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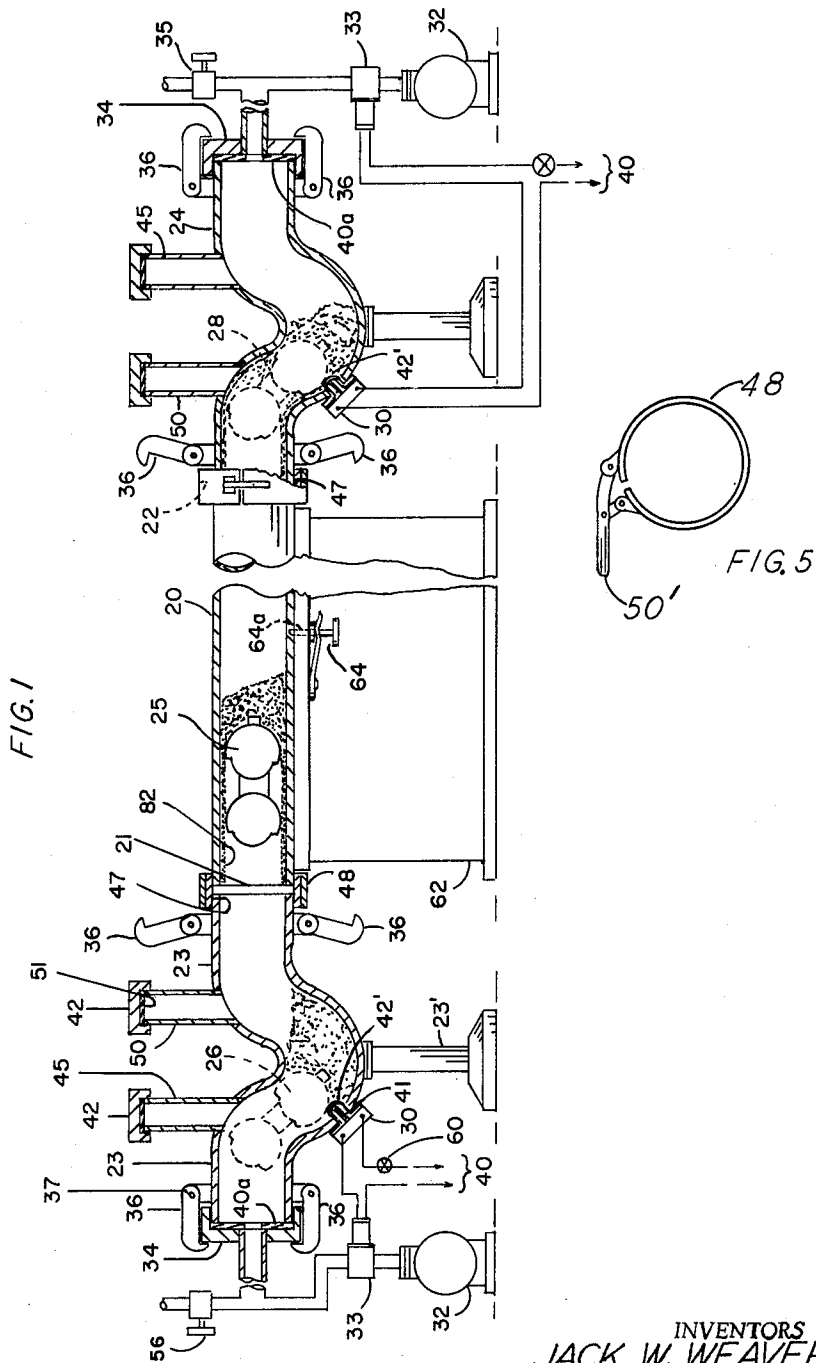
J. W. WEAVER ETAL

