July 19, 1960 E. ROBERTSON 2,945,278

COATING APPARATUS

Filed April 10, 1956 3 Sheets-Sheet 1

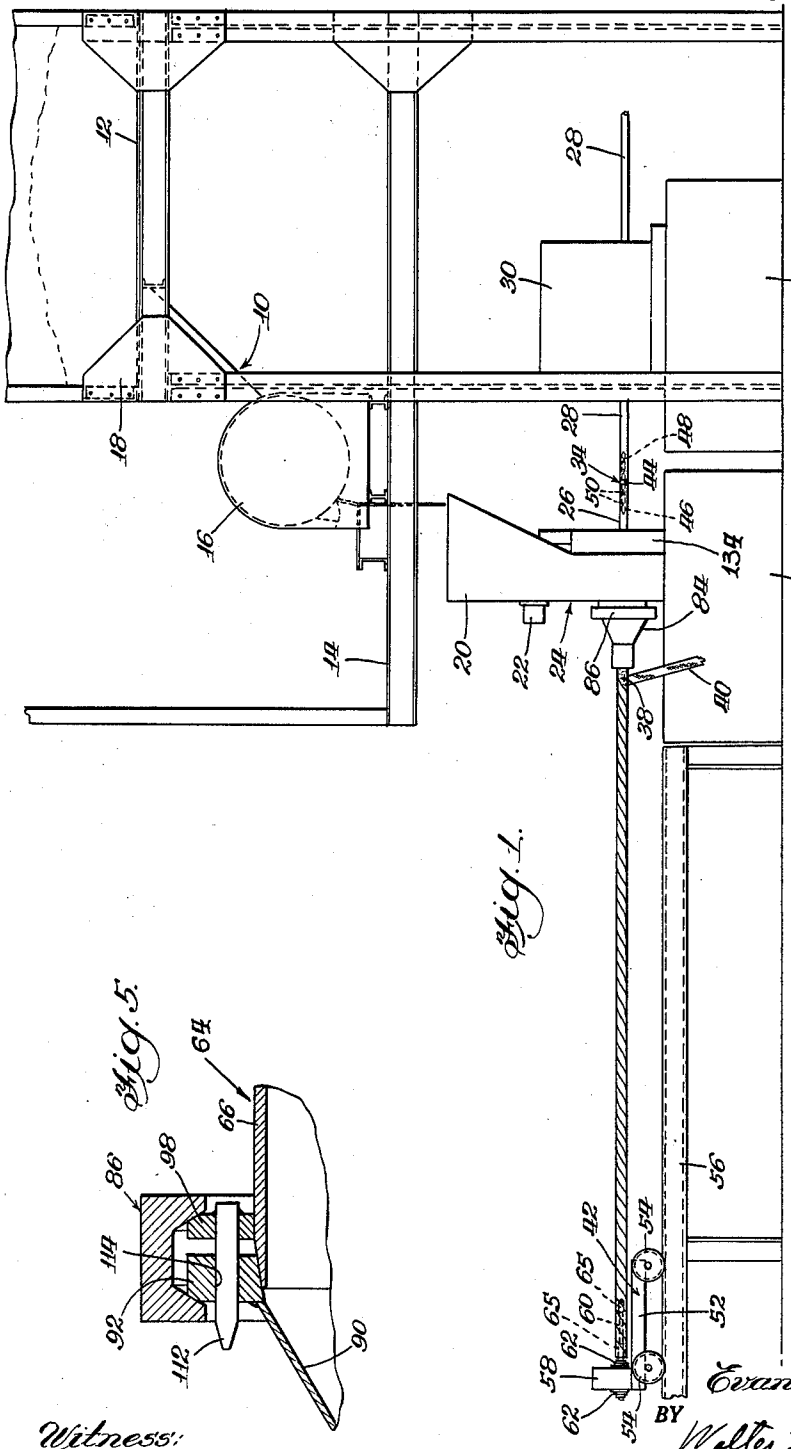


Fig. 1.

Fig. 5.

