

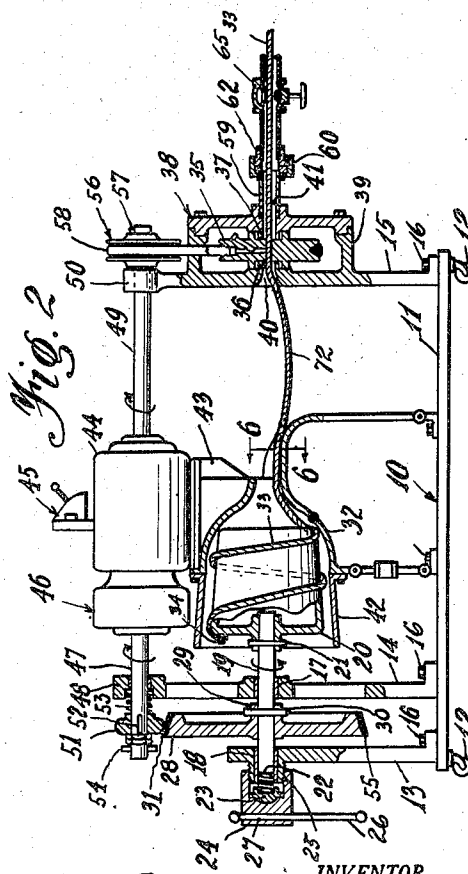
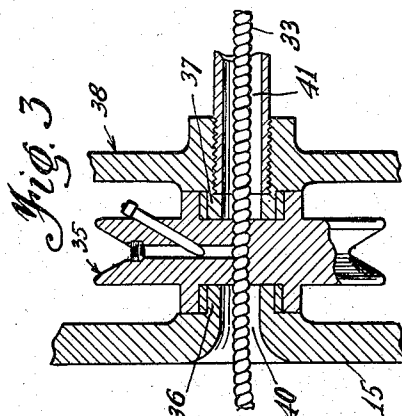
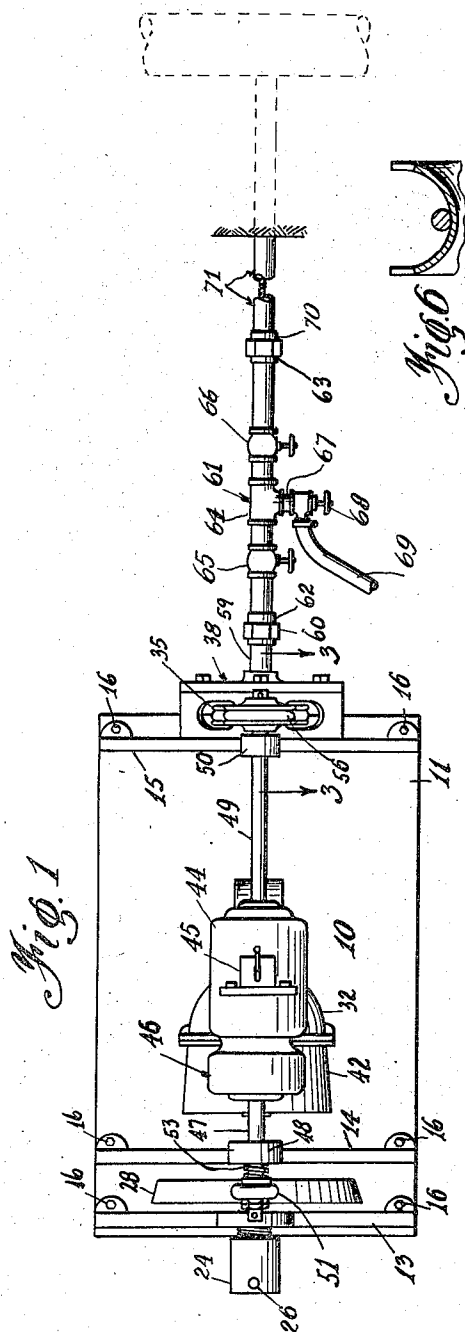
July 31, 1951