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APPARATUS FOR INTERNALLY COATING PIPES OR TUBES

Filed July 25, 1962

2 Sheets-Sheet 1



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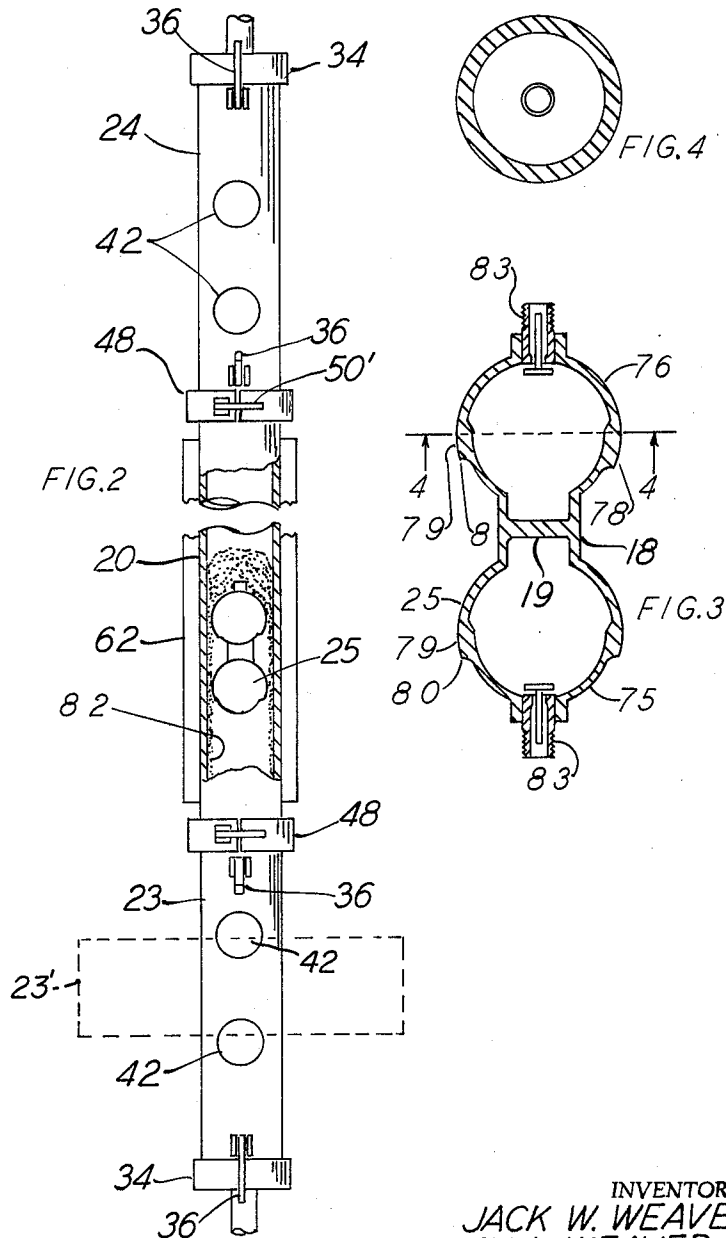
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APPARATUS FOR INTERNALLY COATING PIPES OR TUBES

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This invention pertains to a means for internally coating pipes or tubes.

The present invention pertains to a means for applying a layer of coating material, preferably thixotropic, to a pipe or tube, and its object is to provide a novel means for applying coating material to the interior surface of a pipe or tube.

A further object or advantage of the invention is to provide a novel means for applying a single finished layer of coating material of predetermined thickness to the interior surface of a pipe to expedite the progressive coating application process of stock lengths of pipe to be coated and to provide automatic controls therefor.

A further object is to provide a novel apparatus for utilizing automation techniques in applying a coating material surface to the interior surface of one pipe at a time movable progressively through the pipe to be coated.

A further object is to provide an applicator utilizing a pneumatic gauge means for applying and gauging a single layer of coating to the interior of the pipe to be coated to control the thickness of the layer of coating material deposited on the wall of the pipe, and by using a vacuum techniques to move and control the rate of movement of the pneumatic gauge means or coating applicator through the pipe.

