

Oct. 12, 1965

W. G. HOLLIDAY  
PIPE CLEANING MACHINE

3,210,788

Filed Jan. 16, 1964

3 Sheets-Sheet 1

Fig. 1

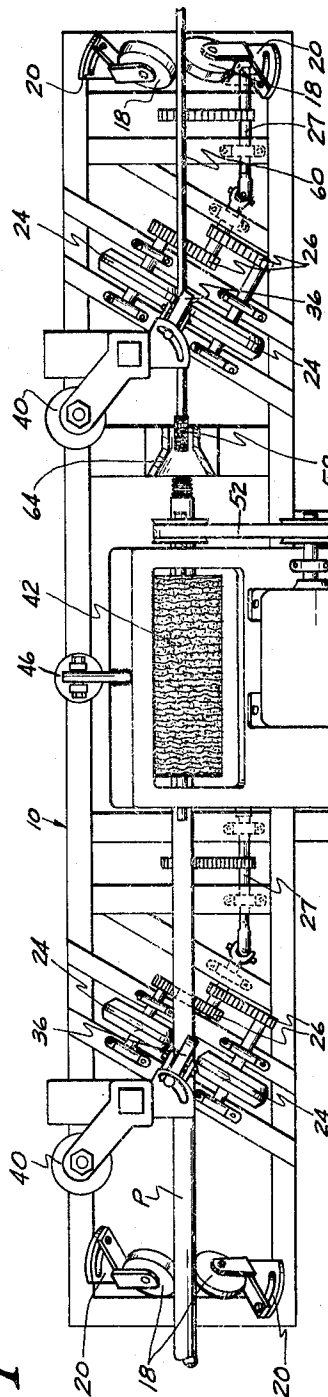
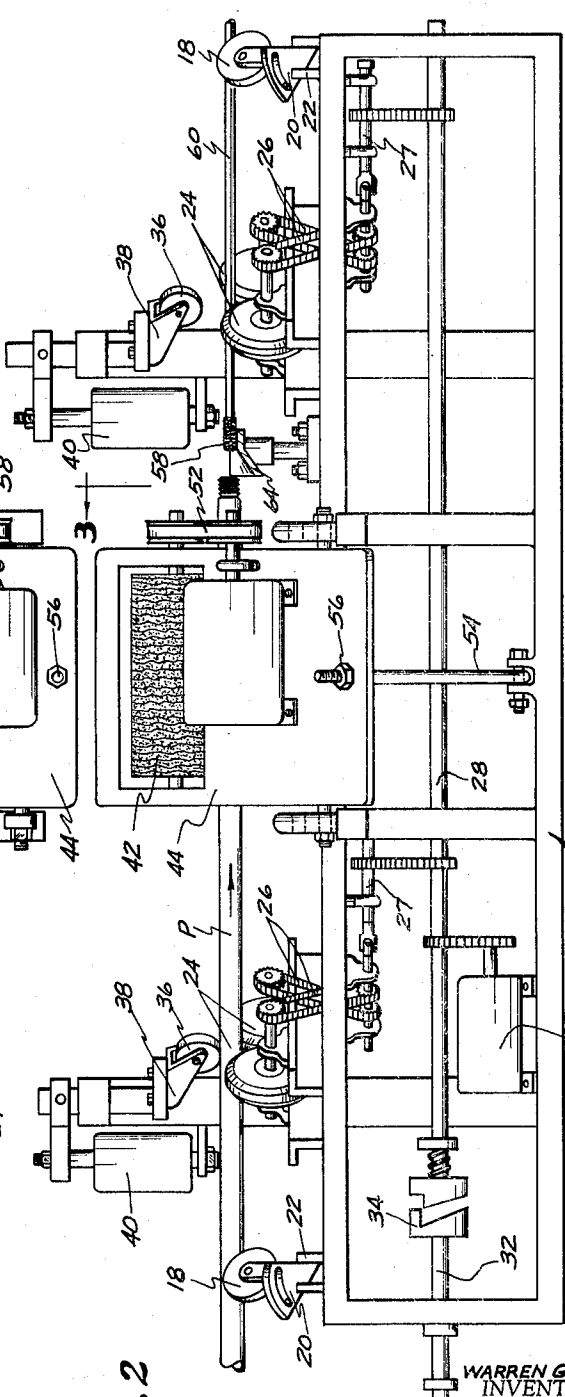