R. A. POEKERT
 DEVICE FOR STORING AND FEEDING ELONGATED
 FLEXIBLE PIPE CLEANING MEMBERS

2,562,574

Filed Feb. 7, 1947

2 Sheets-Sheet 1



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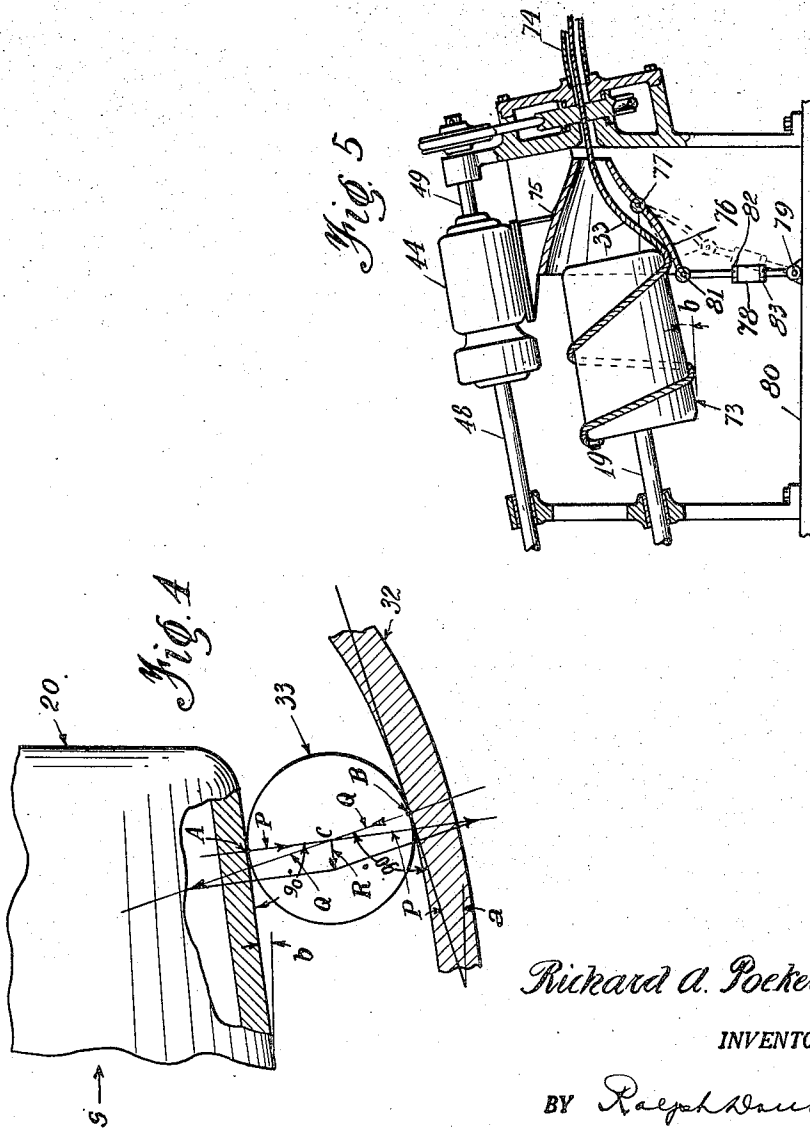
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UNITED STATES PATENT OFFICE

2,562,574

DEVICE FOR STORING AND FEEDING
ELONGATED FLEXIBLE PIPE-CLEANING
MEMBERS

Richard A. Poekert, Pittsburgh, Pa.

Application February 7, 1947, Serial No. 727,163

7 Claims. (Cl. 15—104.3)

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This invention pertains to pipe cleaning machines and particularly to those in which the prime mover rotates a flexible, elongated cleaning member or snake which is forced into the pipe to be cleaned.

At present many of such pipe cleaning devices are known; they all however have the disadvantage that the cleaning member is forced into the pipe intermittently and by manual operation, giving the snake an intermittent, irregular forward motion.

Another disadvantage of the existing devices is that they fail to give the snake radial support close to the entrance into the pipe in consequence of which the cleaning snake, when its free end meets any resistance, collapses and coils in the pipe and is thus prevented from penetrating into bends, dirt or other resistance offering sections.

A further disadvantage of the existing machines is that, on account of lacking radial support close to the entrance into the pipe, their cleaning members have to have considerable diameters to possess some resistance against collapsing, hence, they are not suitable to be used on pipe lines $\frac{3}{4}$ " or smaller.

