July 3, 1928. 1,675,738

L. R. TITCOMB ET AL

NOZZLE PROPELLING MECHANISM AND METHOD OF PROPELLING THE SAME

Filed Oct. 19, 1926 2 Sheets-Sheet 1

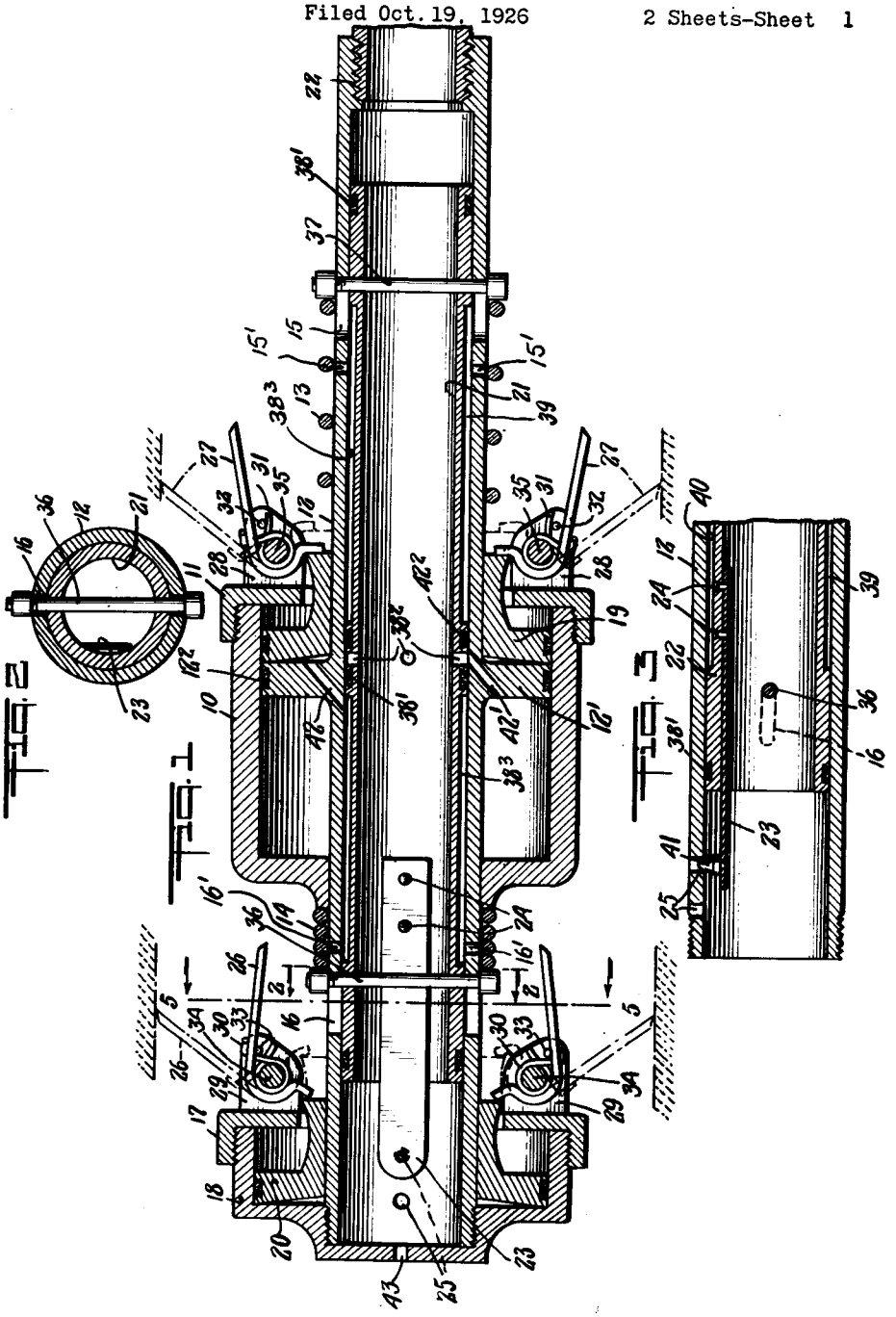


FIG. 2

FIG. 1

FIG. 3

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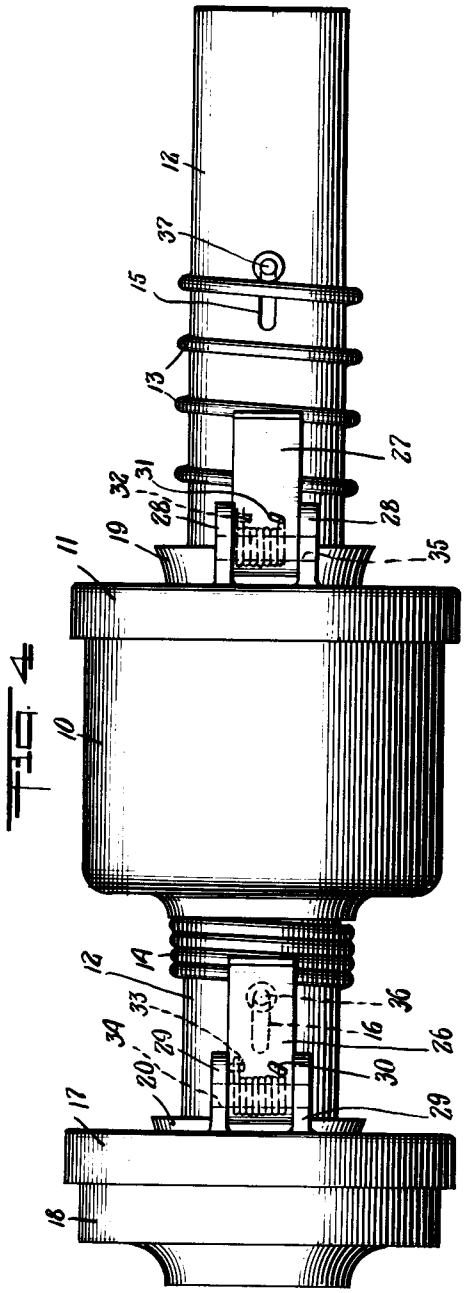


Fig. 4

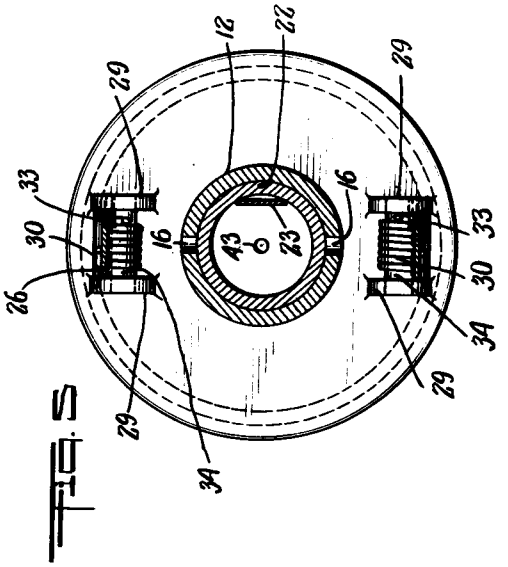


Fig. 5

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Patented July 3, 1928. 1,675,738

UNITED STATES PATENT OFFICE.

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NOZZLE-PROPELLING MECHANISM AND METHOD OF PROPELLING THE SAME.

Application filed October 19, 1926. Serial No. 142,760.

This invention relates to a new and improved nozzle propelling mechanism, and a method of propelling the same.

One of the objects of this invention is to provide a nozzle which will be positively impelled forwardly into a sewer or the like with great force by means of the action of a jet of water, air, or any fluid passing through the same and which issues therefrom through a restricted opening so as to wash away the obstructing matter. This forwardly directed jet of water can operate cutters, brushes, or the like, of the well-known type to mechanically act upon obstructing matter. The use of any aeriform fluid is to be considered as equivalent to the use of water, whenever water is mentioned herein.

Another object of this invention is to provide a nozzle consisting of two relatively slidable parts, each said part or one of said parts alone being provided with gripping fingers adapted to be forced outwardly by the water pressure within the nozzle so as to positively engage the walls of the sewer and the like and prevent the backward movement of the respective parts save when the water pressure has been released.

Another object of this invention is to provide a device of the type described in the last paragraph and also embodying a piston member and a cylinder member for imparting a positive intermittent motion to the respective parts of the nozzle.

Another object of this invention is to provide a simple and reliable control for the propulsive action of the water forced into the nozzle.

Other objects of this invention will be set forth in the following description and drawings which illustrate preferred embodiments thereof, it being understood that the above general statement of the objects of this invention is intended merely to generally explain the same and not to limit it in any manner.

Fig. 1 is a vertical central section illustrating one embodiment of this device.

Fig. 2 is a section on the line 2—2 of Fig. 1.

Fig. 3 is a detail sectional view.

Fig. 4 is a side elevation.