Another advantage or feature of the invention is to employ terminal tubular joints having the dual function of both starter and receiver joints in a system for automatically coating multiple sections of pipe and for terminating the coating operation automatically when the coating of the particular pipe length or section is completed.

A further object is to provide a novel method of coating and apparatus therefore to enable pipe to be internally coated better, quicker, and cheaper.

The invention contemplates a method, an apparatus, and a system for coating progressively one pipe at a time by utilizing a unitary layer gauging means embracing two complex discrete gauge elements, but adjacent one another, to move as a unit through the pipe to be coated by vacuum force so that the coating material which is placed ahead of the coating applicator will be also moved ahead of the applicator except for the quantity deposited on the interior surface of the pipe as a layer in a predetermined substantially uniform thickness. The terminal joints, of which there is one at each end of the particular section of pipe to be coated, is horizontally pivotal so that as the particularly section of pipe is coated, the terminal joints each may be rotated 180°, to enable both of the terminal joints to be suitably rearranged and prepared for coating the following section of pipe.

Other objects and advantages may be and may become apparent from a perusal of the specifications and drawings and it is to be understood that the present disclosure is by way of illustration only and that changes and modifications may be made without departing from the spirit of the invention as presented herewith.

In the drawings:

FIGURE 1 is a vertical section through the pipe and terminal joints to show the relative position of the various elements at one stage of the coating process.

FIGURE 2 is a top view of the invention, partially broken away in the area of the pipe to be coated, as shown in FIGURE 1.

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FIGURE 3 is a vertical section of one form of the pneumatic gauge means or coating applicator.

FIGURE 3 is a vertical section of one form of the pneumatic gauge means or coating applicator.

FIGURE 4 is a cross-sectional view taken along lines 4—4 of FIGURE 3 showing the two discrete pneumatic portions of the unitary applicator.

FIGURE 5 is a side view of the snap ring used to externally compress a rubber-like sleeve for sealably connecting the pipe ends to the terminal tubular members.

Referring to the drawings, there is shown a section of pipe 20 terminating at the pipe ends by 21 and 22, with the terminal joints 23 and 24 shown in one operative position, with terminal joint 23 acting as a starter joint and terminal joint 24 acting as a receiver joint.

In FIGURE 1 the applicator or pneumatic gauge means 25 is shown in solid lines in the center of the particular pipe section to be coated. The gauge means or applicator shown dotted at position 26 is in the starting position within the terminal joint 23 acting as a tubular starter joint (23), on the left of the drawings, and is being used as the coating initiating or starter position, while the tubular terminal joint 24, is momentarily being utilized as the terminal receiver joint and with the coating applicator 25 being shown at receiver position 28, and with the front end discrete gauge means portion being in contact with nipple 42 of the microswitch 30. A microswitch 30 is also shown in the initiating or starter position in the terminal joint 23 to the left of the drawings. At the outside ends of both of the tubular terminal joints 23 and 24 there is shown similar closure parts. For the present showing of the invention, there is a duplication of certain other parts, but this would not necessarily be totally true in the practical application since one unit of equipment would be able to do the work required at both ends of the terminal joints. A pair of compressors 32 are each coupled to a respective solenoid valve 33. The output of the respective solenoid valves 33 is coupled to the respective closure caps 34 and to respective bleeding valve 35. The two terminal joints 23 and 24 each have two sets of pairs of pivoted bevel-jawed hooks or clamps 36 pivoted at 37 by projections secured on the opposite ends of each of the terminal joints.