My invention eliminates these and other disadvantages by providing a pipe cleaning machine having a drum for receiving a suitable length of a flexible cleaning member in the form of a tightly wound helical spring, combined with means for pulling the coiled cleaning member or snake off the drum and winding the same on it, respectively, and with means for giving the cleaning member radial support close to the entrance into the pipe to be cleaned, and for moving the snake positively into and out of the pipe to be cleaned respectively; all these means being operated by a single prime mover.

Hence, one of the objects of my invention is to provide a pipe cleaning machine which has a drum for receiving the flexible pipe cleaning member and for arranging it in helical coils thereon, and a prime mover for rotating this drum selectively in opposite directions, and is supplied with means operated by the same prime mover for moving the flexible snake axially, selectively into or out from the pipe to be cleaned.

Still another object of the invention is to provide a device for cleaning out pipe lines which has a drum for coiling the flexible snake or cleaning member thereon, which drum is rotated by a motor or otherwise, selectively in both directions, and is acted upon by releasable means urging the drum axially toward a stationary guide for pinching the last turn of the flexible snake

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therebetween, and for urging it upward on the drum, tightening the coiled flexible snake upon the drum.

Still another object of the invention is to provide a device of the character described in which a rotatably mounted but axially stationary member serves as a translating nut upon the helically wound flexible cleaning member and is rotated by a motor simultaneously with the drum upon which the snake is coiled, the angular velocities of the drum and translating nut being in such fixed relationship that the change in length of the cleaning member or snake coiled on the drum is substantially the same as that of such portion of the snake that is translated by the nut during the same time.

Another object of the invention is to create a pipe cleaning machine the cleaning member of which is translated in selectively opposite directions with substantially selectively variable speed.

Still another object of the invention is to create a device of the character described which is provided with an adapter for substantially sealed connection with the pipe line to be cleaned, which adapter is equipped with means for flushing the pipe line while it is being cleaned and with means for conducting the flushings away from the cleaning device into a drain or sewer.

These and other objects will be recognized by those versed in the art by perusing the following description and accompanying drawings, in which:

Figure 1 is a top plan view of the entire device in accordance with the invention showing the conical drum mounted substantially parallel to its base-plate.

Figure 2 is a side elevational view of Figure 1, shown partially in vertical section.

Figure 3 is a fragmentary sectional view on a larger scale taken on line 3—3 in Figure 1.

Figure 4 is a diagrammatic view showing the acting forces in a cross-section of the cleaning member or snake at the portion between the drum and stationary guard under the action of the releasable means.

Figure 5 shows a modified embodiment of the invention in a side elevational view, partially in vertical section, which embodiment differs from the one shown in Figure 1 by using a cylindrical drum including its associate parts at an acute angle to the base plate of the device.

Figure 6 is a section on line 6—6 in Figure 2. Identical parts are denoted by identical numerals in the several views of the drawings.

Referring more particularly to the drawings

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and especially to Figures 1 to 4, the numeral 10 designates the frame in general, comprising a horizontal base 11 mounted on casters 12 or otherwise, and vertical uprights 13, 14 and 15 secured by bolts 16 to the base 11. Uprights 13 and 14 accommodate suitable bearings 17 and 18 to support rotatably and slidably the shaft 19 to which the drum 20 is rigidly fixed by suitable means, for instance, such as a tapered pin 21.

Bearing 18 is long enough to have a suitable recess to accommodate a coil spring 22, held compressibly between the shaft 19 and the seat 23 of the cap 24 which is rotatably mounted therein. This cap 24 is screwed on the suitably threaded shank 25 of upright 13. A lever 26 slidably mounted in a hole 27 in cap 24 serves to manually turn the cap 24 on or off the threaded shank 25.

Between the bearings 17 and 18, the shaft 19 carries a conically surfaced friction wheel 28 which has a hub 29 fixed rigidly to the shaft 19 by means such as a tapered pin 30. Wheel 28 is preferably sheathed on its peripheral surface with a rough material 31 having a high frictional coefficient.