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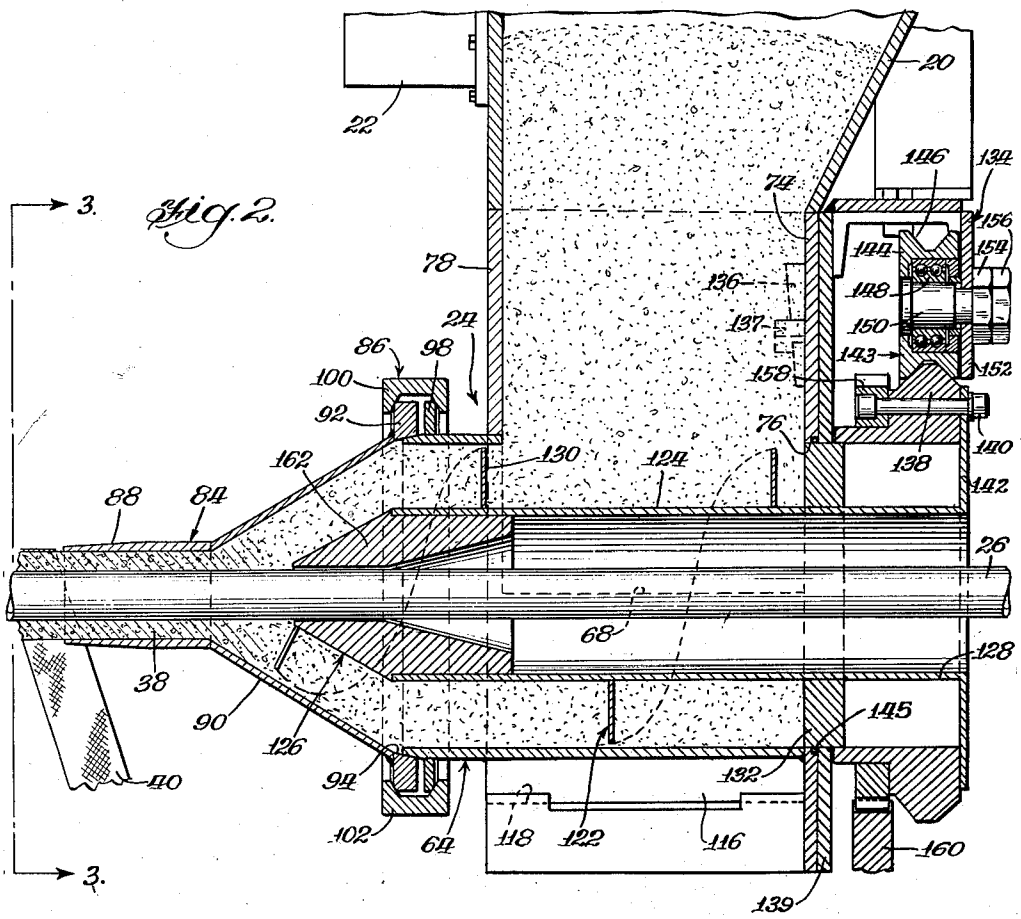


Fig. 2.

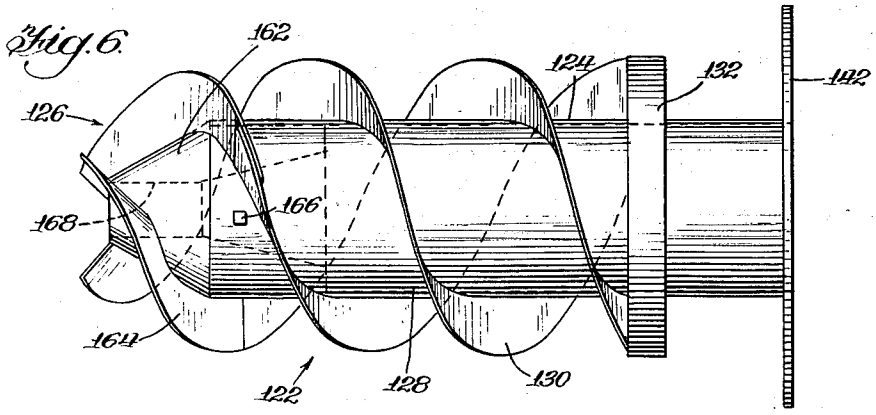


Fig. 6.

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Fig. 3.