Fig. 2



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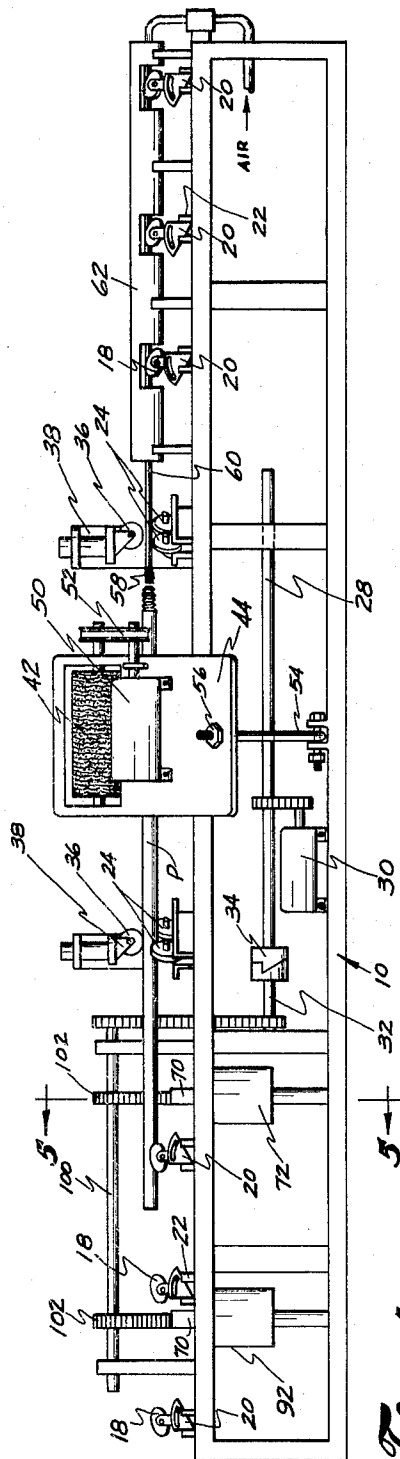


