINGTON, OF HARTFORD, CONNECTICUT.

ROTARY MOTOR.

1,163,642. Specification of Letters Patent. Patented Dec. 14, 1915.

Application filed May 10, 1915. Serial No. 27,139.

To all whom it may concern:

Be it known that I, PHILIP J. DARLINGTON, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented new and useful Improvements in Rotary Motors, of which the following is a specification.

This invention relates to rotary motors of the type employed for boiler tube cleaners.

The object of the invention is to simplify and cheapen the construction of motors of this class and at the same time increase their efficiency and render them longer lived and more easily repaired when the wearing parts become worn.

The invention is applicable to water, steam and air driven motors, for either curved or straight tubes, although it is illustrated and described herein as embodied in a water driven machine for use in curved tubes.

In the accompanying drawings Figure 1 shows a central longitudinal section of a motor constructed according to this invention. Fig. 2 is a transverse section on the line 2—2 of Fig. 1. Fig. 3 is a view of the front face of the turbine wheel. Fig. 4 is a central longitudinal section of the rear bearing cage. Fig. 5 is a transverse section of the rear bearing cage on the line 5—5 of Fig. 4. Fig. 6 is a central longitudinal section of the front bearing cage. Fig. 7 is a transverse section of the front bearing cage on line 7—7 of Fig. 6. Fig. 8 is a central longitudinal section of a modified form of admission member.

The motor includes a cylindrical outer shell 5, preferably of hardened steel, provided at its rear end with an internal flange 6 which is counterbored for a part of its length to form an internal flange 7 at its rear end, forming an annular fluid space 59. Shell 5 has a rounded or crowned external flange 8 at its forward end and an externally tapered portion 9 at its rear end.

Fitting into the shell 5, from its front end, is the frame 10, comprising a hollow cylindrical hub 11, which is closed at its rear end and is provided at its front end with an integral external flange 12. Frame 10 has a plurality of radial arms 13 whose outer ends fit into the bore of shell 5 and form longitudinal fluid passages 14. The arms 13 of frame 10 abut against the front shoulder 15 of flange 6. The flange 12 of frame 10 fits snugly but removably into the bore of shell 5.

An admission member 16 passes through flange 7 and has an external collar 17, which abuts against the rear end face of flange 7. Member 16 has an internal screw thread 18 at its forward end, which fits an external screw thread 19 on the rear end of frame 10, to hold frame 10 in shell 5 against forward shoulder 15 of flange 6. Admission member 16 has radial admission openings 20 communicating from its bore to the counterbore space 59 in flange 6.

The flange 12, at the front end of the frame, has inclined turbine nozzles 21 diagonally through it, equally spaced in circular arrangement near its circumference.

A rotary shaft 22 is supported in frame 10 on rear bearing rollers 23 and front bearing rollers 24.

Frame 10 has a concentric rear bush 25, which is externally tapered and fits into a taper seat 26 in the rear end of frame 10.

Bush 25 has an internal flange 27 near its front end.

Shaft 22 has a rear collar 28, preferably integral, the diameter of which is slightly smaller than the inside diameter or bore of internal flange 27, such that the collar 28 on the shaft may be passed through the flange 27 of the bush.

The rear face of internal flange 27 is, preferably, formed with a conical bearing surface 29.

The forward face of collar 28 is, preferably, formed with a conical bearing surface 30, inclined at the same angle as conical surface 29 and such that a central longitudinal plane cuts conical surfaces 29 and 30 in parallel lines.

Bearing balls 31 are between, and bear upon, conical surfaces 29 and 30, and are held radially in position by the inside surface of bush 25 and the outside surface of shaft 22. A radial hole 32, through the wall of bush 25, is of slightly larger diameter than the balls 31, and is located with its forward edge farther to the rear than the centers of balls 31, so as not to break the bearing surface of balls 31 against bush 25.