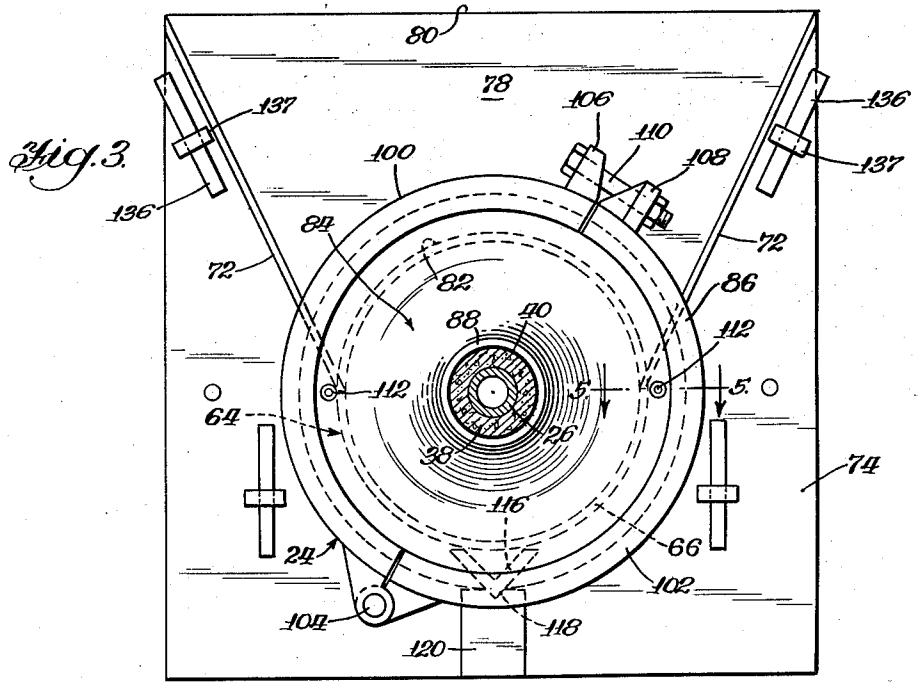
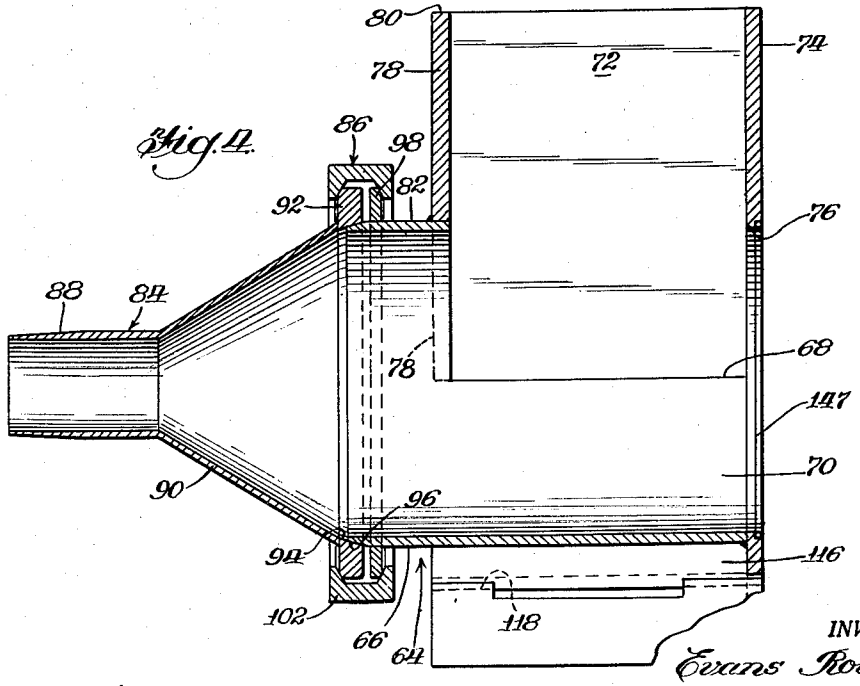


Fig. 4.



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2,945,278

COATING APPARATUS

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Filed Apr. 10, 1956, Ser. No. 577,228

7 Claims. (Cl. 25—38)

This invention contemplates apparatus for coating either bare or precoated pipe with a coating such as concrete. The precoating referred to above may be an enamel coating, a thermo setting or plastic coal tar derivative coating, or an asphalt enamel containing fillers and tars for special purposes.