Fig. 5 is a section on the line 5—5 of Fig. 1.

Heretofore, nozzles have been utilized for cleaning sewers, pipes and the like, in which a jet of water forced into a nozzle was wholly or partially deflected so that it escaped rearwardly from the nozzle, so that the reaction on the nozzle caused it to be impelled forwardly. Nozzles of this type have been subject to serious disadvantages. When said nozzles were made of large sizes or diameters, the reaction of the deflected water proved effective for forcing the nozzle forwardly, but the forward propulsion of the nozzle was often too rapid, because it is desirable not to force the nozzle through the obstructing matter but to move the nozzle immediately adjacent the obstructing matter to cause the same to be washed away by the water flowing forwardly out of the nozzle. In smaller sizes, and particularly in nozzles having hose or pipe connections of diameters of less than one and a half inches experience has shown that the nozzle could not be propelled with sufficient force to drag along the weight of the nozzle and the rubber pipe connected thereto.

According to this invention, the water flowing through the nozzle is, in effect, caused to operate a hydraulic motor which forces the nozzle forwardly with a speed which can be regulated, while a forwardly flowing jet of water is caused to wash away the obstructing matter.

In the embodiment shown in Fig. 1, for example, the device comprises an outer casing 12 provided with two short longitudinal slots 15 and 16. The rear of the casing 12 is provided with a coupling member 22 to which the end of a flexible rubber pipe or the like can be connected so as to force water under pressure into the interior of the casing 12.

A slide valve 38 is provided in the interior of the casing 12. This slide valve 38 is provided with end piston-like parts provided with packing rings 38′ so as to snugly fit the interior of the casing 12, and it also has a central piston-like part also provided with packing rings 42^2 and 38′. The central piston-like part is also provided with any suitable number of perforations 38^2 and these communicate with an external recess which forms, in effect, a port whereby the water forced into the cylinder 10 can intermittently actuate the nozzle, as will be later more fully described.

The front of the casing 12 is provided with an internally threaded cylinder cap

18 and this cap 18 has a front opening 43 through which a restricted amount of the water can constantly pass to wash away the obstructing matter. The cap 18 has a cylindrical longitudinal wall in which a piston 20 is located. The rear of the cap 18 is closed by a threaded rear cap 17 to which brackets 29 are connected. Each of said brackets 29 carries a pin 34 on which a holding finger 26 is pivoted. Each pin 34 is provided with a spiral spring 30, one end of which is connected to a fixed pin 33 and the other end of which bears against the respective finger 26 to move it normally into the inner or inoperative position shown in full lines at the left-hand side of Fig. 1. The rear end of the front piston 20 abuts extensions of the front fingers 26, so that when the front piston 20 is actuated rearwardly, the fingers 26 are moved outwardly to the clutching position, so that their ends engage the wall of the sewer or pipe, said clutching position being indicated in dotted lines at the left-hand side of Fig. 1.

The front end of the casing 12 is provided with two lateral perforations 25 as shown more clearly in Fig. 3, so that water under pressure always acts upon the front face of the front piston 20 to move it rearwardly and to turn the front fingers 26 into the operative position. However, when the water pressure is shut off, the springs 30 operate to move the piston 20 into the position shown in Fig. 1.

The middle portion of the casing 12 is provided with a lateral flange 12′ and this flange 12′ is provided with parallel ports 42 and 42′. The flange 12′ is provided with a piston ring 12^2 and the cylinder member 10 is slidably mounted upon the flange 12′. The rear of the slidable cylinder member 10 is provided with an internally threaded cap 11 and a rear piston 19 is located behind the flange 12′. Each of the ports 42 and 42′ could be replaced by a plurality of ports each similar to that illustrated herein. The right-hand side of the device shown in Fig. 1 is provided with fingers 27 similar to the fingers 26 and these are mounted upon pins 35 connected to brackets 28, which are connected to the cap 11. Spiral torsion springs 31 have the same function as the springs 30 before mentioned, and they bear against pins 32 fixed to the brackets 28. When water under pressure is delivered to the port 42 the rear piston 19 is moved rearwardly to move the fingers 27 into the outer or operative position.

The slide valve 38 is provided with pins 36 and 37 which slide respectively in the slots 16 and 15 so as to prevent the slide valve 38 from turning in the casing 12.

A compression spring 14 is provided intermediate the front end of the cylinder member 10 and the pin 36 and a similar compression spring 13 is provided intermediate the rear pin 37 and the rear end of the adjacent piston 19.

