Oct. 17, 1961 R. C. STANLEY 3,004,278

PIPE CLEANING APPARATUS

Filed Dec. 2, 1959 4 Sheets-Sheet 1

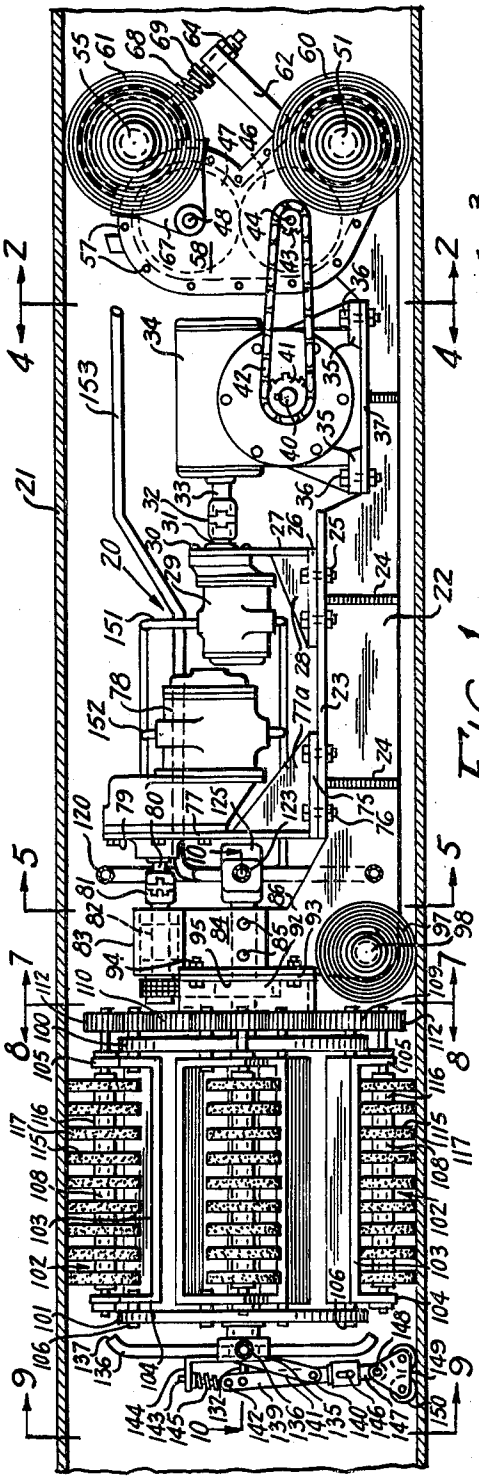

FIG. 1

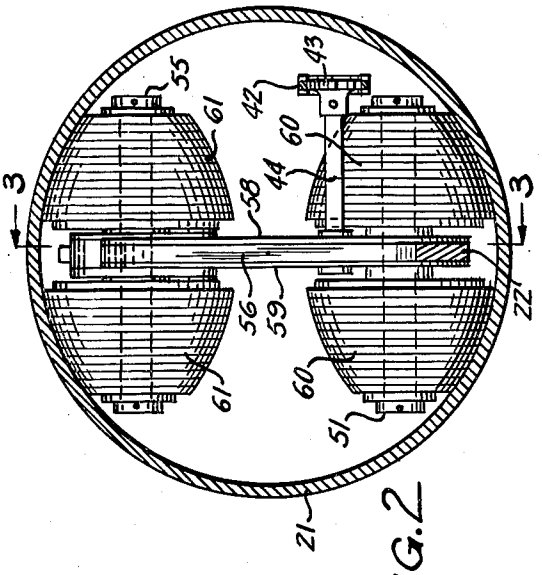

FIG. 2

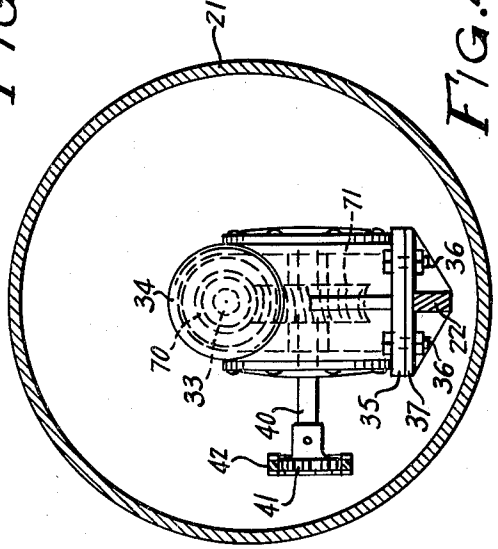

FIG. 4

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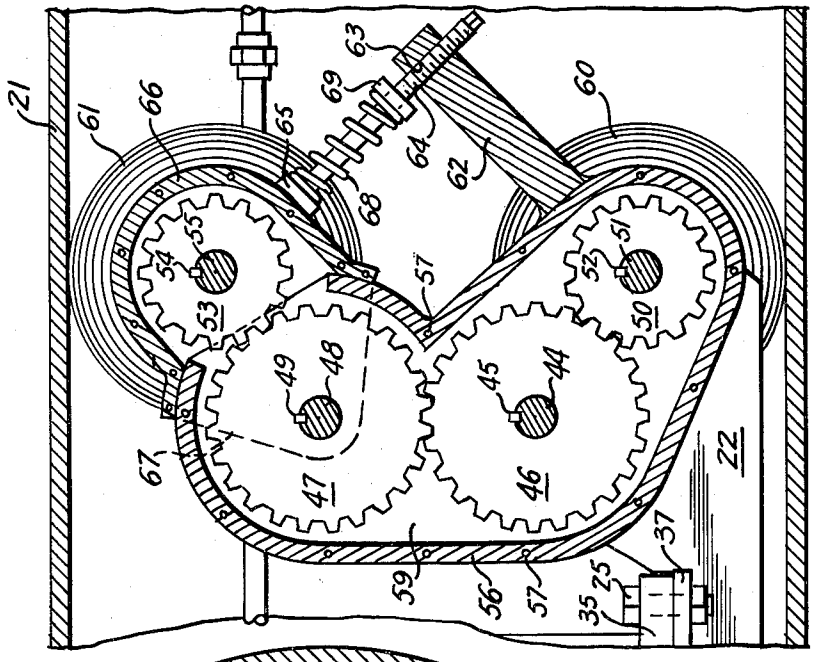