One of the reasons a concrete coating is desirable is to provide mechanical protection for the pipe against the abrasion occasioned by forcefully pushing lengths of pipe through the ground during conventional shallow underground installation.

Another reason for using a concrete coating is to provide mechanical protection for shallow underground installations during digging operations and the like.

It is also advantageous to provide a concrete coating for underwater pipe installations in order to protect the pipe from attack by barnacles and other forms of marine life, and also to protect the pipe from the corrosive action of salt or brackish water. Concrete coating is also utilized on pipe to assure a high enough weight and specific gravity to sink the pipe when the installation is in salt water or muddy water, and also to keep the pipe in place against the forces of tidal action.

The brush throwing method of concrete application can be used successfully on comparatively large diameter pipes, but the extreme amount of waste due to the smaller target area available when coating small diameter pipes makes this method prohibitively expensive for small pipes. The same reasoning applies relative to all types of coating methods wherein the concrete is mechanically thrown. These latter methods include concrete gun applications, air propelled concrete applications and the like.

The present invention therefore contemplates a novel form of extrusion apparatus for the coating of small diameter pipe.

The novel apparatus is particularly suitable due to the small material loss involved. By incorporating in the apparatus means to adequately control pipe deflection or bending, a uniform centered concrete coating may be applied to pipe ranging, for example, from approximately 4 inches to 1¼ inches in diameter.

The general object of the present invention is to provide a pipe coating machine for the coating of small diameter pipe by the extrusion process.

A specific object of the invention is to provide apparatus for the coating of small diameter pipe with concrete, the apparatus being adaptable to rapid, easy, change-over for accommodation of varying sizes of pipe.

Another important object of the invention is to provide concrete coating apparatus of the extrusion type for small diameter pipe which is extremely simple in operation, and which can be assembled and disassembled quickly and easily for cleaning, repairing, replacement of parts and the like.

Still another object is the provision of pipe coating apparatus of the extrusion type for small diameter pipe

wherein means are incorporated to eliminate whipping action in the pipe as it emerges from the machine.

Other objects and advantages will become apparent from an examination of the accompanying specification and drawings, in which:

Figure 1 is a schematic elevational view of pipe coating equipment incorporating the teaching of the present invention;

Figure 2 is a vertical section through the hopper and the extrusion portions of the apparatus of Figure 1;

Figure 3 is a fragmentary front elevational view of a portion of the apparatus shown in Figure 2 and taken substantially at the line 3—3 thereof;

Figure 4 is an auxiliary sectional view similar to Figure 2 but more clearly illustrating the construction of the conduit of the extrusion portion of the apparatus;

Figure 5 is a sectional view taken at line 5—5 of Figure 3 showing the cone positioning means; and

Figure 6 is a side elevational view illustrating the assembled feed screw and adapter screw.

Referring first to Figure 1, it is seen that the assembly comprises a frame generally indicated at 10, the upper portion 12 of which forms a loading platform for the sand which is to be used in the concrete mix. At a slightly lower level, an extension 14 of the frame forms a platform for storing the bags of cement which are to be used in the concrete mix. A conventional paddle type mixer 16 is mounted on the platform 14 and the sand is discharged thereinto by gravity from a batching hopper 18, which is also utilized to control the quantity of sand fed to the mixer at any particular time. The amount of sand fed to the mixer may be controlled manually, or, if desired, conventional weighing means may be employed. The bags of cement are furnished in standard weights, therefore no weighing apparatus is necessary in determining the amount of cement conveyed to the mixer.

The mixed concrete discharges into a hopper 20, which is preferably vibrated by means of a conventional vibrator 22 for the purpose of settling the material and eliminating voids therein. The hopper 20 communicates with the pipe coating portion proper of the device, which is illustrated generally at 24, and which will be described in detail hereinafter.