The front end of the slide valve 38 is provided with a blade spring 23 which is connected thereto by means of rivets 24. The front end of the blade spring 23 is provided with a tapered detent or latch 41 which fits within the holes 25.

The operation of our device is as follows:—

When water or air under pressure enters the rear end of the casing 12, it passes immediately through the hollow valve 38 and then through the front hole 25 into the member 18, so that the pressure of the water forces the piston 20 rearwardly. This moves the fingers 26 from the position shown in full lines in Fig. 1 to the position indicated in dotted lines, so that the said fingers 26 engage the wall of the pipe. Hence, the fingers 26 prevent any substantial rearward movement of the casing 12, because the piston 20 has a very short effective stroke, and it acts as an abutment to limit the rearward movement of casing 12, when the fingers 26 are in the operative position.

The water also passes through the openings 38^2 into the continuous annular recess in the slide valve 38 which communicates with said openings 38^2, so that the water passes through the port 42′ in the flange 12′ and acts to force the casing 12 rearwardly and to urge the cylinder member 10 forwardly. The casing 12 cannot be actuated rearwardly because of the holding action of the fingers 26, which holding action increases if a backward force is impressed upon the casing 12. The forward force acting upon the cylinder member 10 acts upon the pin 36 by means of the intermediate compression spring 14, so that the force exerted upon the slide valve 38 is sufficient to force the latch member 41 out of the rear opening 25. The valve 38 is thereby snapped forwardly until the pins 36 and 37 contact with the forward ends of the slots 15 and 16, and the latch member 41 engages the front opening 25. The water under pressure now enters the front cylinder member 18 through the rear opening 25 so as to keep the fingers 26 in the position indicated in dotted lines in Fig. 1. This rear opening is suitably connected with front portion of cylinder 18, and any number of holes similar to 25 can be provided at the front portion of casing 12, to enable the fluid under pressure to continuously urge the fingers 26 to operative position.

The port of the slide valve 38 now communicates with the port 42 in the flange 12′, so that liquid under pressure now enters the port 42 and does not enter the port 42′. The liquid under pressure which enters the port 42 forces the cylinder 19 rearwardly so as to move the fingers 27 from the full line

position shown in Fig. 1 to the dotted line position indicated therein, so that the fingers 27 now engage the wall of the pipe. This engagement of the fingers 27 with the wall of the pipe limits the rearward movement of the piston 19 and the pressure on the back of the flange 12′ now forces the casing 12 forwardly. While the casing 12 is being forced forwardly, the port 42′ is adjacent the front relatively narrow portion 38^3 of the slide valve 38, so that the water between the front of the flange 12′ and the opposite wall of the cylinder member 10 is free to escape and to pass out through the front slot 16.

The cylinder 10 slides on flange 12′ with a certain amount of friction, due to piston ring 12^2. Hence when the piston 19 is urged rearwardly by the water entering through port 42, it must force the fingers 27 to their operative position before it acts to keep the cylinder member 10 stationary while the casing 12 moves forwardly. Independent of the friction due to piston ring 12^2, the rapidity of forward movement of casing 12 is limited by the speed with which the water intermediate the front face of 12′ and the opposite wall of member 10 can escape. Hence the fingers 27 are always moved to operative position before any substantial forward movement of casing 12 can take place.

As the casing 12 is moved forwardly while the cylinder 10 remains stationary, the rear spring 13 is compressed and this tends to move the slide valve 38 rearwardly. As soon as the compression of the spring 13 is sufficient to overcome the force with which the blade spring 23 maintains the latch member 41 in the front hole 25, the said compression spring 13 snaps the valve 38 rearwardly so as to again place the port 42′ into communication with the interior of the slide valve 38.

The casing 12 and the valve 38 are now in the same relative position shown in Fig. 1, so that water under pressure is free to act upon the front face of flange 12′. This front face is now adjacent the opposite face of cylinder member 10. Since member 12 cannot be forced backwards, the member 10 is pushed forwardly, compressing the spring 14 until the valve 38 is again snapped forwardwardly.

Upon releasing the pressure of the water in the device, the fingers 26 and 27 are moved to their inoperative position, so that the device can be readily removed from the pipe or the like. It will be noted that nearly all the water forced into the device issues forwardly therefrom, so as to wash away obstructing matter. In nozzles of the reaction type, a large quantity of water was deflected so as to issue rearwardly from the nozzle, which was a disadvantage, because this water did not directly act upon the obstructing matter.

Since we are the first to provide a hydraulic motor in association with a nozzle and clutch means to propel the same forwardly in a series of intermittent forward movements, we do not wish to be limited to the details shown herein.

