APPARATUS FOR INSITU ENCASEMENT OF TUBULAR MEMBERS WITHIN CEMENTITIOUS MATERIAL

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References Cited

UNITED STATES PATENTS


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ABSTRACT

Apparatus for encasing tubular members in cement with the cement encased tubular members being disposed within a ditch dug in advance of the encasing operation. The apparatus includes a removable hopper means which is supported by a troweling member and is placed above a fixed vertical bulkhead with the bulkhead having pipe alignment means and seal means associated therewith. A removable vibrator extends through part of the hopper and into close proximity of a rearward portion of the bulkhead, and into underlying relationship with respect to the troweling member. The vibration producing member is disposed adjacent to opposite sides of each of the tubular members so as to compact cement as it is discharged from the lower extremity of the hopper.

8 Claims, 25 Drawing Figures
APPARATUS FOR INSITU ENCASEMENT OF TUBULAR MEMBERS WITHIN CEMENTITIOUS MATERIAL

BACKGROUND OF THE INVENTION

It has previously been proposed to form continuous cement conduit from individual joints of concrete tile, with the tile having a plurality of aligned passageways formed therein which enables multiple spaced apart tubular goods to be inserted therethrough so as to form a continuous cement encased tubular conduit. Obviously, such an arrangement is subject to leakage due to cracking, and the annulus formed by the interface between the tubular member and the passageway in the concrete is objectionable for obvious reasons. The prior art U.S. Pats. to Brown et al. No. 3,145,444; Williamson et al., No. 2,968,081; and Williamson, No. 3,089,215 each set forth other expedients for attaining cement encased tubular goods which are fabricated insitu, to which reference is made for further background of this invention.

SUMMARY OF THE INVENTION

This invention broadly encompasses apparatus for fabricating cast in place pipe conduits comprised of one or more tubular elements encased in cementitious material and placed within a ditch which has been dug in advance of the apparatus. More specifically, the present invention relates to apparatus for encasing a plurality of tubular members in cement, with the cement encased tubular members being disposed within a previously dug ditch, and with the apparatus having a removable hopper and a removable vibration means which cooperate together and with a combination pipe alignment and seal means in a new and unobvious manner so as to provide an improved cement encased tubular member which is strongly anchored to the earth.

Therefore, a primary object of this invention is the provision of apparatus for fabricating a plurality of tubular members encased in concrete and usually contained within a ditch so as to provide cast in place conduit which cannot be damaged by earth moving equipment, effects of electrolytic action, and which provides a greatly strengthened structure since it is devoid of cracks, joints, and seams.

A further object of this invention is to provide improvements in apparatus for cementing tubular goods in a ditch in a continuous operation.

Still another object of this invention is the provision of apparatus for enclosing tubular members in cement with the tubular members being spaced apart from one another and from the side walls of a ditch.

Still another object of this invention is the provision of apparatus for enclosing tubular members in an elongated body of cement, which includes improved means for compacting the uncured cement.

The above objects are attained in accordance with the present invention by the provision of a combination of elements which are fabricated in a manner substantially as described in the above abstract.

These and various other objects and advantages of this invention will become readily apparent to those skilled in the art upon reading the following detailed description and by referring to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1a and 1b show a top plan view of a portion of a ditch formed in the surface of the earth and having apparatus made in accordance with the present invention disposed therein, with the apparatus carrying out the fabrication operation of encasing tubular members within an elongated body of cement;

FIG. 2 is a cross-sectional view taken along line 2—2 of FIG. 1;

FIG. 3a is a schematical top plan view of a modification of the operation seen in FIG. 1;

FIG. 3b is a diagrammatical top plan view of support equipment for use in conjunction with apparatus seen in FIG. 1;

FIG. 4 is a cross-sectional view taken along line 4—4 of FIG. 1;

FIG. 5 is an enlarged end view of the apparatus disclosed in FIG. 4;

FIG. 6 is a side elevational view of part of the apparatus presented in FIG. 1, with some parts thereof being broken away and some parts being shown in cross-section;

FIGS. 7, 8, 9, and 10, respectively, are cross-sectional views taken along lines 7—7, 8—8, 9—9, and 10—10, respectively, of FIG. 6;

FIG. 11a is an enlarged, fragmentary, part cross-sectional view of a portion of the apparatus seen in FIG. 6;