Fig. 4

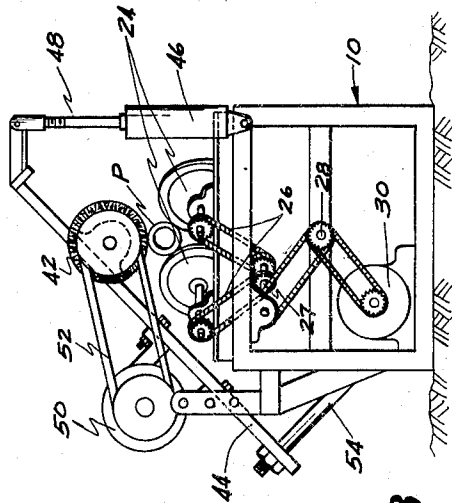


Fig. 3

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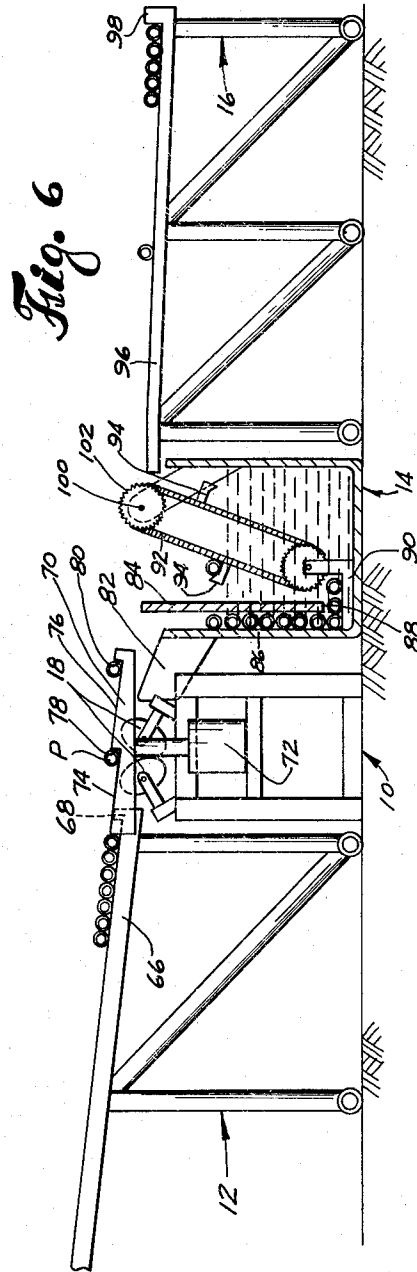
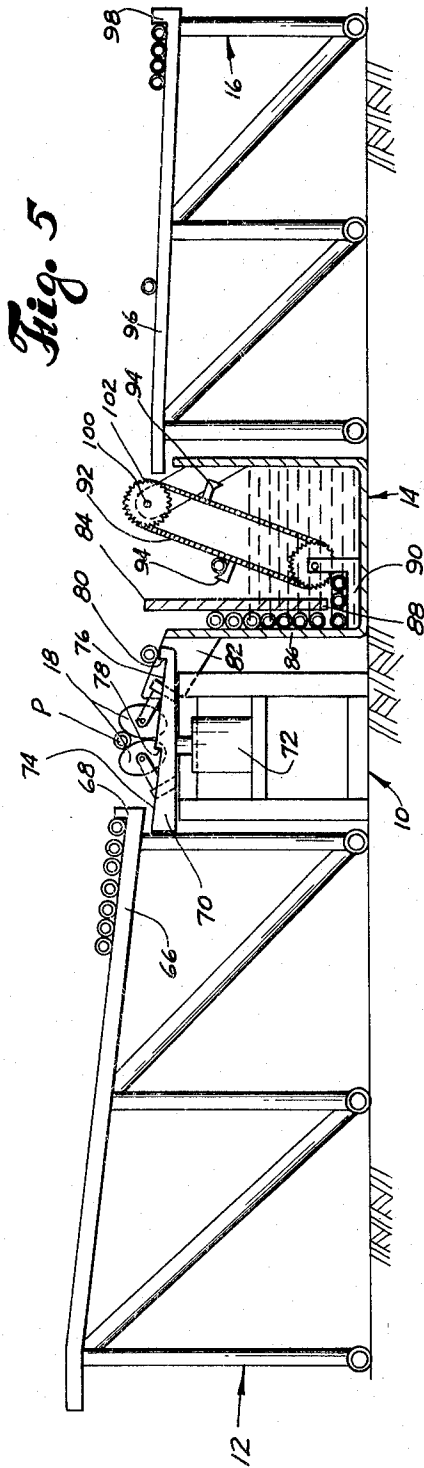
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3 Sheets-Sheet 3



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## PIPE CLEANING MACHINE

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5 Claims. (Cl. 15—88)

This invention relates to the cleaning of pipe and more particularly to the removal of surface deposits, such as rust, mud and paraffin from the interior and exterior of well pipe or tubing to recondition the same for reuse.

The invention finds particular application in connection with the reconditioning of well pipe or tubing, which when it has been in use in the well bore for some time is usually rusted and caked with mud and deposits of paraffin, which must be removed and the pipe thoroughly cleaned and treated with a rust inhibitor before such pipe can be made suitable for reuse.

The invention has for an important object the provision of a machine for cleaning pipe which is semi-automatic in operation, and by which all the necessary operations, such as loading, cleaning and re-racking can be conveniently carried out by the use of a single operator.

Another object of the invention is to provide a pipe cleaning machine which is constructed to clean the outside and inside of the pipe simultaneously.

A further object of the invention is the provision of a pipe cleaning machine having brushes for cleaning the interior and exterior of a pipe as the same is moved longitudinally along the axis of the pipe and including means for varying the rate of travel of the pipe relative to the brushes whereby the speed of the cleaning operation may be varied in accordance with the condition of the pipe to be cleaned.

