A. F. KRAUSE.

LIQUID MOTOR.

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969,378.

Patented Sept. 6, 1910.

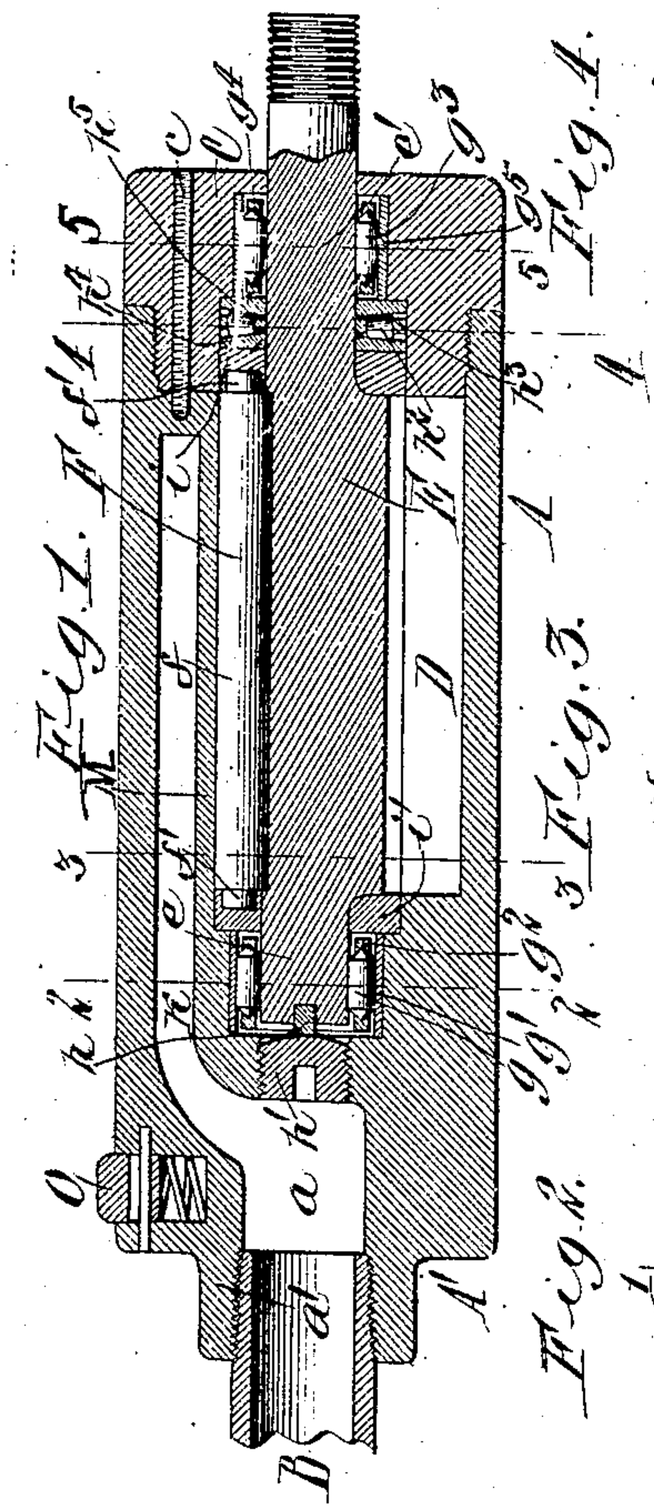

Fig. 1.