A radial tapered dowel pin 33 fits through a tapered seat in one of the radial arms 13, and projects through a semi-circular radial

notch 34 in the front face of bush 25, to hold bush 25 against radial or axial movement. The outer end of pin 33 abuts against the inner wall of shell 5. A concentric threaded hole 35 in the rear end of pin 33 serves as a means of withdrawing pin 33 from its seat when shell 5 is removed.

The front end of frame 10 has a counterbore 36 to an internal shoulder 37. A front bush 38 is seated in counterbore 36 against a shoulder 37, and is, preferably, firmly but removably forced in. Front bearing rollers 24 roll on the inner surface of front bush 38. The rear bearing rollers 23 are loosely supported in the rear bearing cage 39. The front bearing rollers 24 are loosely supported in the front bearing cage 40. Shaft 22 has a forward collar 41, preferably integral, which holds front bearing cage 40 against rearward displacement. A turbine wheel 42 is mounted on the forward end of shaft 22 and secured thereto by a key 43.

Front bearing bush 38 extends forwardly beyond the front face of frame 10 and into a counterbore 44 in the rear end of the turbine wheel 42, which increases the spread of, or distance between, the front and rear bearings and reduces the overhang of the front end of the shaft beyond the bearings.

The forward end of the shaft has a reduced threaded projection 45 to a shoulder 46, flush with the front face of turbine wheel 42, to receive the hub of a driven tool. The forward portion of turbine wheel 42 has wrench flats 47 for use in holding the wheel and shaft against turning, when screwing the tool on or off. The turbine wheel 42 has inclined radial vanes or buckets 48 around its circumference and is completely surrounded by a band or shroud 49, over the outer ends of the buckets, inclosing water passages 50 between the buckets.

Rear roller cage 39 comprises an annular flange 51 and rearwardly projecting spacer arms 52 between which the rear rollers are loosely held. Front bearing cage 40 has an annular flange 53 and forwardly projecting spacer arms 54 between which the front rollers are loosely held. By the use of this rearwardly extending rear bearing cage and forwardly extending front bearing cage, extreme spread or distance between rear and front rollers is obtained.

The inner surface of the rear portion of the admission member 16 has circumferential grooves 55, of saw tooth form in longitudinal section, for the purpose of gripping and securing a pipe 60, preferably of soft and flexible material such as rubber hose. A hose wedge 56 has similar circumferential grooves around its outer surface for the same purpose. A hose rivet 57 passes transversely through admission member 16, the hose 60 and the hose wedge 56 to hold the hose wedge axially in place. This construction insures that both the inner surface of the admission member and the outer surface of the hose wedge will act together in preventing the hose or pipe from pulling out from between them.

The direction of the screw thread on shaft projection 45 is in the same direction, or to the same hand, as screw thread 18 of admission member 16 and screw thread 19 of frame 10, and both of these screw threads advance in direction of rotation of the motor as viewed from the rear looking forward. This results that the turning effort of the motor tightens the driven tool onto the shaft and the reaction of the turning effort of the motor, held against turning by the pipe, tends to screw member 16 farther onto hub 11, drawing frame 10 against shoulder 15 of flange 6 and drawing collar 17 securely against the rear face of flange 7, by which action the entire structure is continually tightened by the turning effort of the motor, while held by the pipe.

A thrust washer 58 is seated in the rear end wall of frame 10 to receive the rear end thrust of shaft 22.

The outside diameter of rear bush 25 is slightly less than the bore or inside diameter of front bush 38, so that the rear bush may be drawn out through the front bush.

Fig. 8 shows a modified construction of the admission member for attachment of the hose where the motor is required to pass very sharp or short bends in the tube to be cleaned. The admission member 70 has an internal flange 71 at its rear end, formed with a conical forward face 72. The hollow hose shank 73 has an externally part spherical front end portion 74, of slightly smaller diameter than the bore of admission member 70, but of larger diameter than rear flange 71 and bearing upon conical face 72, to form a fluid tight universal joint herewith. A hose band 75 and a riveted pin 78 attach the flexible hose 80 to hose shank 73.

