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3,054,461 9/1962 Maguire 37/142.5
 3,203,188 8/1965 Evans 37/142.5 UX
 3,209,925 10/1965 Coenen 198/128 X
 3,273,734 9/1966 Schuler 198/97 X
 3,332,249 7/1967 Idoine 37/142.5 UX

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[54] **EXCAVATION REFILL PACKER**
 7 Claims, 7 Drawing Figs.

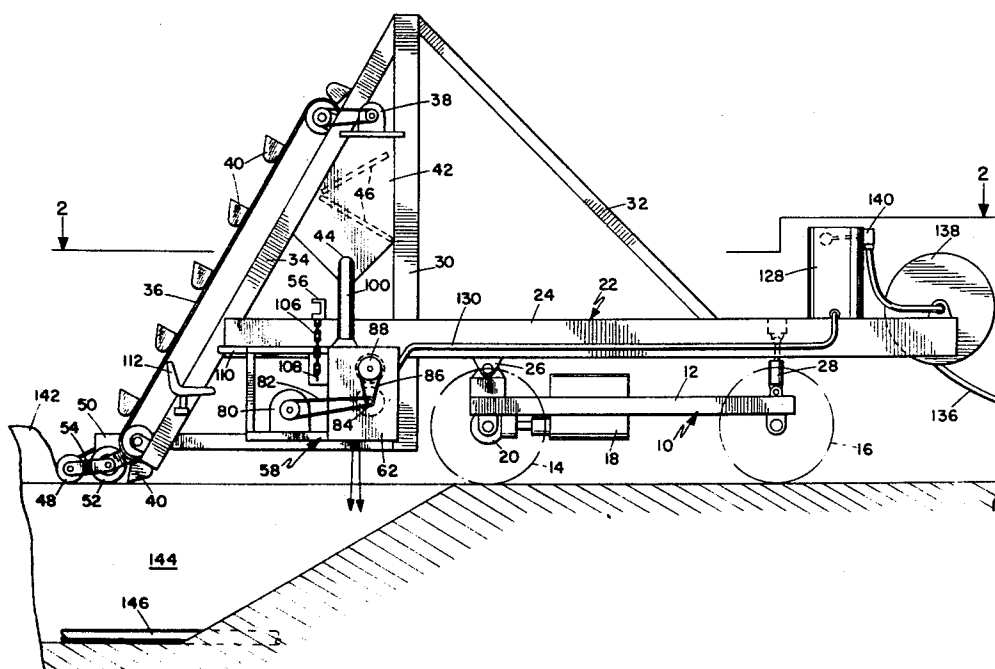
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 [51] Int. Cl. E02f 5/22
 [50] Field of Search 37/142.5,
 81, 90, 190; 61/72.1—72.7; 299/7; 198/9, 97, 128;
 172/121, 123

[56] **References Cited**

UNITED STATES PATENTS

204,308	5/1878	Fascher	198/128
2,568,536	9/1951	Beech	198/128
2,789,804	4/1957	Toulmin, Jr.	37/41 UX
2,857,691	10/1958	Curran	37/142.5 X
2,947,096	8/1960	Cummings et al.	37/142.5

ABSTRACT: The excavation refill packer has its principal use as an ambulant ditch packer, a self-contained machine which picks up and screens soil from a pile alongside a ditch and throws the soil into the ditch, by means of a high-speed impeller, with sufficient force to pack the soil firmly without the need for tamping. Apparatus is provided for injecting a closely controlled flow of water into the moving flow of soil to obtain the desired moisture content. The entire machine is controllable by a single operator, who can direct the high-velocity stream of soil to fill the ditch evenly as the machine advances. The machine can be adapted for pack-refill of excavations which are not narrow as the word "ditch" suggests, since the machine can make repeated and progressive passes.