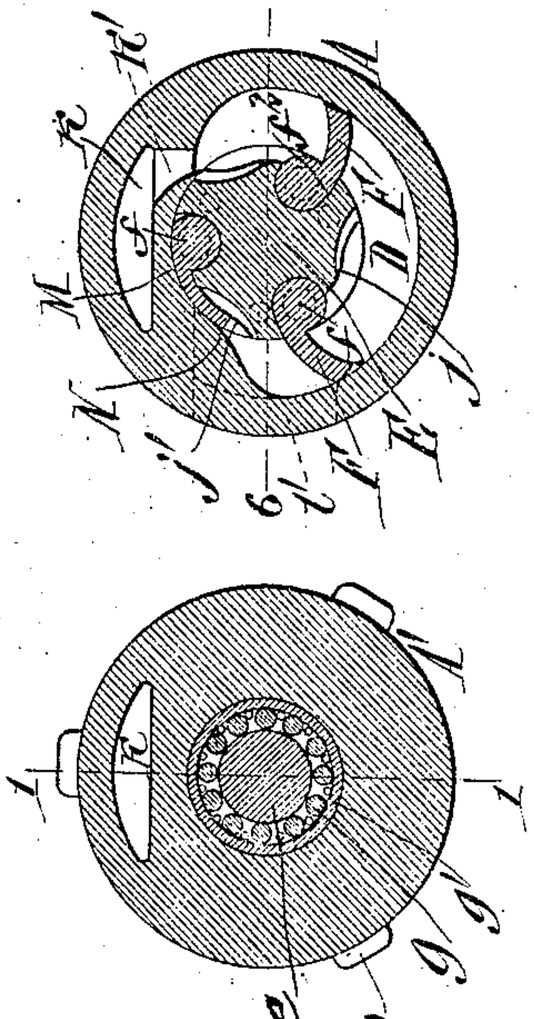

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

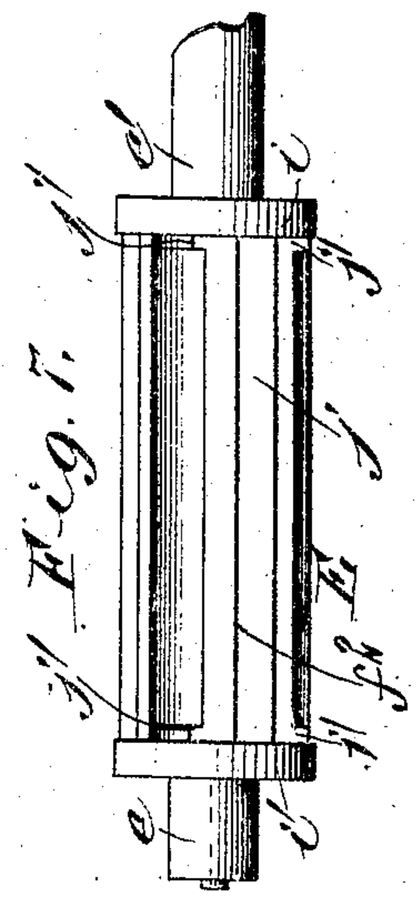

Fig. 7.

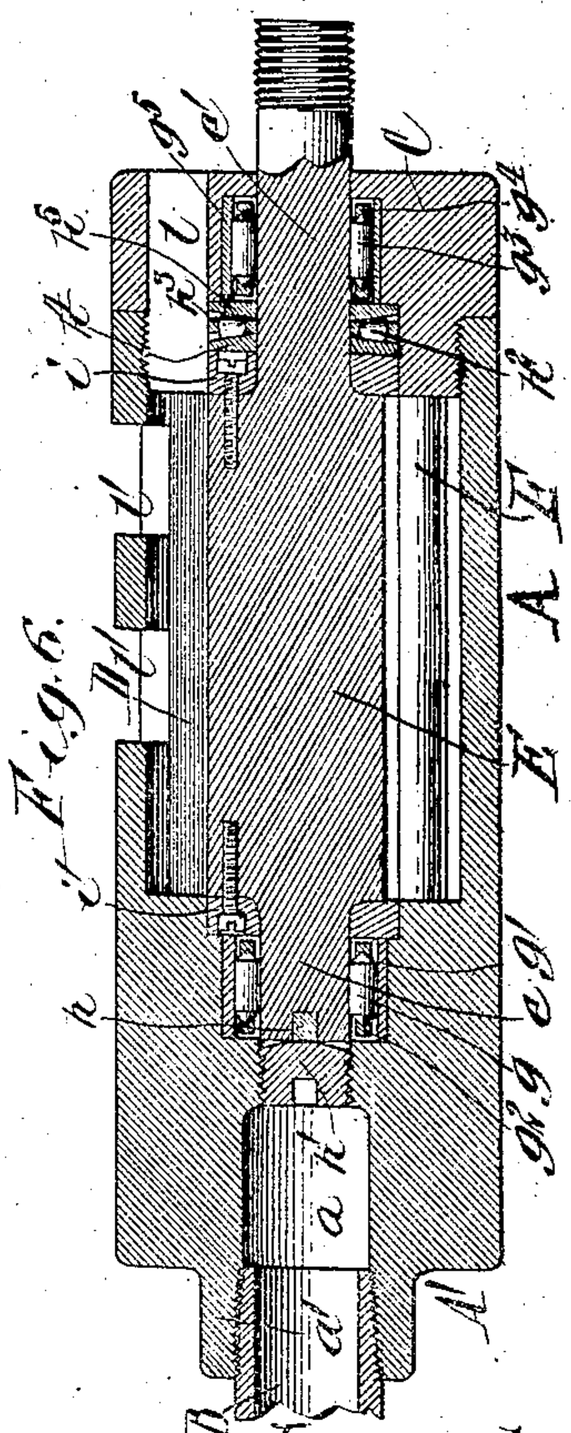

Fig. 6.

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UNITED STATES PATENT OFFICE.

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LIQUID-MOTOR.

969,378. Specification of Letters Patent. Patented Sept. 6, 1910.

Original application filed March 20, 1905, Serial No. 250,954. Divided and this application filed April 6, 1908. Serial No. 425,401.

To all whom it may concern:

Be it known that I, ALBERT F. KRAUSE, a citizen of the United States, and residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Liquid-Motors, of which the following is a specification.

This invention relates to a portable motor adapted to be operated by water pressure or other suitable fluid, and designed more particularly for rotating the cutter head of a boiler tube cleaner of the type employed for removing scale or incrustation from the tubes of water-tube boilers, the motor forming the body of the tool and being pushed through the boiler tube as the cleaning operation progresses.

This application is a sub-division of my application Serial No. 250,954, filed March 20, 1905.

The object of the invention is the production of a simple and compact motor of this character which has the necessary power to operate the cleaner-head in such manner as to effectually and expeditiously detach the scale from the water tubes.

In the accompanying drawings: Figure 1 is a longitudinal section of the motor in line 1—1, Fig. 2. Figs. 2, 3, 4 and 5 are transverse sections on the correspondingly numbered lines in Fig. 1. Fig. 6 is a longitudinal section in line 6—6, Fig. 3. Fig. 7 is a side elevation of the rotary drum omitting the pistons.

Similar letters of reference indicate corresponding parts throughout the several views.

A is the shell or casing of the motor which is preferably cylindrical and sufficiently smaller than the bore of a boiler tube to permit the device to be freely pushed through it. The rear head A^1 of the casing may be integral with the body and provided with an inlet chamber a for the water or other motive fluid and a rearwardly-extending socket a^1 communicating therewith and adapted to receive a water supply pipe B which is connected with the source of supply by a flexible tube or other connection, not shown in the drawings. The front head C of the casing may consist of a screw plug, the reduced inner portion of which engages with the internally screw threaded front end of the casing, this plug being locked in place by a longitudinal screw c or other suitable means.

In the chamber D between the heads A^1 and C is journaled a rotary drum or shaft E carrying retractable wings or pistons F against which the motive fluid acts for turning the drum. The drum is concentric with the casing and its journals e, e^1 are supported in suitable bearings arranged axially in the front and rear heads of the casing, and the journal e^1 extends forwardly through the front head C and carries a cutter-head, not shown in the drawings, or any other suitable tool to be rotated. While these bearings may be of any approved construction, they are preferably of the roller type, as shown.

g indicates the rollers of the rear bearing interposed lengthwise between the adjacent journal e and a bushing g^1 which lines the bearing socket or cavity in the rear head A^1, the ends of the rollers being journaled in suitable retainers g^2. The bearing of the front journal e^1 has similar longitudinal rollers g^3, retainers g^4 and a bushing g^5 seated in a socket of the front head C. In addition to these bearings the journals e, e^1 may be provided with end or thrust-bearings of any suitable construction. In the form shown in the drawings, the rear journal is provided in its end with a projecting hardened pin h which bears against a removable screw plug h^1 seated axially in the rear head A^1, while the front thrust-bearing consists of conical rollers h^2 journaled in retainers h^3 and interposed between corresponding rings h^4, h^5 which surround the front journal. The front ring h^5 abuts against an internal shoulder of the head C, while the rear ring h^4 abuts against a ring i secured to the adjacent end of the drum by a screw or other means, as shown in Fig. 6. A similar ring i^1 is secured to the opposite end of the drum.

As best shown in Figs. 1 and 3, the pistons or wings F are provided with cylindrical knuckles f extending throughout their length and journaled in corresponding sockets in the face of the drum E, and at their ends they are provided with trunnions f^1 seated in bearings formed in the opposing sides of the rings i, i^1. These rings may consist of

flanges formed integral with the drum, but they are preferably separate therefrom to facilitate the manufacture of the device.

The rear walls f^2 of the knuckle-sockets form shoulders against which the pistons abut when fully open, and both the front and rear walls of each socket extend outward so far that a line connecting their outer edges is located on the outer side of the axis of the knuckle f, as shown in Fig. 3. By this construction, each open piston under the pressure of the motive liquid against its face tends to swing on the outer edge of the rear wall f^2 of the corresponding knuckle-socket as a fulcrum and its knuckle bears against the front wall of said socket, thus largely relieving from strain the piston trunnions f^1 which are only required for retaining the knuckle in its sockets while the piston is unfolding. The pistons are preferably curved transversely and fold into pockets or recesses j formed in the periphery of the drum E, so that when closed their backs are flush with the drum. The portions of these pockets which receive the free outer portions of the pistons are somewhat deeper than their inner portions, except at their ends, so as to leave spaces or channels under the pistons when closed which permit the motive liquid or fluid to enter between the pistons and the drum and promptly open the same. The shallow end portions j^1 of the pockets (see Fig. 7) form stops which limit the closing movement of the pistons.

k indicates an inlet passage arranged in the casing on one side of the main or piston chamber D and preferably extending from the inlet chamber a nearly to the front head C. This longitudinal passage communicates with said main chamber by ports k^1 arranged on one side of a longitudinal abutment M against which the piston drum bears and which extends throughout the length of the latter.

l indicates a main exhaust port arranged in the front head C on the opposite side of the abutment M and extending forwardly through the head, as shown in Figs. 5 and 6, and l^1 indicates supplementary exhaust ports arranged in the wall of the chamber D on the same side of the abutment as the exhaust port l. The abutment thus separates the inlet side from the outlet or exhaust side of the chamber D. The drum is considerably smaller in diameter than this chamber to leave an intervening space across which the pistons extend when opened by the water pressure, their outer edges bearing closely against the inner side of the chamber and preventing leakage at these points.

N indicates a stationary cam or incline located in the chamber D near its exhaust ports l^1 and merging into the concave face of the abutment. As the pistons approach the abutment their convex backs come in contact with said cam and are gradually closed, thus avoiding the noise and shock incident to a sudden closure of the pistons.

It will now be understood that the water or other motive fluid under pressure enters the inlet chamber a and passes thence through the longitudinal inlet passage k and ports k^1 into the main chamber D. As the closed pistons successively pass the abutment M and arrive opposite the ports k^1, the motive fluid swings them into their open or projecting position and by filling the portions of the chamber between the inlet ports k^1 and the pistons causes the latter to be subjected to the pressure under which the fluid enters the chamber, thereby rotating the drum at a high speed. When the pistons reach the exhaust side of the chamber D, they are folded into the pockets j by contact with the cam N and the abutment M and the spent water is exhausted laterally through the ports l^1 and forwardly through the port l. By exhausting the water from the motor casing both laterally and forwardly, the boiler tube in which the device is inserted, is constantly flushed during the operation of the tool, washing out the scale as rapidly as it is detached.

In order to support the motor clear of a surrounding boiler tube and prevent binding or blocking of the same by the detached scale, the casing is provided near its front and rear ends with yielding centering pins or plungers O, preferably three in each set, which are adapted to bear against the tube.

An important feature of the invention is the central location of the piston shaft or drum in the casing concentrically with the latter and the chamber D and the arrangement of the inlet passage k lengthwise of the casing on one side of the drum. This construction permits the use of a strong and solid piston shaft and at the same time enables the motor to be made sufficiently small and compact to enter boiler tubes of comparatively small diameter. As the movable pistons are arranged lengthwise of the casing and parallel with the shaft, they can be extended longitudinally and correspondingly increased in area without at the same time enlarging the diameter of the motor casing, producing a small-sized motor of relatively great power which is especially advantageous for rotating at high speed the cutter head of a boiler tube cleaner of the type employed for removing scale from water tubes.

The casing is subjected to considerable strain and by forming the same, its rear head and the abutment M in one piece, it is greatly strengthened, the abutment contributing largely to this result by acting as a brace. The piston drum is also subjected to great strain in the operation of the tool, and by constructing and arranging the bearings as shown and described they effectually

withstand the same. Owing to the comparatively small diameter of the motor, the available space for the bearings is limited; yet it is essential that they be strong and of the largest possible area. Roller bearings with surrounding bushings have been found efficient for this purpose, inasmuch as the bushings have a tendency to become tighter by use, avoiding buckling and breakage of the same which occurs when they are applied to the drum-journals.

I claim as my invention:

1. A fluid pressure motor for boiler tube cleaners, comprising a cylindrical casing, a shaft journaled in the casing concentrically therewith and separated therefrom by an intervening piston chamber, an abutment in said chamber, and movable pistons carried by said shaft and coöperating with said abutment, the casing having in its rear end a fluid inlet arranged substantially in line with said shaft, and an inlet passage connecting said inlet with the piston chamber, said passage being arranged in the side wall of the casing lengthwise thereof.

2. A fluid-pressure motor for boiler tube cleaners, comprising a cylindrical casing, a shaft journaled in the casing concentrically therewith and separated therefrom by an intervening piston-chamber, an abutment in said chamber adjacent to the shaft, and movable pistons carried by the shaft, the casing being provided in its rear end with a fluid-inlet arranged in line with said shaft and a longitudinal inlet-passage leading from said inlet to the piston-chamber on one side of said abutinent, the rear end of the shaft terminating short of said inlet and its front end extending forwardly beyond the piston-chamber.

3. A fluid pressure motor for boiler tube cleaners, comprising a cylindrical casing, a shaft journaled in the casing concentrically therewith and separated therefrom by an intervening piston chamber, an abutment in said chamber adjacent to the shaft, and movable pistons carried by the shaft, the casing being provided in its rear end with a fluid inlet and in its side wall with a longitudinal passage leading forwardly from the inlet, said passage communicating with the piston chamber by a transverse passage arranged on one side of said abutment.

4. A fluid pressure motor for boiler tube cleaners, comprising a cylindrical casing, a shaft journaled in the casing concentrically therewith and separated therefrom by an intervening piston chamber, an abutment in said chamber adjacent to the shaft, and movable pistons carried by the shaft and arranged parallel therewith, the casing having in its rear end a fluid inlet arranged in line with said shaft and in its side wall a longitudinal passage communicating with said inlet and extending throughout the length of the piston chamber, said longitudinal passage communicating with the piston chamber by a transverse passage or passages.

Witness my hand this 31st day of March, 1908.

ALBERT F. KRAUSE.

Witnesses:
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