In extrusion type coating machines, the lengths of pipe are fed through the device, and in Figure 1 successive lengths of pipe are illustrated at 26 and 28. The leading pipe 26, rotating about its longitudinal axis, is shown passing through the coating apparatus and emerging with a coating of concrete 38 and a covering of wrapping material 40. The purpose of the outer wrapper 40 is to retain and reinforce the concrete coating. It is applied in spiral fashion, as the rotating pipe emerges from the coating machine, by means of a conventional wrapping device which is not illustrated in the drawings inasmuch as it forms no part of the present invention. The trailing pipe 28 is also rotated about its longitudinal axis, and is propelled forwardly toward the coating conduit by means of a propelling device 30 of the type shown in Patent No. 2,048,557 to Mickelson.

The propelling unit 30 is provided with power from a conventional variable speed drive unit 32, which is not illustrated in detail as drive units of this type are well known to those familiar with this art.

The spirally advancing motion of the pipe 28 is transmitted to the leading pipe 26 by means of a coupler 34 of the type illustrated in Patent No. 2,153,096 to Mickelson et al. The coupler comprises generally a central flange 44 which transmits the longitudinal force from the pipe 28 to the pipe 26, and a pair of inserts 46 and 48 which project into the pipes 26 and 28, respectively. The inserts 46 and 48 are provided with a plurality of spring

steel blades 50 which bite into the internal periphery of each of the pipes and transmit thereby the rotary motion of pipe 28 to pipe 26.

As the coated and wrapped pipe 26 emerges from the coating portion of the apparatus the large ratio between the weight of the coated pipe and the diameter thereof causes deflection in the pipe 26 which tends to create a whipping action. This deflection and this whipping action, in turn, tends to disrupt the continuity of the coating. To eliminate this deflection a movable dolly, generally indicated at 42, is provided to support the finished coated pipe.

The dolly comprises a frame 52 mounted on wheel and axle assemblies 54 by means of which the dolly may ride toward and away from the extrusion conduit on a pair of rails 56, which extend outwardly from the frame 10 of the machine. Secured to the dolly frame 52 is a bearing bracket 58 which supports a spindle 60, which in turn, is rotatable in antifriction bearings 62 carried in bracket 58. The end portions 65 of the spindle are made to closely fit the internal periphery of the pipe which is being coated, and the spindle when inserted into the pipe provides two-point support therefor at 65—65 and reduces the deflection of the pipe to a minimum.

The extrusion portion 24 of the apparatus is illustrated in Figures 2, 3, 4 and 5 and comprises a coating material conduit 64, the details of which are particularly illustrated in Figures 3 and 4. The conduit 64 comprises a cylindrical portion 66 cut away for a portion of its length, as at 68, leaving a semicylindrical portion 70 which forms the bottom of the conduit. The sides of the conduit are formed of walls 72, which are preferably welded to the upper edges of the semicylindrical portion 70 and diverge outwardly and upwardly, as best seen in Figure 3. A rectangular plate 74, preferably welded to the semicyclindrical portion 70 and to the side walls 72, forms the rear wall of the conduit and is provided with an opening 76 corresponding to the size of the cylindrical portion 66. A front plate 78 having a contour defined by the surface 80 (Figure 3), the side walls 72 and the top portion 82 of the cylinder 66, is preferably welded to the cylinder 66 and to the side walls 72.

An extrusion cone 84 is releasably secured to the outlet end of the conduit 64 by means of a clamping ring, generally indicated at 86. The outer end 88 of the extrusion cone 84 is cylindrical in form and has an internal diameter corresponding to the desired outer diameter of the concrete coating. The purpose of the cylindrical end 88 is to smooth and finish the concrete coating to the proper size. A conical portion or extrusion cone 90 flares outwardly from the end 88 to a flange 92 having a tapered inner periphery 94 snugly engageable with corresponding tapered surface 96 on the cylindrical portion 66. A mating flange 98 is preferably welded to the cylindrical portion 66 in a position to be adjacent the flange 94 when the cone 84 is in assembled position, and the cone is held in assembled position by means of a clamping ring 86, as mentioned heretofore.

The clamping ring 86 is formed of two semicircular pieces 100 and 102 (Figure 3) which are pivotally hinged to each other by means of a hinge pin 104. Diametrically opposed to the hinge pin 104 are a pair of opposed lugs 106 and 108 secured to the semicircular rings 100 and 102, respectively, and adapted to receive a bolt and nut assembly 110, by means of which the clamping ring may be clamped in place over the flanges 92 and 98. The conical portion 90 of the cone serves the purpose of offering resistance to the passage of the concrete mix therethrough, and thereby aids in compacting the coating material around the pipe, as will be described hereinafter.