A stationary guide 32 is fixed to the base 11 and has a central opening and a suitable bowl-like configuration to serve as a stop against which the compressed spring 22 urges the drum 20, pinching the lower part of the coil of the flexible member or snake 33 between the drum 20 and the guide 32. Drum 20 is shaped as a conical frustum with a small apex cone angle converging toward the guide 32.

The snake 33 is secured at one end by a suitable clamp 34 to that portion of the drum 20 which is adjacent to its drive, while the free end or working end of the snake may be of any approved configuration (not shown).

A rotatable member 35 shown on a large scale in Figure 3, comprises a V-grooved pulley rotatably mounted on the cylindrical bearing surface 36 of upright 15 and on a concentric similar bearing surface 37 in cover 38 mounted on lugs 39 integral with, or rigidly fixed to, upright 15. The mounting of the rotatable member 35 is substantially coaxial with that of the drum 20. The rotatable member is threaded axially with a predetermined pitch and is rotated at a predetermined velocity, the determination of which is more fully described hereafter. Upright 15 and the cover 38 have substantially coaxial openings 40 and 41, respectively, of ample cross-sectional areas to admit the snake 33 with a desirable clearance to prevent friction.

To guide 32 is fixed a stationary conical guide 42 encircling the drum 20 and the thereon wound snake 33 with the necessary clearance to prevent injury to the workman or damage to the machinery in case the snake would break accidentally during the operation.

To guide 32 is also fixed a bracket 43 to which is rigidly mounted an electric motor 44, preferably of the variable speed type, carrying in a well known manner a switch board 45 equipped with the necessary instruments for the safe and convenient operation of the device. If desired, any of a number of well known means (such as limit switches) might be employed to disconnect the motor after the drum 20 makes the required number of revolutions to wind on or off the flexible snake 33.

Motor 44 has shaft extensions on both ends; the left end shaft extension 47 is connected to a speed reducer 46 and is supported rotatably

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in a suitable bearing 48 in upright 14 while the right end shaft extension 49 is preferably direct coupled to motor 44 and is supported rotatably in bearing 50 in upright 15.

The friction drive wheel 51 having preferably a rounded peripheral surface is slidably but non-rotatably mounted on shaft extension 47 by means of a feather key 52. A helical spring 53 located between bearing 48 and friction drive wheel 51, urges the latter outwardly toward a pin 54 which it never reaches (the pin serving only for assembling purposes) as the friction wheel 51 is stopped from reaching pin 54 by contact with the conical peripheral band 31 of friction driven wheel 28.

The right hand shaft extension 49 carries a suitable driving member such as a V-grooved pulley 56 which is fixed on shaft extension 49 by means of a tapered key 57, as shown. The pulley 56 registers with the pulley 35 which it drives by suitable means such as a V-shaped belt 58.

The cover 38 has a central threaded opening into which nipple 59 is screwed carrying at its outer end a half union 60 for the connection to an adapter generally denoted by 61.

The adapter 61 comprises pipe nipples and pipe fittings with suitable connecting members, such as half unions 62 and 63 at its ends. Between these half unions there is a centrally located T fitting 64 and two conventional valves 65 and 66 which, when opened permit the passage of the snake 33 without interference. The side opening of the T 64 attaches to a nipple 67 and angle valve 68 to which a hose 69 is attached. Half union 62 is connected to half union 60 on nipple 59, and half union 63 is screwed on half union 70 at the end of pipe 71.

The device operates as follows:

Opening pipe 71 and screwing half union 70 on its end (in case there would be no union at that point) adapter 61 is attached, with all valves closed, by half union 63. Subsequently the cleaning machine is brought into a position in which half union 60 and nipple 59 are coaxial with pipe 71 and adapter 61 which is then attached to half union 60 to nipple 59, by screwing half union 60 together with half union 62. Cleaning member or snake 33, in starting position, is coiled on drum 20 and its free end is threaded through the rotatable member 35 the working end of the cleaning member 33 reaching into adapter 61 up to the closed valve 65. The valves 65 and 66 are now opened to freely admit the snake 33.

Cap 24 is now screwed away from shaft 19 thereby releasing spring 22 from all compression after which motor 44 is started which rotates through speed reducer 46 the shaft extension 47, friction drive wheel 51, friction driven wheel 28 and drum 20 at a predetermined speed *s* in such direction that it unwinds the snake 33 from the drum at the speed that suits the cleaning operation.