In operation, the fluid passes from the hose, through the admission member, outward through the radial openings into the annular fluid space, forward between the arms of the frame and through the turbine nozzles in an inclined direction against the turbine buckets, to revolve the shaft and attached tool.

To take apart the motor, the admission member is unscrewed from the frame and removed from the shell. The entire contents of the shell are then forced forward out of the shell. To take out the shaft from the frame, the dowel pin is drawn, releasing the rear bush. The shaft, rear bush, rear bearings and front bearings are then drawn out through, and without disturbing the front bush.

To remove the balls from the rear bush, the shaft is moved rearwardly until the

collar uncovers the radial hole in the bush, and the balls are then poured out through the radial hole.

It will be noted that the construction is such that the shell has no screw threads formed in it. This allows it to be made of steel and hardened without danger of breaking or cracking it in hardening. The absence of screw threads in the steel shell also avoids danger of rusting fast of the contents, which is a very usual difficulty with other constructions.

This invention allows the use of a very long shaft, with a great spread or distance between the bearings, in the very limited length available for a motor which must pass around sharply curved tubes.

The construction of the rear bearing and rear bush allows the balls to be placed or removed through the radial hole without sliding the shaft back through the rear bush as far as would be required to allow the balls to be placed through the rear end of the rear bush. This makes the construction available for very short motors.

I claim as my invention:—

1. In a rotary motor, an outer cylindrical shell internally reduced in diameter from an internal shoulder to the rear end, a concentric frame removably fitting into the front portion of said shell against said internal shoulder, a hollow concentric pipe connecting member bearing against the rear end face of said shell and screw-threaded onto the rear end of said frame to hold said frame against said internal shoulder in said shell, said pipe connecting member having a fluid passage communicating from its interior to an annular fluid space inside said shell and outside said frame, a rotary shaft mounted concentrically in said shell, and a turbine wheel mounted on said shaft in the forward end of said shell in front of said frame.

2. In a rotary motor, an outer cylindrical shell externally tapered to a smaller diameter at the rear end and internally reduced in diameter from an internal shoulder to the rear end, a concentric frame removably fitting into the front portion of said shell against said internal shoulder, a hollow concentric pipe connecting member bearing against the rear end face of said shell and screw-threaded onto the rear end of said frame to hold said frame against said internal shoulder in said shell, said pipe connecting member having a fluid passage communicating from its interior to an annular fluid space inside said shell and outside said frame, a rotary shaft mounted concentrically in said shell, and a turbine wheel mounted on said shaft in the forward end of said shell in front of said frame.

3. In a rotary motor, a motor body, a rotary shaft, a motor element mounted on said shaft, rear bearing rollers supporting the rear end of said shaft in said body, said rollers being held in alinement by a roller cage comprising an annular body with integral rearwardly projecting spacer arms.

4. In a rotary motor, a motor body, a rotary shaft, a motor element mounted on said shaft, front bearing rollers supporting the front end of said shaft in said body, said bearing rollers being held in alinement by a roller cage comprising an annular body with forwardly extending spacer arms between the rollers.

5. In a rotary motor, a motor body, a rotary shaft, a motor element mounted on said shaft, front and rear bearing rollers supporting said shaft in said body, said rear bearing rollers being held in alinement by a rear roller cage comprising an annular body and rearwardly extending spacer arms between the rollers, said front rollers being held in alinement by a front bearing cage comprising an annular body with forwardly extending spacer arms between the rollers.

6. In a rotary motor, a motor body, a rotary shaft, a motor element mounted on said shaft, a bearing bush having an internal flange, a collar on said shaft, and means for introducing bearing balls through the wall of said bush to a position between said internal flange and said collar.

7. In a rotary motor, a motor body, a rotary shaft, a motor element mounted on said shaft, a removable forward bush laterally supporting the forward end of said shaft on forward roller bearings, a removable rear bush laterally supporting the rear end of said shaft on rear roller bearings and axially supporting said shaft on ball bearings.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses this 8th day of May, 1915.

PHILIP J. DARLINGTON.

Witnesses:
B. A. MOHR,
P. C. SMITH.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."