A pair of locating pins 112 (Figures 3 and 5) are welded to the flange 98 and project forwardly thereof to be received within corresponding openings 114 in the flange 92. The pins 112 serve to locate the cone 84 and prevent rotation thereof under the torque imposed by the concrete which is being extruded.

The conduit 64 is preferably mounted on an angle iron 116 positioned to be located in a V groove 118 formed in an extending bracket 120 of the frame 10.

Referring to Figure 2, it is seen that a conveyor screw assembly 122 is disposed longitudinally in conduit 64 with its longitudinal axis coaxial with the axis of the opening 76 and the axis of the extrusion cone 84. The conveyor screw 122 comprises a feed screw portion 124 and an adapter screw portion 126 (see also Figure 6). The feed screw 124 comprises a hollow cylindrical body portion or rotor 128 encircled by a spiralling flight 130 which is secured at the rear end thereof by a flange 132. The conveyor may be in the form of a single or multiple flight screw, but preferably is formed with three spaced encircling flights in the general form of a triple worm.

The body portion 128 is received through the opening 76 and extends into a support housing 134 (Figure 2) which is preferably formed integrally with or fixed to the frame 10, and to which the extrusion portion 24 is releasably secured by means of a plurality of drive keys 136 (Figures 2 and 3). The keys 136 are received through openings of lugs 137 which are secured to the plate 139 of the housing 134 and extend through and forwardly of the plate 74 through apertures thereof. A sealing ring 145 surrounds the flange 132 and is received in a groove 147 which is formed by the inner face of plate 139 and a cut-out portion of plate 74. The reason for this type of construction is so that the extrusion portion 24 may be disassemled and assembled, as desired, without disturbing or damaging the ring 145 which remains in its proper position on the flange 132 and abutting the plate 139.

Carried by the body portion 128 and received in the support housing 134 is a V roller track 138, which is secured by means of a plurality of cap screws 140 to a flange 142 which is, in turn, welded to the body portion 128.

The entire conveyor screw 122 is rotatably supported through the V roller track 138, which is operatively engaged by a plurality of idler roller supports 143, preferably equally radially spaced about the periphery of the V roller track 138. Each idler roller support comprises a roller 144 having a peripheral V groove 146 operatively engageable with the V roller track 138. The roller 144 is bearing mounted as at 148 on a stud shaft 150, which is received through the back plate 152 of the housing 134 and held in place by means of a conventional nut 154 and lock nut 156. The bearings 148 are preferably of the type designed to accommodate both radial and axial loads and will therefore acommodate both the weight of the screw conveyor and also the axial loads imposed by the action of the conveyor screw in forcing the concrete through the conduit.

Secured to the V roller track 138 for rotation therewith is a driven gear 158 operatively engageable with a drive gear 160 which is driven in a conventional manner from a power unit indicated generally at 36 in Figure 1. The drive unit may be of any conventional type and may be provided with a clutch for starting and stopping, as desired, and as drives of this type are conventional and form no part of the present invention it need not be described in detail.

The adapter screw portion 126 of the screw conveyor 122 comprises a generally conical body portion 162 encircled by three spiral flights 164 which, at assembly with the conveyor screw, overlap the corresponding flights 130 to mate therewith in a substantially continuous flight. The body portion 162 of the adapter screw is receivable inside the body portion 124 of the feed screw and is held in assembled relationship therewith by means of one or more square head set screws 166. The inner peripheral surface 168 of the adapter screw is made to closely fit the outer periphery of the particular size of pipe which

is received therethrough to be coated and in this manner the adapter cone not only serves to afford a third point of support for the pipe but also to accurately locate the pipe coaxially with the axes of the material conveyor portion 66 and extrusion cone 90.