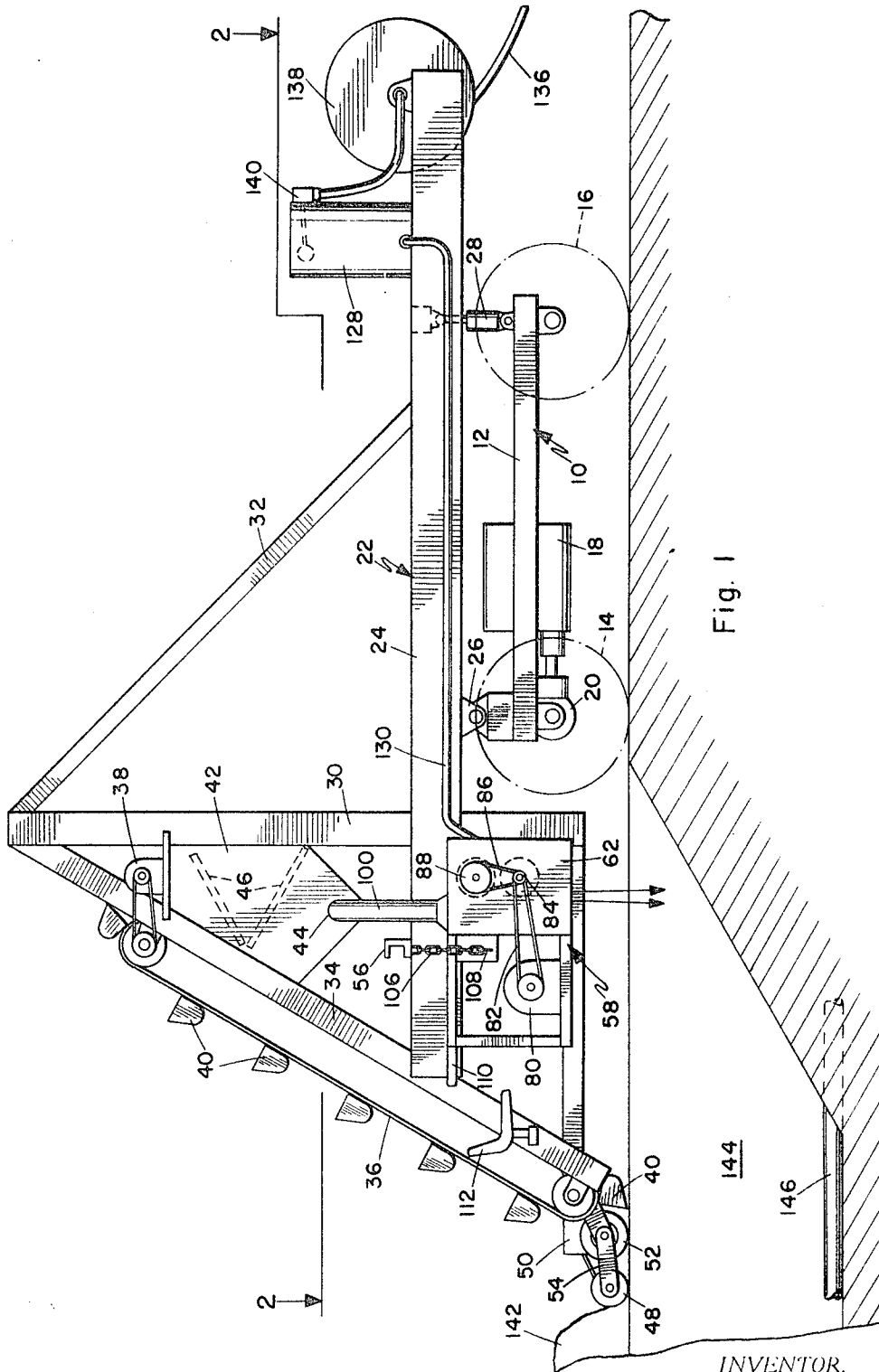


Fig. 1

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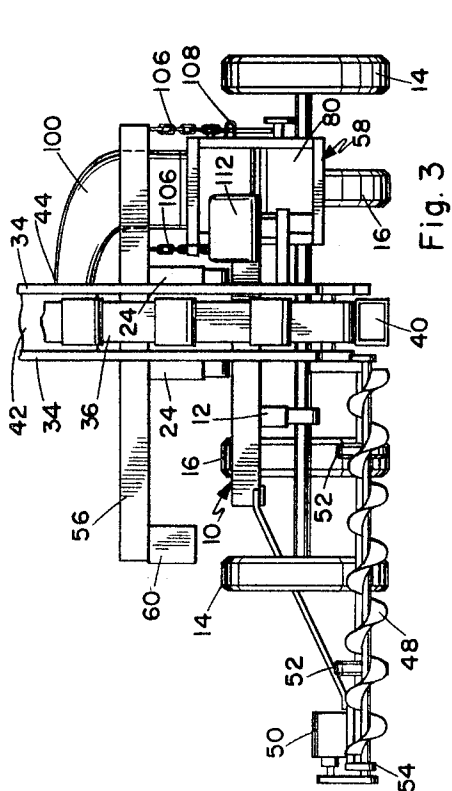