Assuming that the snake 33 is helix wound at right hand and that it is coiled in a right hand helix on the drum 20 (as shown in Figures 2 and 3) then with each counter clockwise revolution of drum 20 (in the direction of the arrows) snake 33 will unwind by one coil from drum 20 and will also turn clockwise about its longitudinal axis by 360 degrees, which means axial advancement of the cleaning member or snake 33 by the pitch or lead of the thread or turns in member 35. In order to give to the snake 33 a translating motion at a speed substan-

tially equal to that with which the snake 33 unwinds from drum 20 it is necessary to rotate member 35 with a predetermined velocity which can be determined mathematically as follows:

Let us designate by D the mean diameter of the coil formed by the flexible member 33 on drum 20; N the R. P. M. of the drum, winding or unwinding; n the R. P. M. of member 35 at which the decoiling speed equals the translating speed of member 33; p the pitch or lead of the helical turns of snake 33; U the unwinding speed; then

$$\text{Inch per second} = \frac{3.14ND}{60} = \frac{np}{60} + p$$

from which

$$n = \frac{3.14ND - 60p}{p}$$

As a numerical example, if D=6 inches, N=5 R. P. M., $p=\frac{1}{8}$ ", then the rotary speed of member 35 necessary to make the decoiling speed equal to the translating speed of the member 33,

$$n = \frac{3.14 \times 5 \times 6 - 60 \times \frac{1}{8}}{\frac{1}{8}} = \frac{94.2 - 7.5}{\frac{1}{8}} = 533.6$$

If the winding of the snake would be left hand instead of right hand as before, the general formula would be:

$$n = \frac{3.14ND + 60p}{p}$$

To unwind snake 33 from drum 20, motor 44 is rotated so that the shaft extensions 47 and 49 turn clockwise the result being that drum 20 will be turning counterclockwise and snake 33 clockwise about its axis as viewed from pipe 71 and shown by arrows in the drawing. The ratio of the speed reducer 46, that of friction wheels 51 and 28 and pulley 56 and member 35 are such that the speed of the snake 33 with which it unwinds from drum 20 will be equal to its translating speed through member 35.

Possible inaccuracies will be equalized partially by the slipping of the friction drives and the increase or decrease of the loop 72 formed by snake 33, for which loop ample space is provided in the machine.

While the cleaning member or snake 33 is progressing into pipe 71 angle valve 68 may be opened and the loosened deposits, scale etc. flushed out of the pipe 71 through hose 69 into convenient receptacles, sewers etc., or the cleaning member 33 may be withdrawn from the adapter, valve 65 closed and then the flushing operation effected.

For withdrawing snake 33 spring 22 is compressed by cap 24, and motor 44 is rotated in the opposite direction than before whereby also the rotation of member 35 is reversed and the withdrawing of member 33 and coiling up on drum 20 is effected.

Figure 4 is the diagram of the forces acting upon drum 20, guide 32 and snake 33 in a cross-section in which the pinching effect is created.

The spring force S due to spring 22 urges drum 20 toward guide 32 pinching snake 33 between the drum and the guide, at points denoted by A and B. Spring force S creates the compressive forces P and Q which are acting in points A and B respectively, perpendicular to the pinching surfaces and radially upon snake 33. Transposing these forces in their line of action to the center of the cross-section of snake 33 and adding them geometrically, the resultant will be a force R which points toward the drive side of the drum 20. The resultant R will tend to move the last coil and with it the previous coils upon the drum

provided this force is greater than the effect of the friction between the coil and the pinching surfaces.

It can be shown by trigonometry that R will overcome the effect of friction when angle (a-b) is greater than a predetermined acute angle depending on the materials used for the drum 20, guide 32 and snake 33 and on the smoothness of their surfaces. Hence, by selecting the suitable conicity for drum 20 (angle b) and a suitable shape for the guide 32, the tangent to which, at the contact point B, determines angle a, the resultant R will overcome the effect of the friction and the snake 33 formed on drum 20 will have an orderly formation on the drum.

The magnitude of R is a function of angles a and b formed by the tangent of the compressive surfaces with the horizontal, so that by employing means for varying one or both of angles, the tightness of the formation of the coil on drum 20 can be controlled.