Another object of the invention is to provide a pipe cleaning machine which is made in sections designed to be easily transported and assembled or disassembled at a desired location for use, and having a loading and unloading section, a driving or cleaning section and a run-out section to allow the sections of pipe to move completely beyond the cleaning brushes during the cleaning operation.

A still further object of the invention is the provision of a pipe cleaning machine of the character mentioned which may also be used for the drilling out of cemented well tubing.

The above and other important objects and advantages of the invention may best be understood from the following detailed description of a preferred embodiment of the same, reference being had to the annexed drawings, wherein:

FIGURE 1 is a top plan view of the driving and cleaning section of the machine of the invention;

FIGURE 2 is a side elevational view of the same;

FIGURE 3 is a cross-sectional view, taken along the line 3—3 of FIGURE 2, looking in the direction indicated by the arrows;

FIGURE 4 is a side elevational view of the entire machine showing the three sections of the same in assembled condition;

FIGURE 5 is a cross-sectional view, taken along the line 5—5 of FIGURE 4, looking in the direction indicated by the arrows, showing the loading mechanism in its down or inactive position; and

FIGURE 6 is a view similar to that of FIGURE 5 showing the loading mechanism in its up or active position.

Referring now to the drawings in greater detail, the machine of the invention is made up of three principal sections, the first of which is denominated the loading and unloading section, best seen at the left in FIGURE 4,

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and in FIGURES 5 and 6; the second of which is called the driving or cleaning section, illustrated separately in FIGURES 1, 2 and 3, and centrally of FIGURE 4; and the third of which is designated the run-out section, shown at the right in FIGURE 4.

The principal sub-sections of the machine may be mounted on a rectangular, box-like frame, generally designated 10, which may be formed in separate sections, one for each of the three sub-sections of the machine, which may thus be adapted to be easily assembled and disassembled, by any usual means, for the purposes of transporting to any desired location.

The mechanism of the invention also includes a loading rack, generally designated 12 in FIGURES 5 and 6, located at one side of the machine, a treating tank, generally designated 14, on the other side of the machine, opposite the rack 12, and a storage rack, generally designated 16, located beside the tank 14.

All three of the sections of the machine are provided with pairs of pipe supporting and centralizing rollers 18 positioned at longitudinally spaced locations and extending above the top of the frame, centrally thereof, each of which rollers is mounted for angular adjustment relative to the axis of the pipe to be supported thereon, so that the angle of contact of the rollers with the pipe may be adjusted from a position in which the rollers are perpendicular to the pipe to a position in which they are at an angle of about 30° thereto. The rollers 18 are rotatably mounted on brackets 20 which brackets are attached to the frame by base elements 22 designed to support the brackets at an angle of 30° to the horizontal so that the included angle between the brackets will be approximately 120°. The roller brackets 20 are positioned so that the peripheral faces of the rollers will be in contact with the pipe in all positions of adjustment of the rollers. It will be apparent that by adjusting the rollers to vary the angle of the same relative to the pipe the rate of feed of the pipe longitudinally of the machine may be adjusted as desired. Thus, when the angle between the rollers and the axis of the pipe is at a minimum the pipe will be moved longitudinally at a maximum rate of speed as the pipe rotates, and when the rollers are nearly perpendicular to the pipe the pipe will be moved longitudinally at a minimum rate. By this means, very dirty pipe can be run through the machine slowly to secure a more thorough cleaning of the pipe, while relatively clean pipe may be run through swiftly.

The pipe is pulled longitudinally of the machine by a plurality of sets of power operated drive wheels 24 which are suitably mounted for rotation in fixed angular relation to the pipe at an angle of about 60° to the axis of the pipe, or at an angle about mid-way of the range of angular adjustment of the rate controlling centering rollers 20. The axes of the driving wheels are disposed horizontal so that each wheel will engage the pipe at one edge portion of its peripheral face rather than across the width of such face to pull the pipe longitudinally as the wheels are rotated.

The driving wheels 24 are rotated simultaneously by a chain driving mechanism, such as that shown at 26, operated from a counter shaft 27 which is in turn rotated by a central drive shaft 28, rotatably mounted longitudinally, centrally of the frame of the machine and which is driven in a usual manner, as by means of a reversible electric motor 30. An extension shaft 32 is rotatably mounted on the frame extending longitudinally beyond one end of the shaft 28 and connected thereto by means of a one-way clutch 34, so that the extension shaft may rotate only in one direction with the shaft 28.

A feed controlling roller 36 is associated with each pair of the driving wheels 24, which roller is rotatably mounted

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above the wheels 24 on a vertically movable bracket 38 suitably attached to an air cylinder 40, whereby the roller may be moved toward and away from the wheels 24 to hold the pipe pressed down against the driving wheels to rotate the pipe and move the pipe longitudinally or to release the pipe. The rollers 36 are constructed and mounted in a manner similar to that described in connection with the rollers 18 for angular adjustment relative to the axis of the pipe to hold the pipe in driving engagement with the rollers 24 and to control the rate of longitudinal movement of the pipe.

The pipe cleaning mechanism includes a large rotary brush 42, rotatably mounted on a tiltably supported plate or base 44 suitably hinged to one side of the frame of the machine centrally of the driving and cleaning section of the same, in position for vertical swinging movement toward and away from the pipe. The position of this plate is adjusted by means of an air cylinder 46 attached to the frame and extending upwardly therefrom, as seen in FIGURE 3 and having a connection 48 with the plate, whereby the plate may be tilted to engage the brush 42 with the pipe or disengage the same therefrom. The brush 42 may be driven by an electric motor 50 mounted on the plate 44 and connected in driving relation to the brush, as by means of a driving belt 52, or other suitable means. The distance to which the brush 42 may be moved downwardly into contact with the pipe may be suitably limited, as by means of a rod 54 pivotally connected at its lower end to the frame and slidably extended upwardly through a suitable opening in the plate 44 and provided with a nut 56 engageable with the plate to limit downward swinging movement of the same.

A small wire brush 58 is provided for cleaning the inside of the pipe, which brush is mounted on the end of a long rod 60. The rod 60 extends the entire length of the run-out section of the machine and lays on the rollers 18 thereof, with the brush 58 positioned to the right of the external brush 42, in position to enter the pipe as the pipe moves longitudinally onto the run-out section. The rod 60 is preferably hollow for connection to a source of air or fluid under pressure, not shown, to allow the air or fluid to be blown through the rod into the pipe to clear the pipe of rust or other material during the cleaning operation. The rod 60 may be clamped to the end of the frame 10 of the machine to hold the rod stationary during the cleaning operation, or the rod may be rotated by suitable means, not shown, such as an electric motor mounted on the frame, if desired. In the usual operation of the machine for cleaning pipe the rod may be held stationary and the rotation of the pipe about the internal brush 58 will be sufficient to clean the inside of the pipe. In the event, however, that the machine is to be used for the drilling out of cement or the like in the pipe, the brush 58 may be replaced by a suitable drilling bit, or the like, not shown, and a drilling fluid pumped through the rod 60 to clean out the cuttings.

The run-out section of the machine is also provided with a series of spaced pairs of the rollers 18, supported and adjusted as previously described, upon which the pipe will be rotatably supported as the pipe moves onto the run-out section and into a cover tube 62, through which the rod 60 extends.

A guide collar 64 is supported on the run-out section, within which the brush 58 is extended, and whose forward end is flared to receive and guide the pipe over the brush.

The loading rack 12 is formed with a number of spaced apart supports such as the support 66, shown in FIGURES 5 and 6, which slope downwardly toward the machine and are provided at their lower ends with upwardly extending stop lugs 68, positioned for engagement with the pipe to hold the pipe against rolling off of the rack. Spaced apart loading bars 70 are provided, extending transversely of the frame of the machine and connected

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to the pistons of pressure fluid or air cylinders 72 mounted on the frame to be lifted and lowered thereby. Each of the loading bars 70 has a longitudinally downwardly sloping, upwardly facing loading surface 74 and a similarly sloping unloading surface 76, best seen in FIGURES 5 and 6, and with upwardly projecting portions which extend vertically upwardly from the lower ends of the surfaces 74 and 76, respectively, to form stop shoulders 78 and 80, respectively, for the pipe in loading the same onto and unloading the same from the rollers 18 and 24 of the loading section of the machine. The loading surface 74 extends into the loading rack a distance of least equal to one-half the diameter of the pipe and the stop shoulder 78 is positioned just short of the longitudinal center axis of the machine from the loading rack, while the unloading surface 76 extends from the shoulder 78 toward the tank 14 past the outer ends of spaced apart guide wings 82, mounted on the upper end of the tank 14, and whose upper edges slope downwardly in position for engagement with the pipe to allow the pipe to roll downwardly there along into the tank.

The tank 14 has a vertical feed plate 84 disposed inside of the tank in spaced relation to the wall 86 thereof and whose upper edge is located above the top of the tank and whose lower edge 88 is spaced above the bottom of the tank, to hold the section of pipe racked in a single vertical row between the plate and the wall 86.

Within the bottom of the tank 14 a stop and support member 90, of angle shape is provided, which is positioned to permit the pipe sections to move one at a time beneath the plate 84 into the bottom of the tank.

A chain conveyor 92 is disposed in the tank, whose chains are provided with spaced apart pipe hooks 94 positioned to engage and pick up the pipe sections as they move inwardly beneath the plate 84. The pipe sections elevated by the chain conveyor are deposited on the supports 96 of the storage rack 16, which are constructed like the supports 66 of the loading rack 12, sloping away from the tank 14 and provided with upwardly extending stop lugs 98 at their outer ends.

It will be apparent that when the loading bars 70 are moved upwardly from the position of FIGURE 5 to that of FIGURE 6, the lowermost one of the pipe sections on the loading rack will be lifted by the bars above the stop lugs 68 and will roll downwardly along the loading surfaces 74 of the bars to engage the stop shoulders 78 thereof. As the loading bars move upwardly the leading end portions of the unloading surfaces 76 thereof will engage the previously cleaned pipe section resting on the rollers 18 to lift the same off of the rollers whereupon this section will roll downwardly along the surfaces 76 to the stop shoulders 80. When the loading bars are again lowered to the position of FIGURE 5, the pipe section which is being loaded will then be deposited on the rollers 18, while the section which is being unloaded will be deposited on the wings 82, along which it will roll downwardly into the tank 14 between the plate 84 and the wall 86.

The chain conveyors 92 in the tank 14 may be conveniently operated by the motor 30 through shaft 28, clutch 34, and shaft 32, as by means of a countershaft 100 driven from the shaft 32 and upon which the upper sprockets 102 of the conveyors are mounted.

In operation of the machine the loading bars 70 are raised from the position of FIGURE 5, to that of FIGURE 6, as described above, to lift the lowermost one of the pipe sections on the loading rack above the lugs 68, whereupon this section will roll downwardly along the surface 74 into engagement with the stop shoulders 78. The loading bars are then again lowered to the position of FIGURE 5, so that the pipe section will be deposited on the rollers 18 and 24, the rollers 26 having been previously elevated by the cylinders 40, to allow the pipe section to be so positioned. The rollers 26 are then moved downwardly by the cylinders 40 to hold the

pipe in contact with the rollers 24 to be rotated thereby.

With the pipe section thus positioned in the machine the pipe is rotated and moved longitudinally toward the run-out section by operation of the motor 30, the external brush 42 being moved into contact with the outer surface of the pipe by operation of the cylinder 46. As the pipe moves longitudinally along the machine the pipe section will be guided over the internal brush 58, by the guide collar 64, so that the pipe will be thoroughly cleaned interiorly and exteriorly by the brushes as the pipe moves on to the run-out section.

When the section of pipe has moved completely beyond the brushes onto the run-out section, the motor 30 is reversed, to move the pipe section back on to the loading section of the machine, after which the loading bars are again elevated to engage the cleaned pipe section with the unloading surfaces 76, to lift the cleaned pipe section off of the machine, while the loading surfaces 74 will be engaged with the lowermost one of the pipe sections on the loading rack to lift the same over the lugs 68, whereby the next pipe section will be positioned to be deposited on the rollers 18 and 24 when the loading bars are again lowered.

The cleaned section of pipe thus lifted off of the machine, will be deposited on the wings 82 upon lowering of the loading bars, whereupon the cleaned section will roll into the tank 14, from whence it will be lifted in its turn by the conveyors 92 and deposited on the storage rack 16.

The tank 14 may be supplied with oil or other suitable treating material to coat the pipe to preserve the same against corrosion.

It will be apparent that the loading and unloading section of the machine provides a loading zone, the driving or cleaning section thereof constituting a cleaning zone, while the run-out section provides a run-out zone, the lengths of pipe being propelled longitudinally from the loading zone completely through the cleaning zone and onto the run-out zone during the cleaning operation.

It will thus be seen that the invention constructed and operated as described above provides a pipe cleaning machine which operates automatically, and by which sections of pipe may be cleaned, coated and stored by a continuous operation, which requires only a minimum of personnel for maintenance and operation.

The invention is disclosed herein in connection with a certain specific embodiment of the same which it will be understood is intended by way of example only, there being numerous modifications of which the apparatus is susceptible, within the spirit of the invention and the scope of the appended claims.

Having thus clearly shown and described the invention, what is claimed as new and desired to secure by Letters Patent, is:

1. Pipe cleaning apparatus comprising an elongated supporting frame, means movably supporting a pipe on the frame for rotation about an axis extending longitudinally of the frame and for movement along said axis, brush means mounted on said frame in position to enter one end of the pipe as the pipe moves along said axis and means on the frame positioned for engagement with said one end to center the pipe relative to the brush as the pipe moves toward the brush.

2. Pipe cleaning apparatus comprising an elongated supporting frame, means movably supporting a pipe on the frame for rotation about an axis extending longitudinally of the frame and for movement along said axis, brush means mounted on said frame in position to enter one

end of the pipe as the pipe moves along said axis and means on the frame positioned at the location of the brush for engagement with the pipe to hold the pipe in concentric relation to the brush as the pipe passes over the brush.

3. Pipe cleaning apparatus comprising an elongated supporting frame having a loading zone at one end, a run-out zone at its other end and a cleaning zone located between said end sections, supporting means movably supporting a length of pipe on the frame for rotation about an axis extending longitudinally of the frame and for movement along said axis from one to the other of said end zones through said cleaning zones, means for moving a length of pipe laterally onto and off of said supporting means at said loading zone, brush means mounted on the frame in position to enter the pipe as the pipe moves onto said run-out zone and means on the frame positioned for engagement with the pipe to hold the pipe in concentric relation to the brush at the location where the brush enters the pipe.

4. Pipe cleaning apparatus comprising an elongated supporting frame having a loading zone at one end, a run-out zone at its other end and a cleaning zone located intermediate said end zones, supporting means on the frame for movably supporting a length of pipe for rotation thereon about an axis extending longitudinally through said zones and for moving the pipe along said axis, means for moving a length of pipe laterally onto and off of said supporting means in said loading zone, external brush means movably mounted on the frame for movement into and out of contact with, and for rotation in engagement with the external surface of the pipe in the cleaning zone, internal brush means positioned to enter the pipe as the pipe moves into said run-out zone and means on the frame positioned for engagement with the external surface of the pipe to hold the pipe in concentric relation to said internal brush means at the location where the internal brush means enters the pipe.

5. Pipe cleaning apparatus comprising an elongated supporting frame having a loading zone at one end, a run-out zone at its other end and a cleaning zone located intermediate said end zones, support means rotatably mounted on the frame in position to support a length of pipe thereon for rotation about, and longitudinal movement along an axis extending through said zones and engageable with the pipe to move the pipe along said axis in one direction upon rotation of said support means in one direction and in the other direction upon rotation of said support means in the other direction, means for moving a length of pipe into and off of said support means and brush means mounted on the frame in said cleaning zone in position for brushing engagement with the interior and exterior surfaces of the pipe throughout the entire length of the pipe as the pipe moves from said loading zone to said run-out zone.

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