The rapidity of the intermittent forward movement of the nozzle depends upon the rapidity with which water can escape out of the cylinder member 10. This can be regulated by providing openings 15′ and 16′ in the casing 12, and these openings can be provided with any suitable regulating valves. It is preferable to have the water or other fluid adapted to enter the motor part of the device more rapidly than it can escape therefrom so that the fingers 27 are always kept in operative position while the device is not used.

The use of gripping fingers for the casing is preferable, but is not absolutely necessary, because the inertia of the flexible hose connected to the rear thereof, and the friction of the hose against the wall of the sewer, substantially hinders any rearward movement of the casing. Hence the hose can be considered as constituting means adapted to prevent a substantial rearward movement of the casing.

When the device is operated by water, air or the like, it can be used as a tractor for dragging heavy cables, such as telephone cables, through conduits, and for other purposes. The device is also useful as a ram, and when used as a ram, no front opening is necessary. Hence whenever the term nozzle is used, we do not wish to be restricted to a device having any opening, save the opening necessary to permit the escape of the fluid necessary to operate the motor part of the device.

We have shown a preferred embodiment of our invention, but it is clear that numerous changes and omissions could be made without departing from its spirit.

We claim:—

1. A nozzle comprising two relatively slidable parts movable away from each other, the said parts having associated pressure faces, means adapted to supply water under pressure to the said pressure faces of the said parts to move them away from each other, and means adapted to prevent the rearward movement of that one of said parts which is rearwardly urged by the said water pressure.

2. In a nozzle, the subcombination of clutch means adapted to grip the wall of a pipe or the like, and hydraulically operable means adapted to force said clutch means to the operative position, and means adapted to move said nozzle longitudinally with respect to said clutch means.

3. In a nozzle, the subcombination of clutch means adapted to grip the wall of a

pipe or the like, spring means adapted to urge said clutch means to the inoperative position, and hydraulically operable means adapted to urge said clutch means to the operative position, and means adapted to move said nozzle longitudinally with respect to said clutch means.

4. In a nozzle, the subcombination of a hollow casing adapted to have water forced therein, an annular cylinder member mounted upon the said casing and longitudinally movable with respect thereto, means connecting the interior of the said casing to the interior of the said cylinder, clutch means associated with said cylinder member and adapted to grip the wall of a pipe or the like, and a piston member located in the said cylinder member and adapted to be actuated by water entering said cylinder member to force said clutch means to the operative position.

5. In a nozzle, the subcombination of two parts, relatively movable in a longitudinal direction away from each other, the said parts having pressure faces adapted to be automatically actuated by water forced into the said nozzle, and spring means connecting the said parts and adapted to be distorted when the said parts are moved relatively to each other.

6. In a nozzle, the subcombination of two relatively movable parts movable away from each other, the said parts having pressure faces adapted to be acted upon by the pressure of water forced into the said nozzle, and a movable valve adapted to be actuated during the movement of water out of the nozzle to control the action of the pressure upon the said pressure faces.

7. A nozzle comprising a casing having an opening at the forward end thereof, means adapted to connect said casing to a source of water supply so that substantially all of the water forced into the said casing escapes from the forward part thereof to wash away any obstructing matter in front of the nozzle, and a hydraulic motor actuated by the passage of water through the said nozzle to intermittently force the said nozzle forwardly.

8. A nozzle comprising a casing having a lateral flange intermediate the ends thereof, the said flange being provided with two ports extending therethrough and opening into the interior of the said casing, the said ports being correspondingly inclined with respect to the central axis of the casing and being laterally and longitudinally spaced from each other, a slidable cylinder member fitting over the flange of the said casing, the said flange of the casing being located intermediate the ends of the said cylinder member, clutch means associated with the said cylinder member and adapted to grip the wall of a pipe or the like, means operable by water pressure located in said cylinder member and adapted to force the said clutch means into operative position, a slide valve having end piston-like parts and an intermediate piston-like part fitting within the said casing and connected by two intermediate parts of relatively smaller diameter, a port recess located on the exterior of said central piston-like part and communicating with the interior of the said valve, compressible spring means yieldably associated with one end of said slide valve to the said casing, second compressible spring means associated with the other end of said valve to the adjacent end of the said cylinder member, and spring controlled latch means adapted to yieldingly connect the said slide valve to two separated points of the said casing so that the said port recess is alternately aligned with the ports of the said flange.

In testimony whereof we affix our signatures.

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