For cleaning or unwinding, spring 22 is released by unscrewing cap 23 when spring 53 will push friction drive wheels 51 and 28 and with them shaft 19 and drum 20 toward the left until the hub 29 on wheel 28 is stopped by upright 13, in which position a suitable clearance is produced between drum 20 and guide 32 to permit the snake 33 to slip off drum 20 coil by coil, and be translated by rotating member 35 toward pipe 71.

Figure 5 is an elevational view of a modified form of my invention. It differs from the first embodiment in that drum 73 is not conical like drum 20 of the first embodiment but it is cylindrical and is mounted at an acute angle b to the horizontal. The motor 44 and shaft extension 48 and 49 are parallel to shaft 19 of drum 73, hence are mounted at the same angle to the horizontal, while the central planes of friction wheels 51 and 28 and rotary member 35 form the same angle b with the vertical. Nipple 74 is curved to lead the snake 33 horizontally into adapter 61.

The purpose of the cylindrical drum and its angular mounting is to produce the angle b on the drum surface and the pinching effect between the drum 73, cleaning member or snake 33 and guide 32. Furthermore it is to facilitate the winding up of the snake 33 on the drum 73, which being cylindrical all coils will have the same diameter and will slide more readily thereon than in case of a conical drum with increasing diameter. Hence this embodiment is especially suitable for extremely long snakes as a large number of turns of coils can be placed on a cylindrical drum in an orderly fashion.

A stationary guide 75 has its lower portion 76 hinged at 77 in order to be adjustable relative to drum 73. Tangent T at the contact point with flexible snake 33 forms angle a with the horizontal and by pivoting the lower guide portion 76 around pin 77 the angle a is varied and with it angle a-b upon which the magnitude of resultant force R depends. For adjusting the power guide portion 76 a turnbuckle 78 is provided pivoting at pin 79 mounted on the frame 80 and also at pin 81 mounted on lower guide portion 76. Turnbuckle 78 is provided with a nut 82 and a locknut 83 for adjusting its length and locking it, respectively.

From the foregoing description taken in connection with the accompanying drawings, the construction of the device and the method of

operation will be readily apparent to those skilled in the art to which the invention appertains, and while describing the principle of operation of the invention together with the two preferred embodiments which are now considered to be the best embodiments thereof, it is to be understood that various changes in the form, proportion and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of the invention as defined in the appended claims.

I claim:

1. In a pipe cleaning machine comprising a frame, a drum rotatably and slidably mounted therein, a cleaning member employing a tightly wound helical spring of considerable length, means for releasably attaching one end of said cleaning member to one end of said drum whereby the rotation of said drum will change the length of the coiled portion of said cleaning member on said drum, means for rotating said drum for selectively coiling thereon and uncoiling therefrom said cleaning member, a stationary bowl-shaped guide attached to said frame and fitting around the other end of said drum, resilient means having a manual adjustment for regulating the pressure exerted by the resilient means, means for forcing said drum axially toward said guide to engage said cleaning member therebetween, means to translate said cleaning member at a velocity that substantially equals that of said coiling, and means for introducing said cleaning member into the pipeline to be cleaned.

2. In a pipe cleaning machine comprising a frame, a rotating drum axially slidably mounted therein, a cleaning member employing a tightly wound helical spring of considerable length, means to attach one end of said cleaning member to one end of said drum whereby the rotating of said drum will cause a change in length of the coiled portion of said cleaning member on said drum, a stationary bowl-shaped guide attached to said frame and fitting around the other end of said drum, resilient means having a manual adjustment for regulating the pressure exerted by the resilient means, means for forcing said drum axially toward said guide to engage said cleaning member therebetween, resilient means for urging said drum axially toward said guide, a rotatable member mounted on said frame, said member having a central threaded hole snugly engaging the turns of said cleaning member for positive translation thereof, a prime mover secured to said frame, drive means operatively connecting said prime mover to said drum and to said rotatable member for effecting their rotation in selectively opposite directions and at different speeds of such predetermined relationship that the change in the length of the cleaning member coiled on said drum is substantially the same as the length of the cleaning member translated through the threaded hole of said rotatable member during the same period of time, an adapter for connecting sealingly the threaded central hole of said rotatable member with the pipeline to be cleaned.

3. In a pipe cleaning machine comprising a frame, a rotatable conical frustum shaped drum axially slidably mounted therein with one end unobstructed, a cleaning member employing a tightly wound helical spring of considerable length, means to releasably attach one end of said cleaning member to said drum whereby the rotating of said drum will cause a change in length of the coiled portion of said cleaning member, a stationary bowl-shaped guide attached to said

frame and fitting over the unobstructed end of said drum, releasable means for forcing said drum axially toward said guide to engage said cleaning member therebetween, a rotatable member mounted on said frame, said member having a central threaded hole snugly fitting the turns of said cleaning member for positive translation thereof, a prime mover fastened to said frame, and drive means including a speed reducer and a friction drive operatively connecting said prime mover to said rotatable member for effecting their rotation at selectively opposite directions at different speeds of such predetermined relationship that the change in the length of the cleaning member, coiled on said drum, is substantially the same as the length of the cleaning member translated through the threaded hole of said rotatable member during the same period of time.

4. In a pipe cleaning machine comprising a frame, a rotatable, conical frustum shaped drum axially slidably mounted on a shaft overhanging the latter with one end unobstructed, a cleaning member employing a tightly wound helical spring of considerable length, means to attach one end of said cleaning member to said drum whereby the rotating of said drum will cause a change in the length of the coiled portion of said cleaning member on said drum, a bowl-shaped stationary guide fitting around the unobstructed end of the drum, a cap threaded on said frame, a spring interposed between said cap and said shaft to vary the compression force upon said spring from zero to a predetermined maximum of force for urging said drum axially toward said guide to engage said cleaning member therebetween, a rotatable member mounted on said frame, said member having a central threaded hole snugly fitting said cleaning member for positive translation thereof, a motor fastened to said frame, and drive means, including a speed reducer and a friction drive operatively connecting said motor to said drum and frictional means operatively connecting said motor to said rotatable member, for effecting their rotation in selectively opposite directions at different speeds of such predetermined relationship that the change in length of the cleaning member coiled on said drum is substantially the same as the length of the cleaning member translated through the threaded hole of said rotatable member during the same period of time.

5. In a pipe cleaning device comprising a frame, a cylindrical drum rotatably and axially slidably mounted on a shaft with one end unobstructed, a cleaning member employing a tightly wound helical spring of considerable length, means to releasably attach one end of said cleaning member to said drum whereby the rotating of said drum will cause a change in the length of the coiled portion of said cleaning member on said drum, a bowl-shaped guide fitting around the unobstructed end of said drum, the axis of said bowl-shaped guide being at an acute angle to the axis of said drum, a cap threaded on said frame, a spring interposed between said cap and said shaft to vary the compression forces upon said spring from zero to a predetermined maximum for forcing said drum axially toward said guide to engage said cleaning member therebetween, a rotatable member mounted on said frame, said member having a central threaded hole snugly fitting said cleaning member for positive translation thereof, a motor fastened to said frame, and drive means, including a speed reducer and a friction drive operatively connecting said motor to said drum and

frictional means operatively connecting said motor to said rotatable member for effecting their rotation in selectively opposite directions at different speeds at such predetermined relationship that the change in the length of the cleaning member coiled on said drum is substantially the same as the length of the cleaning member translated through the threaded hole of said rotatable member during the same period of time.

6. Apparatus for manipulating a pipe cleaning snake in the form of an elongated helical spring, said apparatus comprising a drum, means supporting the drum from one end only for rotation about its axis, the other end being free to permit wraps of the snake to be put on or removed from the drum, a bowl shaped guide having a central opening through which the snake extends, the adjacent surfaces of the drum and guide diverging towards the end of the roll remote from the opening, means for thrusting said snake into the pipe to be cleared and common means for driving said drum and said thrusting means, said drum being movable axially in said supporting means toward and from said guide to a point spaced from said guide substantially the diameter of said snake whereby the drum and guide may engage the snake to urge it towards said drum during re-winding.

7. Apparatus as defined by claim 6 characterized by manually adjustable means for yieldingly urging said drum toward said guide.

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