FIG. 11b is a top plan view of part of the apparatus seen in FIG. 11a, with part of the apparatus being broken away and shown in cross-section;

FIG. 12 is an isolated elevational view of part of the apparatus seen in FIG. 6;

FIGS. 13 and 14 are top plan views of part of the apparatus disclosed in FIG. 10;

FIG. 15 is an enlarged cross-sectional view of part of the apparatus seen in FIG. 10;

FIG. 16 is a cross-sectional view of part of the apparatus seen in FIG. 6 and 10;

FIG. 17 sets forth another embodiment of this invention and discloses a cross-sectional view of a portion of the surface of the earth so as to operatively disclose another aspect of the invention;

FIG. 18 is an enlarged side elevational view of part of the apparatus disclosed in FIG. 17, with parts thereof being broken away so as to better disclose the apparatus;

FIGS. 19 and 20, respectively, are cross-sectional views taken along lines 19—19 and 20—20 of FIG. 18;

FIG. 21 is an end view of the apparatus seen in FIG. 18; and

FIG. 22 is a cross-sectional view taken along line 22—22 of FIG. 21.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1a and 1b illustrate apparatus made in accordance with the present invention and generally indicated by the arrow at numeral 1, for casting a plurality of conduits 2 in spaced apart relationship with respect to one another as the machine travels longitudinally along and within a ditch. The machine has an outlet end 3, an inlet end 4, and is seen to have towered the upper surface of the concrete at 5, with the concrete having side walls 6 formed or defined by the previously dug ditch 7.
A starting plate 8 is anchored into the earth at the beginning or at one end of the ditch so as to anchor the ends of the conduit 2 thereto, while a deadman 9 is anchored within the ditch and in advance of the moving apparatus so as to enable the apparatus to pull itself longitudinally of the ditch by means of cables 10.

Edge portions 12 of a hopper form the upper extremity of the machine, and looking down through the opened hopper throat one can see the bottom of the ditch at 14. A sliding gate 16 provides a valve means for controlling the flow of concrete through the throat or discharge end of the hopper. A hydraulic motor driven vibrator assembly 18 compacts the uncured cement as it flows through the throat of the hopper. A hydraulically actuated winch includes a drum 20 which has a cable disposed thereon in the usual manner. The cable is rove between shives 21 and 22 with the cable continuing on to the previously mentioned deadman. Controls 23 may take on several different forms so long as they enable an operator to adjust the speed with which the vibrator and winch are driven.

Looking now to the details of FIG. 2 which presents a cross-section of the completed cement encased conduit, nine conduits 2 are seen, each of which are spaced apart relative to one another and to the side walls and top of the ditch so as to provide cement having pipes or tubes disposed therein in the most optimum manner.

Looking now to FIG. 6, together with the remaining figures, it is seen that the hopper converges in the usual manner at 24 and includes a forwardly sloped portion 25. The lower peripheral edge portion 26 of the hopper preferably terminates in a horizontal plane for bottom supporting the remainder of the hopper.

Fastener means 28 are disposed at spaced apart locations about the lower portion of the hopper to enable the hopper to be removable affixed to structure of the apparatus.

Parallel side walls 30 are spaced apart from one another and form the main vertical structural members of the apparatus. The side walls terminate at a bottom wall 31. The bottom wall supports the machine as it bears against the bottom of the ditch. Upper edge portion 32 preferably extends above the normal ground surface so as to prevent debris from entering into the machine should portions of the ditch fail to be self-supporting and cave. Upper projection 33 provides a support means for removable bottom supporting the before mentioned vibrator. A trailing end portion 34 of the machine forms a troweling member at the lowermost surface thereof, with the hopper being interposed forwardly of the troweling member and rearwardly spaced apart from and overlying a pipe aligning member 35.

A cradle 36 has the ends thereof welded to projection 33 and bottom supports rubber tires 37, while the forwardly sloped portion of the hopper indirectly bottom supports the arcuate shaped resilient members 38. Member 38 can be a segment of another rubber tire. The rubber tires are disposed in pairs, spaced apart laterally of one another, and journeled to horizontal plate member 39 which has the illustrated upstanding vertical member 18 rigidly affixed thereto for receiving the hydraulically actuated vibrator thereon by bolts or the like.