Describing now the manner of operation of the device, a length of pipe 26, to be coated, is fed into the pipe propelling unit 30. This unit advances the pipe forwardly into the extrusion portion of the machine and simultaneously rotates the pipe about its longitudinal axis. Insert 46 of the coupler 34 is inserted into the trailing end of the pipe 26 and the next length of pipe 28 is inserted over the portion 48 of the coupler which is protruding from the pipe 26. As the pipe 26 advances through the extrusion device and leaves the propelling unit, it will still be advanced and rotated by means of the coupler 34 as explained heretofore inasmuch as pipe 28 is being advanced and rotated by propelling unit 30. Simultaneously with the advance of the pipe 26 through the extrusion coating device 24 the concrete mix is fed from the hopper 20 into the conduit 64, and is forced forwardly by means of the screw conveyor 122 into the extrusion cone 84 where it is compacted around the pipe. As explained before, the cylindrical portion 88 of the extrusion cone 84 smooths the outer surface of the concrete coating and finishes it to the proper size. As the leading end of the pipe 26 emerges from the extrusion cone 84 the dolly 42 is moved on the tracks 56 into close proximity with the extrusion cone so that the spindle 60 of the dolly will be received within the pipe 26 to provide support therefor against excessive deflection. The force of the advancing pipe will, of course, move the dolly away from the extrusion cone along the tracks 56. Immediately adjacent the outer end of the cone 84 a conventional wrapping device (not shown) spirally applies a wrapper 40 over the concrete coating to retain and reinforce the still semi-plastic coating. When the trailing end of the pipe 26 emerges from the extrusion cone 84, the entire machine is temporarily stopped and the operators make a knife cut around the wrapper 40, withdraw the spindle 60 from the pipe, and also pull the pipe off of the coupler 34. The finished pipe is then placed on a sand bed for a length of time sufficient to cure and harden the coating. The coupler 34 is then removed from the leading end of the length of pipe which is now projecting from the cone and inserted in the trailing end thereof and the cycle is repeated for successive lengths of pipe.

When it is desired to coat pipes of a diameter differing from that being coated in the machine, it is only necessary to remove the bolt and nut 110 and unhinge the clamping ring 86, which automatically releases the extrusion cone 84. The set screw 166 is then loosened, at which time the adapter screw may be slipped out of the conveyor screw. Another adapter screw and exrusion cone of the proper size to accommodate the pipe to be coated are reassembled by reversing this procedure. It should be noted that easy access to the entire screw may be attained, for cleaning purposes or the like, by removing drive keys 136 at which time the extrusion cone 84, the conduit 64 and the hopper 20 may be completely removed as a unit.

It is apparent, therefore, that the device is readily adaptable to quick change-overs to various diameters of pipe and is also quickly and easily accessible for cleaning purposes and the like. By incorporating the deflection control means, small pipes in the order of 4 inches diameter and less, which heretofore could only be coated with great difficulty and expense, can be provided with a concrete coating easily, quickly and with practically no loss of material.

I claim:

1. In a device for applying an external coating to a pipe which is being advanced through the device, the combination of a frame, an extrusion conduit carried by said frame and having an outlet end, hopper means to feed the coating material to said conduit, an extrusion cone releasably secured to said conduit at the outlet end thereof, a hollow screw type conveyor rotatably carried in said conduit for advancing the coating material therethrough and adapted to receive the pipe internally thereof, a hollow adapter screw secured to said first-mentioned screw at the end thereof adjacent said cone, said adapter screw projecting partially into said cone and serving to compact said material in said cone and around said pipe, said adapter screw being adapted to receive said pipe therethrough and support said pipe centrally thereof and of said cone, means to rotate said screws, and movable means to support the leading end of the finished coated pipe after the coating thereof.

2. In a device for applying an external coating to a pipe, the combination of a frame, an extrusion conduit carried by said frame, hopper means to feed the coating material to said conduit, an extrusion cone releasably secured to said conduit, a screw type conveyor rotatably carried in said conduit for advancing the coating material therethrough and adapted to receive said pipe internally thereof, an adapter screw secured to said first-mentioned screw adjacent and partially received in said cone to compact said material in said cone and around said pipe, said adapter screw being adapted to receive said pipe therethrough and support said pipe centrally thereof and of said cone, power means to rotate said screw, other power means to advance said pipe through said device, and movable means affording two-point internal support for the leading end of said pipe after the coating thereof.