The arrows 40 represent a source of electrical energy which periodically connects the normally-open switch contacts of the respective microswitches 30 with the electrical circuit of the solenoid 33 so that when the particular microswitch 30 is actuated by movement of the coating applicator 25 when in position 28, the circuit to the solenoid valve when the terminal switch 30 in the receiver is operated and the respective compressor 32 (depending on which one is in operation), is blocked from further action in a conventional manner performed by commercial apparatus. In operation, after the coating applicator 25 moves from the starter position shown at 26 through the pipe 20, to be coated, and then through the receiver position shown as 28 in the right end terminal joint 24, the microswitch 30 in the receiver position is closed to energize the respective solenoid valve 33 and break the vacuum in the system and permit the bleeder valve 35 in the receiver position to be opened thereby completely and further positively breaking the vacuum to enable the operator to remove conveniently the closure caps such as 34 on each of the terminal joints 23 and 24.

The clamps 36 are used for holding the rigid or metal closure cap 34 against its respective outside or gasket ends 40a of the starter joints 23 and 24. The bevel-jaws of clamps 36 frictionally hold the cap 34 in place, but the vacuum of the system draws the caps tightly closed when in operation.

It will be seen that each microswitch 30 has a projection 41 which protrudes through an opening in the re-

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spective pipe to which the microswitch is secured in its respective starter joint. A rubber nipple 42' having a flange thereon is positioned over the projection of the respective microswitches and when the microswitch is secured into position on its respective starter joint, the flange of the nipple 42 is compressed between the pipe and the microswitch to form a tight seal. The applicator at position 28 presses projection 41 to actuate the micro-switch and stop the applicator due to breaking of the vacuum in the system.

Caps 42 are on vertical pipes 45 and are air-tight by their gasket seals, but are easily removed when the vacuum is destroyed.

When the applicator device is in position at 26, as shown before starting the coating process in (FIGURE 1) one length of pipe, the clamps 36 on the extreme left are closed, and the left cap 34 is held tightly against the terminal joint 23 with the bleeder valve 35 being left open (fully or at a control position to facilitate or regulate movement of the applicator when the vacuum is applied). The clamps 36 on the extreme right-hand end of the left-hand terminal joint 24 and the clamps 36 on the left end of the right-hand terminal joint 24 are shown extended outwardly or radially and are doing no clamping work at all in this particular position. The reason for this radially extended showing of clamps 36 is that the pipe 20 is hermetically sealed, when being coated, to its respective terminal joints 23 and 24 by annular sleeves of rubber 47, or other sealing means; which are clamped in an operative position by respective conventional type snap clamp 48 having a snap lever 50' as shown in FIGURE 5 to lock the rubber in an hermetic seal relation to pipe 20.

Normally, in setting up the arrangement for coating, the terminal joints are swung into position as shown in FIGURE 1, with the annular bands or rubber 47 moved back adjacent their respective clamps 36. After the starter joints are swung into operative position relative to the opposed ends 21 and 22 of the pipe 20, the rubber sleeves 47 are moved into respective sealing positions to close the joints between the pipe 20 and its respective starter terminal joint portions and is held securely by its respective clamp 48.

In operation, a predetermined amount of coating material, which may be thixotropic, is dumped into the terminal joint starter position pipe 50 after its cap 42 has been removed, and thereafter replaced. A gasket 40a is positioned on the inside of the cap 42 on each pipe 50, as is the case on all of the caps 42 and their respective pipes such as 50 to seal same during operation of the apparatus.

The closure cap 34 shown on the right-hand end of the terminal joint is placed in position and its clamps 36 are swung into clamping position to tightly fix the cap operatively on the end of the starter joint. The right end bleeder valve 35 is closed. In this particular instance in initiating the coating of one section of pipe, the coating applicator is first placed in the starter position 26 as shown in the drawings. A manually operable switch 60 on the left-hand side circuit may be opened to normalize the normally open circuit conditions. However, this is not necessary because with the bleeder valve 35 on the left-hand terminal joint 23 being opened to permit air to flow through, the condition of the solenoid 33 associated with the left terminal joint 23 would have no effect with this system.

As soon as the joints at 21 and 22 are sealed, and the left-hand terminal starter joint closure cap 34 properly clamped and with its bleeder 35 open, and the predetermined amount of coating material placed in the left-hand starter joint, the evacuation system at the right side may be started. With the right-hand cap operatively in position and its bleeder valve 35 closed, operation of the compressor, with the valve solenoid 33 being conditioned

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to permit evacuation, the air pressure within the starter joint 34 will be reduced. With the left end bleeder valve 35 being open, and upon sufficient lowering of pressure, a partial vacuum is created in the terminal joint 24. This vacuum will cause the coating material applicator 25 and the coating material of a predetermined amount, to move to the right end position, and thus the coating material moves ahead of the applicator or gauge means to release a layer of coating material to coat the walls of the tubular terminal joint. The coating applicator and the mass of coating material then moves into the pipe 20 to be coated and deposits its uniform layer of a predetermined thickness as determined by the transverse diameter of the coating material and final diameter of the gauge means or applicator. When the applicator or gauge means is sucked through the pipe by the vacuum created by the right-hand compressor 32, the coating applicator or gauge means 35 will ultimately reach position 28 at which time the applicator or gauge means will actuate the respective microswitch which will in turn operate the solenoid valve to destroy the vacuum ahead of the coating applicator at position 28. At this time in the operation, the bleeder valve 35 of starter joint 24 is manually opened and the vacuum is completely destroyed therein.

The snap levers 50' are then released, and the annular rubber sleeves are manually pushed back against their respective adjacent clamps 36. The starter joints are then moved out of the way and the section of pipe 20 removed by actuating the stop pin 64 which is normally spring-held upwardly to prevent movement of the pipe while being coated, and another section of pipe is then rolled into position on the inclined pipe rack.

In the present arrangement, the flat pipe table 62 has its top surface positioned slightly at an angle so that it forms an inclined pipe rack and the pipes will roll down the incline of the pipe rack or table top and strike the removable stop 64. The pipe stop is actually spring loaded by a leaf spring that is forked and engages a limiting washer secured on the pin 64a so that the pin is biased upward in the way of the pipe 20 shown in its coating position.

In order to permit the coated piece of pipe to move on out of coating position, the operator merely hits the spring-loaded pin 64a downwardly and the coated pipe rolls out of the way and a new piece of uncoated pipe is automatically stopped by the spring-urged pin 64a projecting above the table sufficiently to engage and stop the new piece of pipe in coating position.

In FIGURE 2, a dotted oblong support means 23' is shown for supporting the tubular terminal joint 23, rotated 90 degrees horizontally from that shown in FIGURE 1, and in a position to be swung around the other 90 degrees when the pipe terminal joints are changed.

In FIGURES 3 and 4 the coating applicator 25 or gauge means is shown as having two ball-like structures or discrete gauge means portions 75 and 76. Each of the ball-like structures 75 and 76 have the greatest diameter at substantially the lines 4—4 shown in FIGURE 3, which is a transverse cross-section substantially at its greatest diameter. However, each of the ball-like structures have an annular skirt portion 79 forming a shoulder with a trailing annular edge 80 so that the applicator may move forward and have an abrupt termination of the skirt 79 in its contact with the coating material 82 as shown in drawings of FIGURE 1.

Valves 83 have valve nipples thereon so that air under pressure may be forced into or released from the respective ball-like structures 75 and 76. The coating applicator is preferably made of resilient material, such as rubber, so that the diameter of both of the ball-like structures or gauge means may be independently pressure controlled for independently controlling the diameter of one with respect to the other.

More pressure may be placed in one ball-like structure than in the other so that the one with greater pres-

sure may have a larger diameter, or they both may be of the same diameter. While both ball-like structures may be of the same diameter, frequently the trailing ball-like structure such as 75 may be slightly larger in its normal diameter, that is without pressure above atmospheric pressure, or without inflating pressure so that the trailing ball or gauge will be able to finish smooth or even alter the coating diameter of the leading ball or gauge after its passage through the pipe in a coating operation.