Downwardly disposed spaced apart parallel legs 40 each have one end portion thereof rigidly affixed to plate 39, with the legs slidably extending through the removable plate 41, and through an aperture formed in a rubber seal plate 42. The apertured rubber seal plate has slots 43 formed therein for sealingly engaging a marginal intermediate portion of each of the legs so as to prevent siphoning off a portion of the vibrational energy produced by the vibrator, and to preclude seepage of cementitious substances therethrough. Each leg is drawn in a rearward direction at 44 the maximum amount allowable by slots 43, remembering that it is desirable that the legs be slidably removed therethrough. The free terminal end 44 of each leg is spaced slightly above support surface 31 so as to avoid engagement with the bottom of the ditch.

As seen in the Figures, a removable plate 46 presses against rubber seal sheet 47. Spaced apart apertures 48 are of a sufficient diameter to receive the box end 2' of the plastic pipe 2 therethrough while the rubber seal sheet has apertures 49 formed therein which are smaller than apertures 48, so as to provide a circumferentially extending deformable seal member 147 which always is in contact with the outside peripheral surface of the pipe 2 in a manner best appreciated by the disclosure of FIG. 15. As seen in FIGS. 13 and 14, plate 46 is received in the approximate position relative to the seal sheet as indicated by the dashed line at numeral 50.

Apertured bulkhead 51 is placed intermediate rear bulkhead 52 and the front end 3 of the apparatus. The parallel spaced part bulkheads receive barrels 53 therethrough, with the forward end of the barrels being outwardly flaired in the manner seen at 53'. Each aperture 48 receives one barrel 53, with the inside peripheral surface of the barrel being indexed with apertures 48 and 49 so as to provide the illustrated structure forming the seal means of FIG. 15.

Looking now to the details of the starter plate seen in FIGS. 1, 4, and 5, the bucket-like body of the starter plate includes a bottom wall 56, a vertical end wall 57, with the bottom wall being apertured to removably receive pin 58 therethrough to thereby enable the pin to be driven into the walls forming the ditch. Apertures 59 each receive a marginal end of a pipe 2 therethrough. A free plate 60 has apertures 61 located therein with the apertures being indexed with apertures 59. Spaced apart tabular bushings 62 are welded to the plate and provide a means together with the vertical cutouts 63 which can bring the opposed walls of the aperture 61 together and compressed against the outside peripheral wall surface of the pipe 2, thereby releasably engaging the pipe and preventing it being pulled longitudinally of the ditch during the initial stage of operation. After a few feet of pipe has been cemented into the ditch, there is no need for the starter plate.

Looking now to the details of the deadman seen in FIG. 1b, where there is disclosed a vertical end plate 64 which is turned horizontally and vertically so as to engage both the bottom of the ditch as well as the sidewalls by means of pins 65 which are driven through a sidewalk thereof and into the earth that forms the sidewalks of the ditch. Movable earth engaging members 66 are pivoted toward and away from one another by means of the slotted arms 68, depending upon the
direction of force imparted into the shive 69 by cable 10.

Looking now to FIG. 3a, there is seen a sleigh 70 having compartment 1' for transporting apparatus 1 therein and compartment 2' for holding several joints of pipe 2 therein. A workman feeds joints of pipe from compartment 2' into the machine at 1' as the filing machine 71 pulls the sleigh through swampy or sandy country, wherein the nature of the structure of the earth fails to provide a self supporting ditch side wall. Digging wheel 72 is of conventional design and forms a continuous ditch in advance of the apparatus.

Looking now to the details of FIG. 3b, there is seen a truck 73 having a cab, hydraulic motor, working bed, and a boom; all arranged thereon so as to enable the truck to transport the apparatus to the construction area, unload the apparatus, and to provide a continuous source of hydraulic fluid pressure which flows to and from the various motors of the device. The truck travels along parallel to the ditch and in close proximity to the apparatus. The truck is provided with hydraulic hose containing reels which can be manipulated so as to control the tension in the hydraulic lines.

Looking now to the embodiment of the invention set forth in FIGS. 17-22, there is seen a road 75 which is laterally disposed with respect to a ditch 76. Concrete 77 is seen to fill the ditch leading up to a tunnel which continues under the road so as to connect the lateral ditches together. The concrete encased pipe is being fabricated by the novel apparatus seen at 78. A supply of concrete is delivered through a flexible conduit from truck 7 into the lowermost conduit 79 connected to the forward end of the apparatus. A plurality of tubes 80 are maintained spaced apart from one another and from the walls of the tunnel, and are encapsulated within cement by the apparatus seen at 78.

As best seen in the remaining figures, apparatus 78 is in the form of a hollow cylinder and has a circumferentially extending wall 81 formed thereinabout which provides an enclosure 82. The concrete supply conduit 79 preferably extends longitudinally through the cylinder in the manner as seen at 179, with he discharge end of the conduit being indicated by the numeral at 279.

Seal means 83 is in the form of an enlarged resilient waffer and includes a circumferentially extending marginal edge portion which extends radially beyond side wall 81 so as to provide a seal which is similar in action to the seal 47 in FIG. 10. A circumferentially extending arcuate shoe 84 extends about the entire peripheral surface of the chamber so as to maintain longitudinal alignment of the cylinder with respect to the side walls of the tunnel leading under the road bed.

Plate 85 has a forwardly directed face which is identical to the face seen at 85' thereof. The plate is provided with a plurality of spaced apart apertures 88 for guidingly receiving the pipes 80 therethrough, with each aperture receiving one pipe therethrough.

Plate 86 is spaced apart from plate 88 by the resilient washer 83, in the same manner as set forth in FIG. 10. As seen in FIG. 22, the washer is sandwiched between plates 86 and 88 and is provided with apertures which are aligned with apertures 87, 88' so as to provide the illustrated circumferentially extending seal means 83' for engaging the outer peripheral wall surface of the pipes, which are adapted to be received therethrough in properly aligned relationship with respect to each other and to the side walls of the tunnel.

When deemed desirable, a barrel can be longitudinally disposed between plates 85 and 88, with the housing being fixed within the interior of the housing 81, so as to support and guide the individual spaced apart tubes 80 therethrough in the same illustrated manner as seen at 53 in FIG. 6.

Another modification which can be carried out in conjunction with the present invention is in the provision of intersecting guide bars for supporting and guiding the pipes 80 in lieu of the rear plate 86, however, this necessitates moving the seal means seen in FIG. 22 from the rear to the front section of the housing. Moreover, this arrangement forces the housing 81 to carry a load of cement therewithin, and accordingly, reduces the efficiency of the operation.

**OPERATION**

In the operation of the first embodiment, the machine together with its source of hydraulic pressure fluid is delivered to the construction site by the truck seen in the illustration of FIG. 3B. The truck boom is used to unload the machine and to place it into the previously dug ditch. The hoses are unreeled from the truck and affixed to the machine so as to supply a source of hydraulic fluid pressure. The truck thereafter follows along with the machine in close proximity to the ditch.

A pipe 2 is placed longitudinally through each of the barrels of the machine, with the marginal terminal ends of the pipe being compressibly held by the plate member of FIG. 5. Cement, preferably from a commercial cement truck, is fed into the hopper as it is used. Gate 16 is opened the required amount to attain a uniform flow of cement through the hopper discharge at 14. The vibrator 18 promotes the flow of concrete and compacts the cement as it flows around each of the pipes to completely fill the lower portion of the ditch in the illustrated manner of FIG. 2.

As the machine progresses along longitudinally of the ditch by means of the winch 20 which winches in cable 10 by means of pulley 69, additional pipe must be joined together ahead of the machine so as to enable a continuous operation to be carried out.

The box end of the pipe readily passes into the entrance 53' of the guide 53, through the seal means at 35, and under the troweling member with the previously laid concrete offering one wall surface, the sides and bottom of the ditch offering another wall surface, and the seal plate 46 providing a forward wall surface. As the machine moves along the ditch, the lowermost face of the trailing end portion thereof trowels the top of the concrete so as to present a suitably finished surface. At the same time, legs 40 of the vibrator compact the cement and prevent the formation of voids.

It will be noted that the vibrator floats on the machine since it is bottom supported by the four spaced apart rubber insulators 37 and 38, and accordingly can be lifted vertically upwards free of the machine. The legs of the vibrator extend through the slots 43 of members 41 and 42 so as to prevent siphoning vibrational energy from the vibrator motor. Since each pipe has a leg of the vibrator apparatus disposed
on opposed sides thereof, the area between the side wall of the ditch, the side wall of the pipe, and the area between adjacent pipe side walls are subjected to sufficient agitation so as to cause the cement to continuously flow down around the pipe in an improved manner. Furthermore, as the cement flows towards the throat of the hopper, it comes into contact with the upper extremity of the legs prior to reaching the hopper discharge, thereby further aiding the flow of the concrete through the throat of the hopper and into the ditch.

Upon reaching a lateral obstruction, such as a lateral conduit under which the machine must pass, the vibrator is removed from the machine by merely disconnecting the pressure and suction hoses therefrom and lifting the vibrator in an upward direction. The hopper is next removed by disengaging the four fasteners and using the boom on the truck to lift the hopper from the machine. This presents an extremely low profile which admits passage of the machine through the ditch and under the obstruction.

The seal member provides an effective seal means by which the flow of concrete upstream of the sleigh is precluded because of the action of the flap with respect to the ditch side walls and bottom, as well as the action of the apertures as they are deformed in the manner seen at Fig. 15.

Where the soil is of a nature which precludes the existence of self supporting ditch side walls, a sleigh is pulled behind the ditching machine so as to prevent caving of the sidewalls prior to machine 1 engaging the side walls. The sleigh is U-shaped in configuration and provides ample room at 2' for workmen to store and assemble a continuous string of pipe. The machine at 1' is attached to and may be part of the sleigh.

In the operation of the second embodiment, the open ditch will have been dug in the ground and extends into close proximity of the concrete road 75 where the ditch digger must then abandon the ditch and continue its operation on the opposite side of the roadway. The next step is to employ a horizontal boring apparatus in order to tunnel under the concrete road. There are many satisfactory mechanisms for boring under roadways and such an operation need not be discussed in detail herein.

As the apparatus of FIG. 1 comes into close proximity of the roadway, it must cease operation, be transported across the roadway, where it can then continue operation on the opposite side thereof. Prior to the last recited step, or after the last recited step, the method set forth in FIG. 17 may be carried out in order to provide a continuous uninterrupted laying of concrete encased tubular goods by disposing the apparatus 78 within the entrance of the tunnel, and threading the pipe 80 therethrough. Where pipe 80 is not properly anchored to a batch of previously deposited concrete, the operation can be commenced by either pouring a few feet of concrete at the beginning of the tunnel, or alternatively, a circular starter plate similar to the one disclosed at 8 in FIG. 1 can be employed.

Cement is pumped from the source T into conduit 79 where it exits at 279, thereby causing a pressure differential across the chamber 81, with the resultant force urging the apparatus 78 through the tunnel while the pipes 80 are maintained properly aligned within the ditch as the voids between the wall of the tunnel and the pipe are completely filled with fresh concrete. The seal means at 83 and 84 prevent concrete from flowing into chamber 82 or through the annulus between the apparatus and the tunnel. The length of the apparatus can be of a ratio with respect to the diameter to preclude inadvertently lodging the machine within the tunnel. Suitable means can be affixed to plate 85 for attachment of a cable should it become necessary to assist the apparatus through the tunnel.

I claim:

1. Apparatus for traveling longitudinally of a ditch while encasing at least one pipe within concrete, with the pipe being longitudinally disposed within the ditch and extending longitudinally through the apparatus, and with the walls of the ditch providing forms for the concrete, comprising:

- a main frame means which includes spaced apart sides, a front end, a trailing end portion in the form of a trowel member, and a lowermost supporting surface;
- a hopper, means supporting said hopper from said main frame means, said hopper having an inlet and a discharge opening formed therein; means enclosed within said spaced apart sides for supporting and aligning a pipe; said troweling member having a troweling surface thereon for troweling concrete over which it may pass;
- vibration producing means including elongated members extending therethrough for compacting cement, said hopper including a forwardly and downwardly disposed wall portion, seal means in said wall portion for slidably receiving said elongated members therethrough, a lateral support member affixed to said main frame means; said vibration producing means having support means thereon for bottom supporting said vibration producing means by said lateral support member with said elongated members extending through said seal means, through a portion of the interior of said hopper, and into underlying relationship relative to said troweling member so that at least one of said elongated members is located on either side of a pipe when a pipe is extended through said pipe aligning means.

2. The apparatus of claim 1 wherein said pipe supporting and aligning means includes a barrel and spaced apart bulkheads, said barrel being affixed to at least one of said bulkheads with another of said bulkheads being comprised of at least two plate members, at least one of said bulkheads being affixed to said spaced apart sides;

- a resilient member sandwiched between said plate members, means by which apertures are formed through said plate and resilient members so as to enable a pipe to slide therethrough with the aperture in the resilient member sealingly engaging the external surface of the pipe; said aperture in said plate members being larger with respect to the aperture in said resilient member.

3. The apparatus of claim 1 wherein said hopper includes means by which it is removably affixed to the remainder of the apparatus; said vibration producing means being freely supported by structure associated with the apparatus; whereby,
said hopper and said vibration producing means can be removed from the remaining apparatus so as to present a low profile to thereby enable the apparatus to pass under obstructions.

4. Apparatus for traveling longitudinally of a ditch while encasing at least one pipe within concrete, with the pipe being longitudinally disposed within the ditch while extending longitudinally through the apparatus, and with the walls of the ditch providing means for the concrete, comprising:

a main frame means including spaced apart sides, a front end, a trailing end portion in the form of a trowel member, and a lowermost supporting surface;

a hopper for holding and distributing concrete, said hopper having an inlet and a discharge opening formed therein; means for supporting and aligning a pipe; means by which said hopper is supported by said main frame means with said hopper discharge opening being located rearwardly of and overlying said means for supporting and aligning a pipe;

vibrating means for compacting cement, said vibrating means including elongated members freely depending therefrom and extending through a portion of said hopper for transferring vibrational energy into uncured cement when the cement is flowing through the hopper, with at least one said member being located on either side of a pipe when a pipe is extended through said means for supporting and aligning pipe;

said pipe supporting and aligning means includes spaced apart bulkheads and a barrel through which a pipe is guidedly received, said barrel being affixed to at least one of said bulkheads with at least one said bulkhead being affixed to said frame members; and, seal means formed on said means for supporting and aligning pipe for sealingly engaging the outer peripheral wall surface of a pipe as the pipe slides therethrough.

5. The apparatus of claim 4 wherein said hopper includes means by which it is removable affixed to the remainder of the apparatus;

said vibration producing means being freely supported by structure associated with the apparatus; whereby,

said hopper and said vibration producing means can be removed from the remaining apparatus so as to present a low profile to thereby enable the apparatus to pass under obstructions.

6. Apparatus for traveling longitudinally of a ditch while encasing at least one pipe within concrete, with the pipe being longitudinally disposed within the ditch, and with the walls of the ditch providing forms for the concrete, comprising:

a main frame means including spaced apart sides, a front end, a trailing end portion in the form of a trowel member, and a lowermost supporting surface; said main frame means adapted to receive a pipe therethrough;

a hopper having an inlet and a discharge opening formed therein; pipe supporting and aligning means affixed to said main frame means; said troweling member having a troweling surface thereon which is spaced apart from said supporting surface by said pipe supporting and aligning means; means by which said hopper is supported by said main frame means with said hopper discharge opening being located rearwardly of and overlying said pipe supporting and aligning means;

vibration producing means for compacting cement, said vibration producing means including elongated members which extend through a portion of said hopper and into proximity of said pipe supporting and aligning means for transferring vibrational energy into uncured cement when the cement is flowing through the hopper, with at least one said member being located either side of a pipe when a pipe is extended through said pipe supporting and aligning means;

said pipe supporting and aligning means being in the form of spaced apart bulkheads with one bulkhead including spaced apart plate members, a resilient member sandwiched between said plate members, apertures formed through said plate and resilient members for receiving a pipe therethrough, said aperture in said resilient member being of a smaller diameter relative to the pipe which is to be received therethrough; said aperture in said plate members being larger in diameter relative to the aperture in said resilient member;

a barrel through which a pipe is guidedly received, and means by which said barrel is affixed to at least one of said spaced apart bulkheads.

7. The apparatus of claim 6 wherein said hopper includes means by which it is removable affixed to the remainder of the apparatus;

said vibration producing means being freely supported by structure associated with the apparatus; whereby,

said hopper and said vibration producing means can be removed from the remaining apparatus so as to present a low profile to thereby enable the apparatus to pass under obstructions.

8. The apparatus of claim 6 wherein said resilient member has a marginal edge portion extending outwardly of the plate member and laterally of the ditch for engaging the side walls of the ditch.

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