3. A machine for applying concrete coating material to the outer surface of a rotating, small diameter pipe, said machine comprising coating material conduit means, said means terminating in a quickly releasable cone, rotating screw means for advancing said material through said conduit means, power means for driving said rotating means, other rotating screw means carried by said first mentioned rotating and partially received in said cone means to compact said material in said cone, both of said rotating means accommodating reception of the pipe therethrough, said other rotating means being adapted to support said pipe centrally of said cone, and movable means for supporting the leading end of the pipe, said means comprising a rotatable mandrel receivable internally of the pipe and supporting the pipe at two axially spaced points.

4. A machine for applying concrete coating material to the outer periphery of a rotating, small diameter pipe, said machine comprising, coating material conduit means terminating in a quickly releasable cone, a hollow helical screw for advancing said material to said conduit means, means for rotating said screw, another hollow helical screw carried by said first screw and partially received in said cone to compact said material in said cone, both of said screws accommodating reception of the pipe therethrough, said other helical screw being readily detachable and selectively adapted to support the pipe centrally of the cone, and movable means for rotatably supporting the leading end of the pipe, said means comprising a mandrel receivable internally of the pipe and supporting the latter at two axially spaced points.

5. A machine for applying concrete coating material to the outer surface of a rotating small diameter pipe, said machine comprising, coating material conduit means, said means terminating in a quickly releasable cone, rotating screw means for advancing said material through said conduit means, means for driving said rotating means, other rotating screw means carried by said first mentioned rotating means and partially received in said cone to compact said material in said cone, both of said rotating means accommodating reception of the pipe therethrough, said other rotating means being adapted to support said pipe centrally of said cone, and linearly movable rotatable means affording two-point support internally and axially of said pipe to decrease bending thereof as said pipe emerges from said machine.

6. A machine for applying concrete coating material to the outer surface of a rotating small diameter pipe, said machine comprising, coating material conduit means, said means terminating in a quickly releasable cone, rotating screw means for advancing said material through said conduit means, power means for driving said rotating means, other rotating screw means carried by said first mentioned rotating means to compact said material in said cone, both of said rotating means accommodating reception of the pipe therethrough, means to simultaneously rotate and advance said pipe through said machine, said other rotating means being adapted to support said pipe centrally of said cone, and movable means affording two-point support internally of said pipe to decrease bending thereof as said pipe emerges from said machine, said movable means comprising a dolly carried by said frame and movable longitudinally thereof, and a rotatable horizontally disposed mandrel carried by said dolly, said mandrel being receivable in the coated pipe as said pipe emerges from said conduit.

7. A pipe coating machine for small diameter pipe comprising a movable support for the leading end of a rotating pipe, said support being received internally of the pipe and rotatably supporting the latter at two axially spaced points a chamber for material to be extruded onto said pipe to coat the latter, a hollow member rotatable in said chamber, means for rotating said hollow member another member detachably mounted on said hollow member, an opening through said other member snugly confining the pipe to afford a second support therefor, at least one worm on said hollow member, a worm on the detachable member mated with the leading end of the first-mentioned worm and defining therewith a continuous worm flight, and an extrusion cone surrounding the pipe and receiving the forward extremity of said flight.

References Cited in the file of this patent

UNITED STATES PATENTS

1,211,370	Price	Jan. 2, 1917
1,294,008	Will	Feb. 11, 1919
1,328,817	Budinich	Jan. 27, 1920
1,689,312	Williams	Oct. 30, 1928
2,048,557	Mickelson et al.	July 21, 1936
2,053,307	Wilson	Sept. 8, 1936
2,236,757	Lines	Apr. 1, 1941
2,287,828	Bryan	June 30, 1942
2,611,941	Leitl	Sept. 30, 1952
2,659,932	McNamee	Nov. 24, 1953
2,695,422	Gray	Nov. 30, 1954
2,740,988	Henning	Apr. 10, 1956
2,760,230	Van Riper	Aug. 28, 1956
2,791,803	Henning	May 14, 1957

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,945,278 July 19, 1960

Evans Robertson

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 31, for "disassemled" read -- disassembled--; column 5, line 54, for "exrusion" read -- extrusion --; column 6, line 38, strike out "means" and insert the same after "rotating" in line 37, same column.

Signed and sealed this 20th day of December 1960.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents