

[54] **MOTOR PISTON TUBE CLEANER**

[76] Inventor: **Harold L. Richter**, 7950 Hawthorne Ave., Miami Beach, Fla. 33141

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[51] Int. Cl. **B08b 9/02**

[58] Field of Search **15/104.1 R, 104.11, 104.1; 173/155; 175/162; 266/42**

[56] **References Cited**

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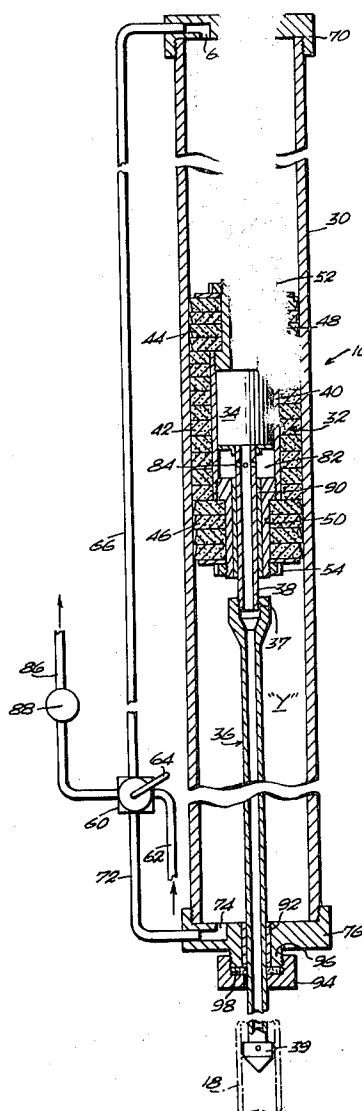
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Primary Examiner—Edward L. Roberts

[57] **ABSTRACT**

A motor piston tube cleaner for providing controlled reciprocating and rotary action externally of its self-contained cylinder housing. A coaxial vane or turbine displacement type rotor is incorporated in the piston, the energy source for the motor piston can be a fluid such as water, gas or steam. The device is used for drilling, cleaning or brushing the interior of various sizes of tubes used in coolers, condensers, heat exchangers, reactors, boilers, etc., plus many other applications such as for drilling long holes in materials such as cement or plastics, for example.

10 Claims, 2 Drawing Figures



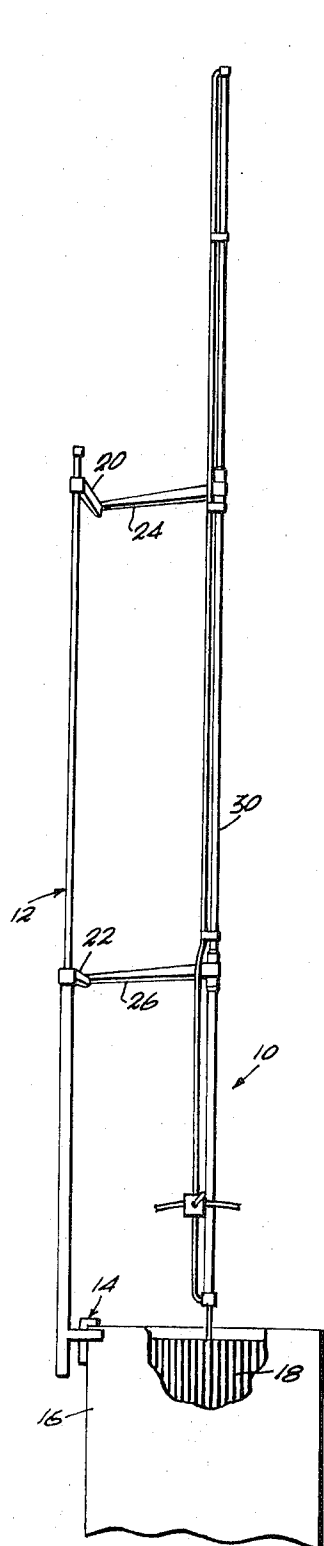


Fig. 1

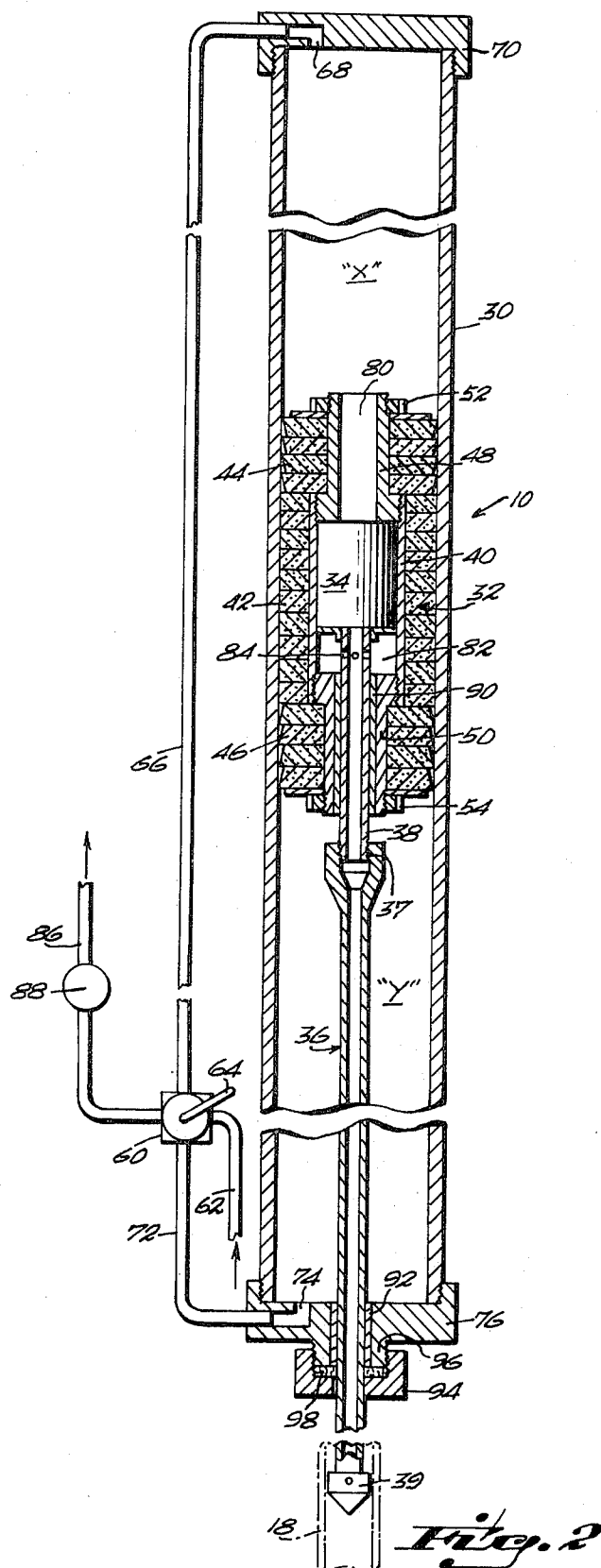


Fig. 2

MOTOR PISTON TUBE CLEANER

FIELD OF THE INVENTION

The device of the present invention pertains to a self-contained motor piston tube cleaner for providing a controlled reciprocating and rotary action for cleaning, drilling or brushing various sizes of tubes used in heat exchangers, coolers, condensers, reactors, boilers, etc.

Tubes in such devices are subject to deposits which cover a wide range from flint hardness to a soft gummy nature and it is imperative that such deposits periodically be cleaned from within the tubes. Accumulated scale reduces efficiency and considerably increases the cost of plant operations. For example, the serious effect of low heat exchanger output on production schedules cannot be tolerated, particularly in plants working "around the clock." Such heat exchangers contain a bundle of many tubes, each of which may be 30 feet or more in length. In the past, when the tubes of such devices have become plugged with scale, it has often become necessary for a complete shut-down of production for one or two months to accomplish a complete cleaning of the tubes resulting in a truly staggering financial loss to the industry as well as to the employees.

OBJECTS AND ADVANTAGES OF THE PRESENT INVENTION

One of the principal objects of the present invention is to provide a self-contained motor piston tube cleaner which will clean or remove all kinds of deposits, including hard scale, from tubes of the aforementioned nature at a very rapid rate of speed such as thirty feet in a fraction of a minute.

Another object of the present invention is to provide a tube cleaner comprised generally of an elongated cylinder with a reciprocating piston therein, said piston containing a power source such as a coaxial vane or turbine displacement type rotor. The energy source for the power unit may be a fluid, such as water under pressure, gas or steam, for example.

Yet another object of this invention is to provide an elongated tubular drill shaft from the piston, extending outwardly of one end of the cylinder for the reception of an appropriate tool on its working end to accomplish the desired drilling, cleaning or brushing operation.

A further object of the invention is to utilize the single energy source such as water to power the vane or turbine for rotary action as well as the reciprocating movement of the tool through the tube.

A still further object of the present invention is to utilize said energy source, such as water, for passage through the elongated tubular drill shaft to cool the tool during a drilling operation and/or to flush the residue from the tube.

Another object of this invention is to provide a single manual control means, such as a four way valve, whereby the energy source may be reversed, relative to the piston, while continuing to drive the tool by means of the rotor during withdrawal of the drill shaft and tool from a tube.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of a typical application of the motor piston tube cleaner of the present invention, set up for operation in a vertical disposition; and

FIG. 2 is a longitudinal sectional view through the motor piston tube cleaner device of the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

With reference to the drawings in which like reference characters designate like or corresponding parts throughout both views, the motor piston tube cleaner 10 of the present invention is illustrated mounted to a stanchion 12 fixed at 14 to a shell 16 containing a bundle of elongated tubes 18 to be cleaned.

For the purpose of providing for movement of the tube cleaner 10, pairs of pivotally connected arms 20, 22 and 24, 26 are fixed respectively to the stanchion 12 and tube cleaner 10. In this manner, the tube cleaner can be readily axially aligned with each of the tubes 18 comprising said bundle.

It should be understood that the tube cleaner of the present invention is a demountable, highly portable device and the illustration in FIG. 1 is by way of example only; the mounting stanchion forms no part of this invention which may in fact be mounted to a variety of support means for horizontal or vertical operations at ground level or at any elevation to accommodate the normal position or elevation of the tubes to be cleaned.

With reference to FIG. 2, the motor piston tube cleaner 10 of the present invention is comprised generally of an elongated barrel or cylindrical tube 30 containing a reciprocating piston 32 having an axially mounted vane or turbine type of displacement motor 34 fixed therein. An elongated tubular drill shaft 36 is mounted at 37 to a tubular rotor shaft 38 for rotation therewith, said drill shaft 36 extends outwardly of one end of the barrel 30 and has fixed to its outer end an appropriate tool 39 as determined by the drilling, cleaning or brushing operation to be performed.

In more detail, the motor 34 is fixed within a sleeve 40 which is of a reduced diameter relative to the I.D. of the barrel 30. A stack of piston torque washers 42 fill the space between the sleeve 40 and the inside wall of the barrel and stacks of peripherally beveled piston seals 44 and 46 fill the space between a pair of fittings 48 and 50, screw threaded to the opposed ends of sleeve 40 and extending outwardly therefrom in opposite directions, and the inside barrel wall.

The respective outer ends of the fittings 48 and 50 are screw threaded to receive adjustment nuts 52 and 54. In a preferred form of the invention, the piston seals and torque washers are formed of neoprene or a similar material and act as a relief clutch in case of jamming of a tool bit. Clutch tension is set by tightening or loosening the adjustment nuts 52 and 54 which control the expansion or contraction of the piston seals 44, 46 and torque washers 42. If desired, the barrel 30 and motor piston 32 may be splined or keyed together or shaped other than round such as oval, square, etc.

As previously stated the energy source for the motor 34 can be a fluid, water, gas or steam and will be hereinafter referred to as water under pressure. A conventional manually operated four-way valve 60 receives the pressurized water from a source of supply through a conduit 62. Control handle 64 on the valve 60 provides selective manual control means for directing the pressurized water through a conduit 66 to a port 68 in a first barrel end cap 70 for advancing the drill shaft 36 or through a second conduit 72 to a port 74 in a second barrel end cap 76 for retracting the drill shaft 36.

In operation, the drill shaft 36 is positioned to locate the tool 39 relative to the tube to be drilled, cleaned or brushed and the four-way valve 60 is actuated to direct the pressurized water through the conduit 66 to the interior portion of the barrel designated "X." As the water pressure increases it flows into the piston inlet 80 in fitting 48 to the vane or turbine motor 34. The water exhausts through the motor 34 into chamber 82, and through ports 84 into the tubular drill shaft 36 to, and out of the tool holder for tool 39. This flow of water acts as a coolant for the cutting tool 39 as well as a scavenger supply to wash away any cuttings or debris from the tube being drilled or cleaned.

This initial flow of pressurized water also activates the motor 34. As the water pressure increases due to the limited openings of exhaust ports 84, the motor piston 32 moves toward barrel portion "Y" advancing the tool through the tube to be drilled or cleaned, simultaneously rotating said drill shaft and tool 36 and 39 by means of motor 34.

Water in the barrel portion "Y" is exhausted through port 74, conduit 72 and an exhaust conduit 86. Reversing the four-way valve 60 admits pressurized water into the barrel portion "Y" through conduit 72. As the water pressure increases, the motor piston 32 travels through barrel portion "X" back to its starting position, ready to repeat the cycle.

As the motor piston 32 returns to the starting position, water trapped in barrel portion "X" is forced out through the motor 34, keeping it operating, through ports 84 to the tool 39 and through port 68, conduit 66, through the four-way valve 60 and exhaust conduit 86. Rotary and reciprocal speeds are determined by inlet and exhaust pressures set by the four-way control valve 60 and by a pressure relief valve 88 in exhaust conduit 86.

The tubular rotor shaft 38 rotates in a bushing 90 carried in the fitting 50 while the drill shaft 36 is journaled in a bushing 92 fixed in the second end cap 76. A packing nut 94 is screw-threaded onto a boss 96, extending outwardly from said end cap 76, to retain a suitable packing 98 to seal the barrel portion "Y."

What is claimed is:

1. A device for driving a tool carrying drill shaft for drilling elongated holes or for drilling, cleaning or brushing the interiors of tubes of the nature contained in heat exchangers, coolers, condensers, etc., comprising:

A. an elongated barrel defining a column having a first end and a second end and including,
1. first and second end caps, said barrel having a port adjacent each of the opposite ends, said second end cap having an opening;

B. a piston for reciprocating movement in said barrel between the end caps including,

1. motor means fixed within said piston, and means to supply drive fluid to the motor means and to provide exit means for the drive fluid including port means extending in fluid communication through said piston and means exteriorly of the barrel to provide fluid communication means between the ports adjacent the opposite ends;

C. a drill shaft rotatably attached to a rotor shaft extending outwardly from said motor, said drill shaft

extending through the opening of said second end cap for the detachable reception of a tool on its extended end, outwardly of said second end cap;

D. a fluid power means;

E. conduit means;

F. four-way valve means connected in said conduit means for selectively directing said fluid power means through said ports adjacent each of the opposite ends into corresponding end portions of said barrel to cause reciprocating movement of said motor carrying piston within said barrel and to simultaneously energize said motor to cause rotary movement of said tool carrying drill shaft.

2. The device as defined in claim 1 wherein said motor is fixed within a sleeve which is carried in axial alignment within said piston.

3. The device as defined in claim 2 wherein said piston is comprised of a stack of compressible piston torque washers in the area of said sleeve and first and second stacks of compressible piston seal washers extending outwardly from opposed ends of said piston torque washers.

4. The device as defined in claim 1 including bearing means, extending through said piston, to rotatably journal said rotor shaft from said motor, said rotor shaft being fixed at its outer, extended end to the inner end of said drill shaft.

5. The device as defined in claim 4 including a pair of adjustment nuts, screw threaded respectively onto the opposed outer ends of first and second fittings, attached to the opposed ends of said sleeve, said first fitting providing a through opening comprising said inlet port means and said second fitting providing an inner axially extending bushing comprising said bearing means.

6. The device as defined in claim 5 wherein each washer of said first and second stacks of piston seal washers is annularly beveled, said pair of adjustment nuts normally being engaged against the respective outer ends thereof whereby the compression forces against both of said stacks of piston seal washers and said stack of piston torque washers, disposed therebetween, can be adjusted.

7. The device as defined in claim 4 including a fluid exhaust chamber in said sleeve, between said motor and second fitting, and relatively small exhaust ports opening from said exhaust chamber through the wall of said tubular rotor shaft.

8. The device as defined in claim 7 wherein the interior of said tubular drive shaft communicates between said tubular rotor shaft and fluid exhaust port means in the tool holding end of said drill shaft.

9. The device as defined in claim 1 wherein said conduit means comprises a first conduit to direct said fluid drive means from a source of supply to said four-way valve, second and third conduit means to selectively direct said fluid drive means from said four-way valve, respectively, through said first or second end cap into the corresponding end portion of said barrel and a fourth, exhaust conduit connecting to said four-way valve.

10. The device as defined in claim 9 including a pressure relief valve in said exhaust conduit.

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