FIG. 3

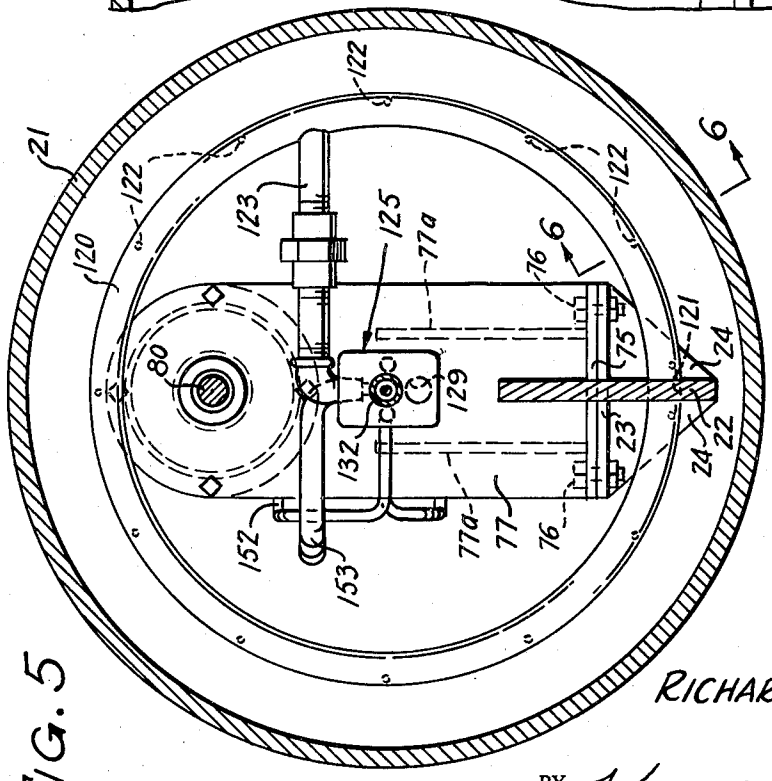

FIG. 5

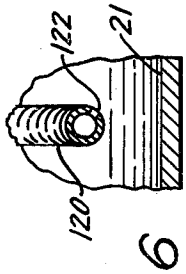

FIG. 6

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FIG. 7

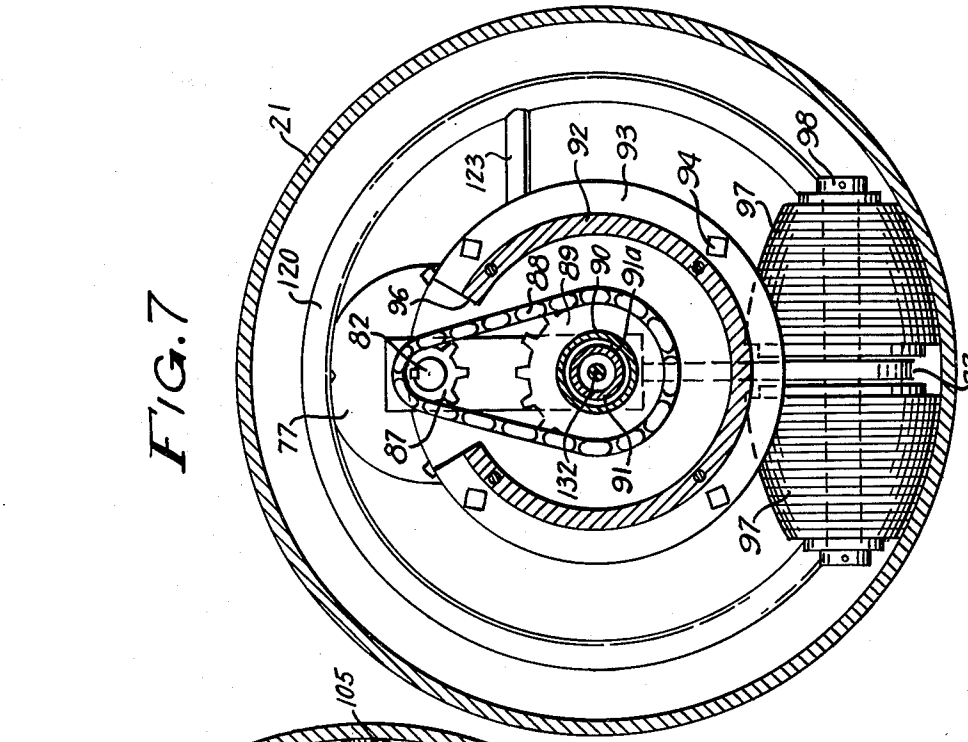
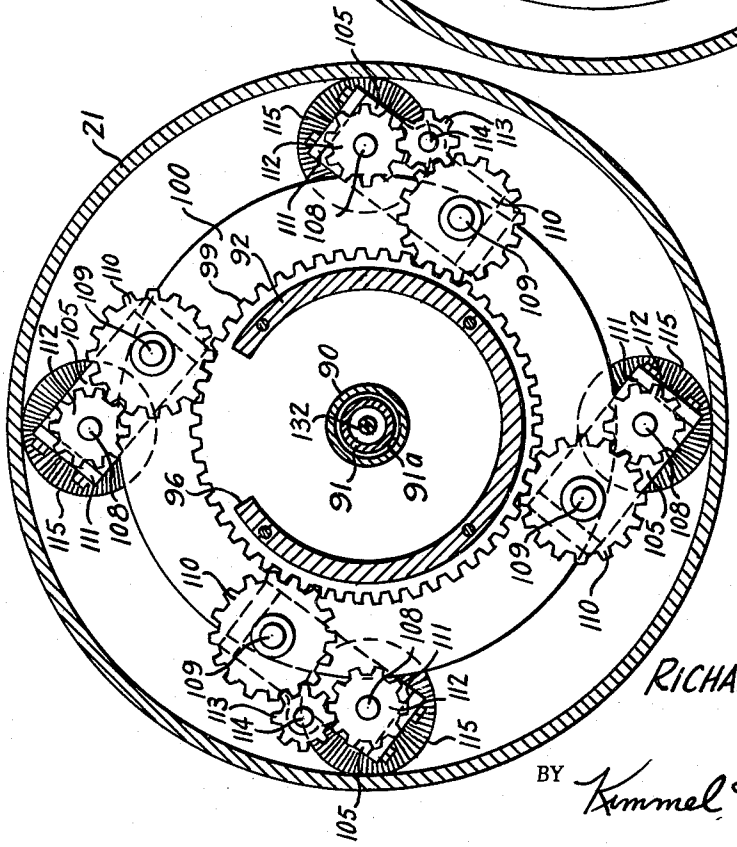


FIG. 8



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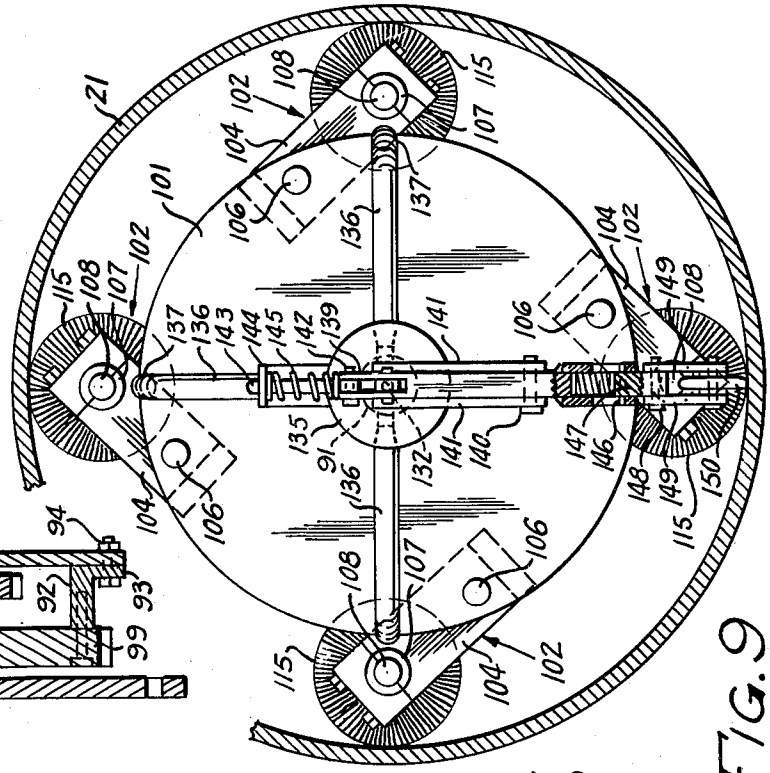

FIG. 9

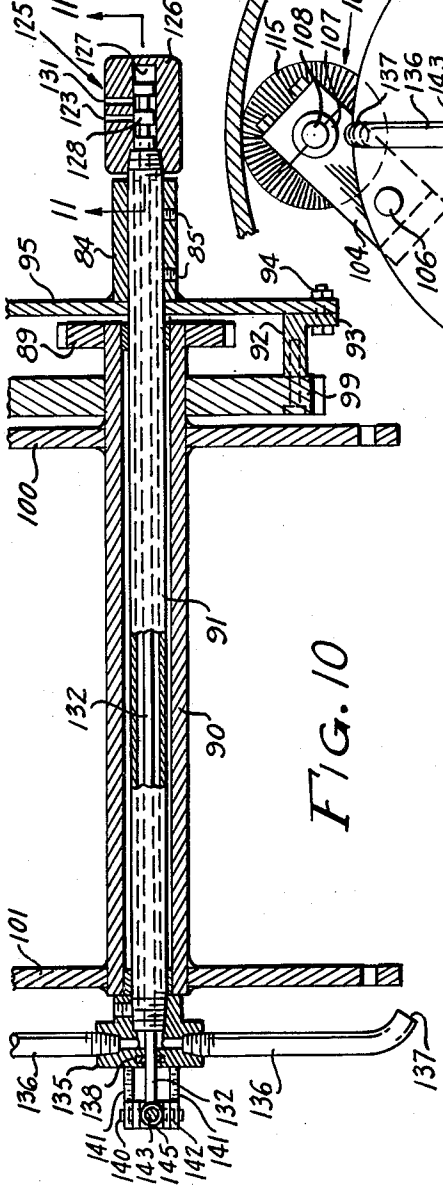

FIG. 10

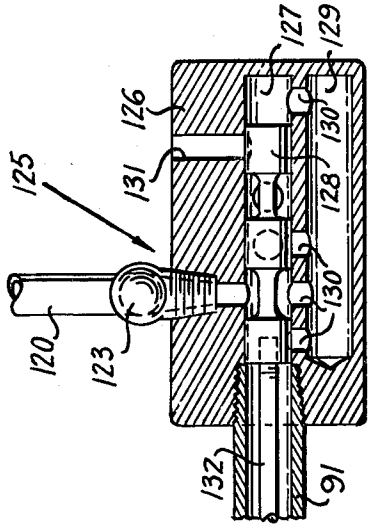

FIG. 11

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3,004,278
PIPE CLEANING APPARATUS

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Filed Dec. 2, 1959, Ser. No. 856,704
8 Claims. (Cl. 15—319)

This invention relates to pipe cleaning apparatus and more particularly to a device for cleaning the inside of large diameter pipe prior to inside paint coating.

The primary object of the invention is the provision of a self propelled unit adapted thoroughly to clean the inside area of the pipe.

An additional object of the invention is the provision of such a device which will thoroughly clean the pipe without leaving dust or mill scale inside of the pipe.

Still another important object of the invention is the provision, in association with a self propelled pipe cleaning device, of trip means adapted automatically to reverse the direction of travel of the apparatus and return it to its original position from the far end of the pipe.

An additional object of the invention is the provision of an apparatus of this character which includes a power driven rotatable head, which rotates around a stationary bull gear, operable to rotate smaller gears to rotate brushes in opposite directions for thoroughly cleaning the inside of the pipe.

An additional object of the invention is the provision of large rubber rolls, driven through reducing gears, for driving the device, thus preventing the machine from turning inside the pipe.

Still another object of the invention is the provision of rubber idler wheels to provide extra support for the frame of the device internally of the pipe.

A further object of the invention is the provision of such an apparatus which is sturdy and durable in construction, reliable and efficient in operation, and relatively simple and inexpensive to manufacture, assemble and utilize.

Other objects reside in the combinations of elements, arrangements of parts, and features of construction, all as will be more fully pointed out hereinafter and disclosed in the accompanying drawings wherein:

FIGURE 1 is a side elevational view of one form of apparatus embodying the instant inventive concept, shown in position interiorly of a pipe to be cleaned;

FIGURE 2 is an enlarged sectional view taken substantially along the line 2—2 of FIGURE 1, as viewed in the direction indicated by the arrows;

FIGURE 3 is an enlarged sectional view taken substantially along the line 3—3 of FIGURE 2, as viewed in the direction indicated by the arrows;

FIGURE 4 is an enlarged sectional view taken along the line 4—4 of FIGURE 1, as viewed in the direction indicated by the arrows;

FIGURE 5 is an enlarged sectional view taken substantially along the line 5—5 of FIGURE 1, as viewed in the direction indicated by the arrows;

FIGURE 6 is a fragmentary detail sectional view taken substantially along the line 6—6 of FIGURE 5, as viewed in the direction indicated by the arrows;

FIGURE 7 is an enlarged sectional view taken substantially along the line 7—7 of FIGURE 1, as viewed in the direction indicated by the arrows;

FIGURE 8 is an enlarged sectional view taken substantially along the line 8—8 of FIGURE 1, as viewed in the direction indicated by the arrows;

FIGURE 9 is an enlarged end elevational view of the device taken substantially along the line 9—9 of FIGURE 1, as viewed in the direction indicated by the arrows;

FIGURE 10 is an enlarged fragmentary detail sectional view taken substantially along the line 10—10 of FIGURE 1, as viewed in the direction indicated by the arrows; and

FIGURE 11 is an enlarged sectional view taken substantially along the line 11—11 of FIGURE 10, as viewed in the direction indicated by the arrows.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Having reference now to the drawings in detail, the device of the instant invention, generally indicated at 20, is shown in FIGURE 1 positioned interiorly of the pipe 21 to be cleaned. The apparatus consists of a main supporting fin or rib 22 extending longitudinally thereof, on the upper side of which is mounted a substantially horizontal base plate 23 supported by angularly disposed reinforcing ribs 24, which are suitably secured to the fin 22 and plate 23 in any desired manner, as by welding or the like.

Secured to the plate 23, as by means of bolts 25, is a horizontal plate 26, which carries as an integral part thereof a vertical plate 27, the latter being reinforced by an angular integral metal brace 28. A suitable electric or air motor 29 is bolted as by means of bolts 30 or otherwise secured to the vertical plate 27, and includes a drive shaft 31 which through a clutch 32 engages the shaft 33 of a reduction gear assembly 34.

The latter includes mounting lugs 35 which are secured as by bolts 36 to a second horizontal plate 37 which is also integral with the central rib 22, but positioned at a slightly lower elevation than the plate 23, rib 22 being cut away for the accommodation of plate 37.

The reduction gear assembly 34 has a drive shaft 40, which through a sprocket 41 drives a chain 42. The chain engages a sprocket 43 carried by a shaft 44 which is keyed, as by means of a key 45, to a relatively large gear 46. Drive gear 46 meshes with a second drive gear 47 which is similar in size, the latter being mounted on a stub axle 48 and secured thereto by means of a key 49. Gear 46 is also in mesh with a slightly smaller gear 50, which is mounted on a transverse shaft 51 and keyed thereto as by a key 52, while the gear 47 meshes with a gear 53 similar to the gear 50 keyed as by key 54 to a second transverse shaft 55. The gear assembly 46, 47, 50 and 53 is contained within a gear housing, which includes a rim 56, to which are secured, as by means of suitable bolts 57, opposite side plates 58 and 59, all as best shown in FIGURES 2 and 3.

Shafts or axles 48 are stub shafts and are journalled in the respective side plates 58 and 59, while axles 51 and 55 are journalled for rotation in their respective side plates, but extend transversely thereof for a substantial distance.

Shafts 51 and 55 each carry oppositely tapered arcuate surfaced segmental rubber rollers 60 and 61, respectively, the rollers being arranged to contact the lower and upper surfaces of the pipe, and serve as a propulsion unit for the entire assembly.

Means are provided for varying the relative spacing of the upper and lower rubber drive rollers, and take the form of a lug 62 which extends outwardly from the lower side of rim 56. The outer end of lug or arm 62 is provided with a threaded bore 63 which accommodates the end of a bolt 64, the other end of which is fixedly secured as at 65 to a movable rim portion 66 which comprises an extension of the rim 56. Side plates 67 enclose the sides of rim 66 to encase gear 53, the axle or shaft 55 being journalled in the side plates 67. A compression spring 68 is positioned around bolt 64, and abuts a lock nut 69 on the bolt. Obviously, rotation of the threaded end 64 in bore 63 will effect relatively slight movement of the rim 66 and its associated mechanism slightly to

vary the relative position of rollers 61 relative to rollers 60 to compensate for variations of a minor nature in pipe diameter.

FIGURE 4 discloses details of the construction of reduction gear assembly 34, it being noted that the shaft 33 carries a worm gear 70 which serves to actuate a drive gear 71 carried by the shaft 40.

The end of plate 23 opposite that carrying motor 29 has affixed thereto a second horizontal plate 75, the securing means taking the form of bolts 76, plate 75 having integrally associated therewith a vertical plate 77. A triangular central reinforcing rib 77A extends between plate 75 and plate 77. A second motor 78, which may be either air or electric as desired, is secured as by means of bolts 79 to vertical plate 77, and is provided with a drive shaft 80 which through a clutch 81 drives the shaft 82 mounted in a bushing 83 which is supported by plates 84 bolted or riveted as by means of bolts or rivets 85 to an upwardly extending portion 86 of main rib 22. The end of shaft 82 extends outwardly of the bushing and carries a sprocket 87, which drives a chain 88 which, in turn, drives a sprocket 89 which is fixedly secured to a tubular shaft 90, the latter being rotatable on a stub shaft or axle 91, suitable bearings 91A being provided between the shafts 90 and 91.

The shaft 91 is fixedly secured between plates 84 and held in position by bolts or rivets 85.

An annular housing 92 includes a flange 93 which is bolted as by means of bolts 94 to a corersponding flange 95 carried by the end of rib 22. Housing 92 surrounds the sprocket assembly 89 and is provided with an opening 96 at its upper extremity (see FIG. 7) through which the chain 88 passes.

The forward end of the assembly is supported by a pair of opposed rollers 97 which are similar in configuration to the rollers 61, being comprised of a plurality of segments tapering toward the outside, and having an arcuate configuration adapted to conform to the contour of the pipe. The rollers 97 are mounted on an axle 98 which is suitably journalled in an aperture extending through the forward lower portion of rib 22.

A stationary ring gear 99 is fixedly secured to the front face of the annular housing 92, as by means of the bolts 94, for a purpose to be more fully described hereinafter.

Fixedly secured to the tubular shaft 90 are a pair of spaced apart circular plates 100 and 101, these plates comprising portions of a rotatable brush carrying head assembly.

Mounted between the plates 100 and 101 are a plurality of brush assemblies, each generally indicated at 102, and each comprising a U-shaped member having a bight 103 and oppositely disposed legs 104 and 105. Each leg 104 is secured to plate 101, as by means of a rivet or stud 106, in inclined angular relation, and each leg 104 is provided at its upper end with a bearing assembly 107 in which is rotatably mounted one end of a brush carrying shaft 108. The opposite legs 105 are secured to plate 100, as by means of stub shafts 109, in aligned relation with the legs 104. Each stub shaft 109 also comprises an axle for a gear 110, which is mounted on the opposite side of plate 100, and which engages in meshing relation with gear 99. Each of legs 105 also carry at its upper end a bearing 111 which journals the opposite end of brush carrying shaft 108, and which extends slightly beyond the bearing 111 to provide accommodation for a gear 112.

Each of the gears 110 is in meshing engagement with the stationary gear 99 so that rotation of the driving head by means of shaft 90 will occasion opposite rotation of the gears 110. Alternate gears 110 engage directly with gears 112, to impart rotation to brush shafts 108 in one direction, while the others of gears 110 directly engage pinions 113 mounted on stub axles 114, as best shown in FIGURE 8, which pinions in turn engage gears 112 in order to rotate alternate brush shafts 108 in opposite directions.

Each of shafts 108 carries between legs 104 and 105 a plurality of spaced apart radial brush elements 115. Each of the brush elements 115 is circular, and comprises a hub 116 mounted on the associated shaft 108 and a plurality of relatively stiff, radially extending bristles tufts 117, the latter being adapted to scour the innerside of the pipe 21.

It will be seen that the brush head assembly rotates relatively slowly, being driven directly by the shaft 90, while the individual brushes 115 rotate considerably more rapidly, and alternate brush assemblies rotate in opposite directions thoroughly to clean and scour the interior of the pipe 21.

Means are also provided for directing air interiorly of the pipe and over the brush head in a direction in accordance with the direction of travel of the apparatus, in order that scrappings from the interior of the pipe are constantly blown outwardly relative to the direction of travel of the apparatus.

Such means take the form of an annular ring 120 which is mounted in a suitable opening 121 in rib 22, and which is provided with a plurality of inclined perforations 122 (see FIGS. 5 and 6), the perforations being inclined to direct air forwardly over the brush head assembly when the device is traveling forwardly. Annulus 120 is positioned relatively closely adjacent the inner wall of pipe 21, and is supplied with air through a connection 123, which extends from a 6-way valve, generally indicated at 125.

The valve 125 comprises, as best shown in FIGURES 10 and 11, a housing 126 provided with a central bore 127 in which is slidably mounted a valve member 128. Housing 126 also contains an air chamber 129, and a series of ports 130 communicating the air chamber with bore 127. An inlet 131 is provided for air under pressure, and is suitably connected to an air line 153, which extends rearwardly from the machine, to any suitable source of air pressure.

The bore 127 is in communication with the interior of tubular support 91 which serves as an air passage, and which has positioned interiorly thereof a valve operating rod 132. With the parts in the position as disclosed in FIGURE 11, the valve, which is of conventional construction, directs air through the communicating pipe 123 to annulus 120, from which it is directed outwardly through openings 122 to blow dust and mill scale from the interior of pipe 21 forwardly over the brush head in the direction of travel of the apparatus.

When the valve 128 is moved rearwardly, or to the right as viewed in FIGURE 11, by the rod 132, in a manner to be more fully described hereinafter, the outlet, or communication 123 is closed and air is directed through the tubular pipe 91.

The opposite end of pipe 91 outwardly of rotatable tube 90 and plate 101 is provided with a cap 135, from which extend a plurality of radial air pipes 136, having inwardly turned ends 137 so arranged that when the valve 128 is in position to direct air through tubular member 91, the air is directed rearwardly back over the brush head.

Operating rod 132 extends outwardly through the end of cap member 135 through a suitable opening which is provided with a sealing gasket 138, and is connected at its outer end to a lever 139, which is pivotally connected as by means of a pivot 140 to an angularly disposed supporting member 141, which is fixedly secured to cap 135. The upper end of lever 139 is pivotally secured as at 142 to a rod 143, which is movably mounted in an L-shaped bracket 144 carried by the cap 135. A spring 145 serves to bias the end of lever 139 outwardly to the position shown in FIGURE 1 when the device or apparatus is traveling forwardly. The lower end of lever 139 carries a socket 146 in which is mounted a rod 147 to the lower

end of which is pivotally secured as by means of a pivot **148** a triangular frame **149**. The frame **149** carries a pair of wheels **150**, which normally ride on the bottom of the pipe **21**.

The arrangement is such that when the wheels **150** over-ride the end of the pipe, the pressure of the spring **145** serves to swing the lever **139** inwardly or towards the brush head, as soon as one of the wheels **150** strikes the end of the pipe on the return movement of the apparatus, to move the valve to the position opposite that shown in FIGURE 10, whereupon the air supply to annulus **120** is cut off, and air is directed through the tubular member **91** to the pipes **136** and their outlets **137**, and thus directed in the opposite direction during the reverse travel of the apparatus.

If desired, the trip mechanism actuated by the wheels **150** may also be connected to the motor **29**, either to reverse the direction of air flow thereto, or to throw a switch to reverse the direction of drive of an electric motor, in which case the wheels **60** and **61** are oppositely rotated to draw the apparatus back through the pipe which it has just traversed. Alternatively, the direction of the drive of motor **29** may be remotely controlled from the opposite end of the pipe.

In the event that air motors are used, suitable air connections **151** and **152**, respectively, may extend from the valve housing **125** to motors **29** and **78**, respectively, in order that the direction of operation of the motors may be reversed by the wheels **150** of the valve reversing mechanism.

From the foregoing the operation of the device should now be readily understandable. The apparatus is inserted in one end of a pipe to be cleaned, and motors **29** and **78** energized in any desired conventional manner. Rollers **60** and **61** drive the apparatus through the pipe, while the brush head is rotated through the drive mechanism previously described by the motor **78**. At the same time the gearing arrangement **99**, **110**, **112** serves to rotate the brushes **115**, and at a much more rapid rate than the rotation of the brush head assembly. Opposite rotation of alternate brushes is effected in the manner previously described.

At the same time air is blown forwardly over the brush head assembly through the openings **122** in annular ring **120**, to remove dust and scale from the interior of the pipe and force the same outwardly over the brush head, so that after the brush head assembly is passed the interior of the pipe is completely clean.

When the end of the pipe is reached the wheels **150** of the trip mechanism drop over the end of the pipe, thus, through valve **125**, reversing the direction of air flow and, at the same time, if desired, reversing the direction of motor **29** and consequently the direction of rotation of the drive rollers **60** and **61**. The direction of rotation of the brush head assembly may also be affected by reversal of the operation of motor **78** if desired.

The device then travels rearwardly through the pipe to the opposite end thereof, and air is blown through the openings **137** of pipes **136** to clear all dust and scale to the rear of the apparatus. The arrangement is thus such that when the apparatus has completed its journey both ways through the pipe, the interior thereof is entirely clean and ready for painting.

From the foregoing it will now be seen that there is herein provided an apparatus for cleaning the interior of large diameter pipes which accomplishes all of the objects of this invention, and others, including many advantages of great practical utility and commercial importance.

As many embodiments may be made of this inventive concept, and as many modifications may be made of the embodiment hereinbefore shown and described, it is to be understood that all matter herein is to be interpreted merely as illustrative, and not in a limiting sense.

I claim:

1. An apparatus for cleaning the interior of pipes comprising, in combination, a frame, means for supporting and driving said frame through a pipe, a brush head assembly rotatably mounted on said frame, a plurality of cylindrical brushes rotatably mounted in said brush head assembly to contact the interior of said pipe, and means for rotating said rotary brushes in said assembly at a higher rate of speed than the speed of rotation of said brush head assembly, including means for rotating alternate of said brushes in opposite directions.

2. An apparatus for cleaning the interior of pipes comprising, in combination, a frame, rollers mounting said frame for movement within a pipe, power means for driving certain of said rollers for moving said frame through a pipe, a brush head assembly rotatably mounted on said frame, means for rotating said brush head assembly, a plurality of cylindrical brushes rotatably mounted on said brush head assembly to planetate in contact with the interior of said pipe, means for rotating said brushes at a higher rate of speed than the speed of rotation of said brush head assembly, means for rotating alternate brushes in opposite directions and means including a plurality of radial rotating air pipes for directing air over said brush head assembly.

3. An apparatus for cleaning the interior of pipes comprising, in combination, a frame, rollers mounting said frame for movement within a pipe, power means for driving certain of said rollers for moving said frame through a pipe, a brush head assembly mounted on said frame, means for rotating said brush head assembly, a plurality of cylindrical brushes rotatably mounted on said brush head assembly in contact with the interior of said pipe, means for rotating said rotary brushes at a higher rate of speed than the speed of rotation of said brush head assembly, means for rotating alternate brushes in opposite directions, means including a plurality of radial rotating air pipes for directing air over said brush head assembly, and automatic means actuated when the apparatus reaches the end of the pipe for reversing said power means, the direction of travel of said apparatus, and the direction of air flow over said brush head assembly.

4. An apparatus for cleaning the interior of pipes comprising, in combination, a frame, power means for driving said frame through a pipe, a brush head assembly mounted on said frame, means for rotating said brush head assembly, a plurality of cylindrical brushes rotatably mounted in said brush head assembly in contact with the interior of said pipe, means for rotating said rotary brushes at a higher rate of speed than the speed of rotation of said brush head assembly, means for directing air over said brush head assembly and axially of said pipe in either direction, and automatic means actuated upon engagement with the end of the pipe for reversing said power means and thereby the direction of travel of said frame and concomitantly reversing the direction of said air flow.

5. The structure of claim 1 wherein the means for driving said frame through a pipe comprises a motor carried by said frame, and a plurality of rollers driven by said motor, said rollers comprising a plurality of segments forming a substantially cone-shaped member having an arcuate surface to conform to the configuration of the interior of the pipe, said plurality of rollers comprising upper and lower spaced rollers, and resilient means biasing the upper rollers against the upper surface of said pipe.

6. The structure of claim 1 wherein said brush head assembly comprises a tubular support member, a tube rotatably mounted on said tubular support member, a pair of spaced apart discs carried by said tube, and rotary brush supporting frame members extending between said plates for containing said rotary brushes.

7. The structure of claim 4 wherein said automatic means comprises a rod, an air valve actuated by said rod, a lever pivotally supported at the forward end of

said frame and connected to said rod, and trip wheels carried by the lower end of said lever and adapted upon running out of the end of said pipe to move said rod to reverse the direction of air flow through said valve.

8. The construction of claim 7 wherein separate air ducts are provided on opposite sides of said brush head assembly, and said valve selectively directs air to one of said ducts in accordance with the direction of travel of said apparatus.

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