In actual operation, the annular rubber sleeve 47 and snap rings 48 are made as an annular unit with the rubber 47 secured to the metal snap ring so that the deformation of the snap ring 48 also deforms the rubber sleeve 47 and makes the operation of sealing the tube ends of pipe 20 to the terminal tubular joints quick and simple.

The other tube 45 on the same terminal joint as the filler tube 50, is used for inspection and test movement of the applicator, microswitch and thixotropic coating material as needed.

While the invention is shown with one section of pipe being coated in the shop or yard, the invention, method and system have been successfully used in coating pipe-in-place, and also in pipe over-the-ditch.

Each pipe 20 to be internally coated receives only one pass of the applicator 25 or gauge means regardless of the thickness of the layer of coating material desired and applied.

While the invention has been frequently used in pipe having inside diameters of from two to twelve inches, the same basic apparatus and method can be used in pipes of much larger inside diameters.

With the present invention, the operator of the invention actually applies a single layer of coating material to a surface with said single layer of coating material being of the desired thickness which was predetermined by either the valve 83 or planned resiliency of the gauge means with atmospheric pressure only in the ball-like portions, or with the ball-like portions each being independently under pressure greater than atmospheric pressure. The method involves applying a linearly controlled thickness layer of coating material to the interior surface of a pipe, and of a predetermined thickness of coating variable as established by a variable pressure controlled gauge means.

This apparatus provides a novel means of rapidly applying a coating material of a predetermined final thickness layer in a single application.

The gauge means 25 or applicator may be of fixed or pre-established dimensions in a usable non-pressurized state, and the dimensions may be increased with an increase in pressure through valve 83. The gauge means may be of one dimension in an inoperative state. When in an operative state it may be of another dimension due to external pressure when working with the thixotropic coating material in the pipe. Accordingly, the term "effective dimensions" or "effective transverse dimension" may be used as the dimension or diameter used to obtain a coating of a desired thickness, or a coating to obtain a desired inside diameter of the coated pipe.

The invention will supply a coating to the interior surface of a pipe with said coating being either thick layers or thin films, and with or without solvents being employed.

The inherent resilient characteristics of the device, with or without internal pressure of the applicator or

gauge means balances out resistance of flow in the coating material, thereby producing a uniform thickness controlled layer which is virtually constant regardless of the gauge means pressure.

Thixotropic layers of from several thousandths of an inch up to and beyond three tenths of an inch are not uncommon and are applied linearly internally of a pipe with the desired layer thickness being obtained in a single application only.

The particular form the invention may take is not to be limited except by the spirit of the subjoined claims.

What is new and desired to be claimed by Letters Patent of the United States is:

1. An apparatus for applying a layer of coating material to the interior surfaces of a pipe comprising a horizontally disposed pipe to be internally coated; a pair of tubular end members in a generally horizontal alignment with and releasably sealed to the ends of said pipe; each of said members being mounted for rotation about a vertical axis through the support pedestal thereof and including a U-shaped trap-like section along the longitudinal extent thereof, coating material charging means for each of said end members, suction means selectively communicating with each of said end members, a floating and bulbous resilient applicator means in one of said end members actuated in one direction of travel during coating of the internal surface of said pipe due to reaction on said applicator by said suction means, said coating material charging means communicating with each of said end members for charging said end members with coating material ahead of said bulbous applicator, energized electrical circuit means for actuating said suction means, and resiliently sealed switch means in each of said trap-like end members connected to said circuit means and operated by contact with said applicator means to selectively actuate said suction means to control the direction of travel of said applicator means in said pipe to be coated.

2. An apparatus for applying a layer of coating material to the interior surfaces of a pipe as in claim 1, wherein said applicator comprises two bulbous portions joined by a longitudinal web portion.

3. An apparatus for applying a layer of coating material to the interior surfaces of a pipe as in claim 2 wherein each of said bulbous portions comprise valve means therein for independently controlling the external diameter thereof.

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