Fig. 3

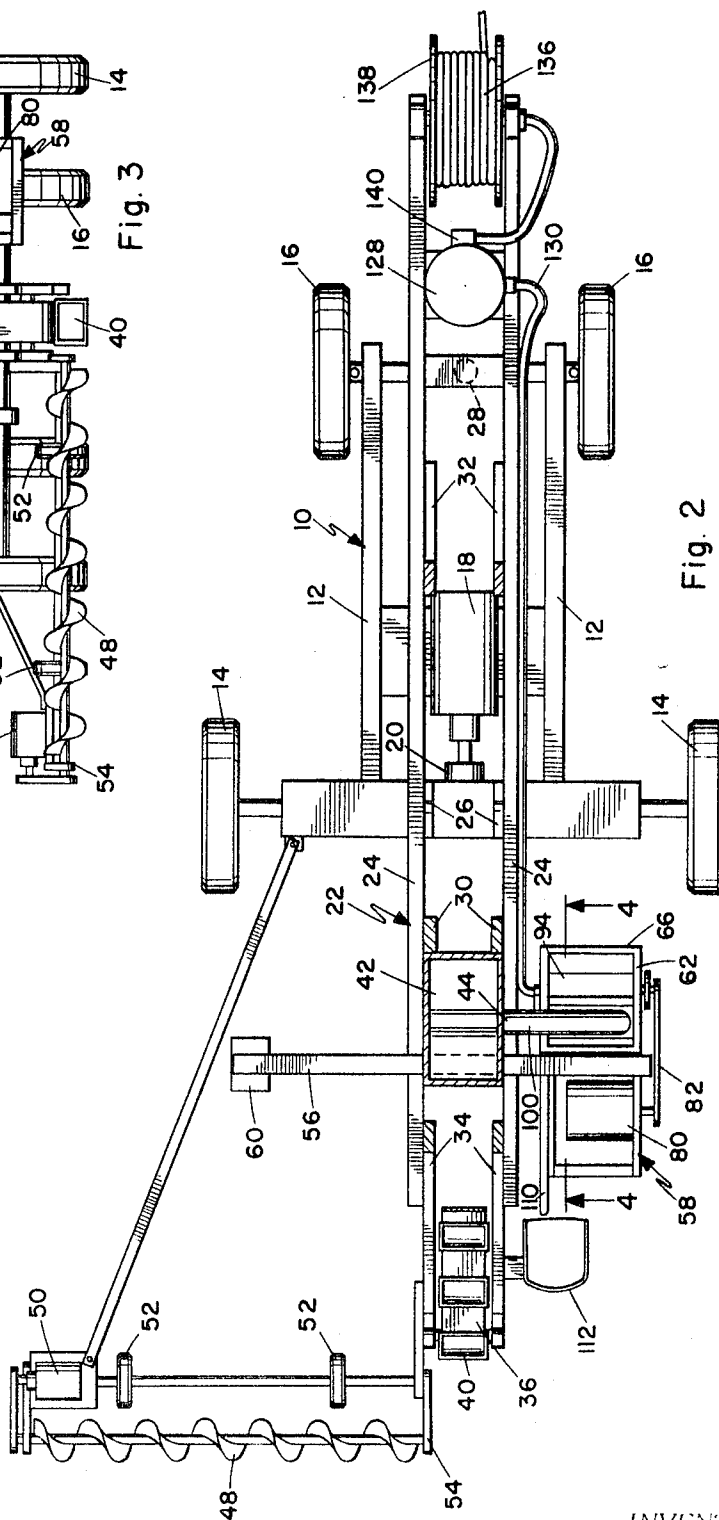


Fig. 2

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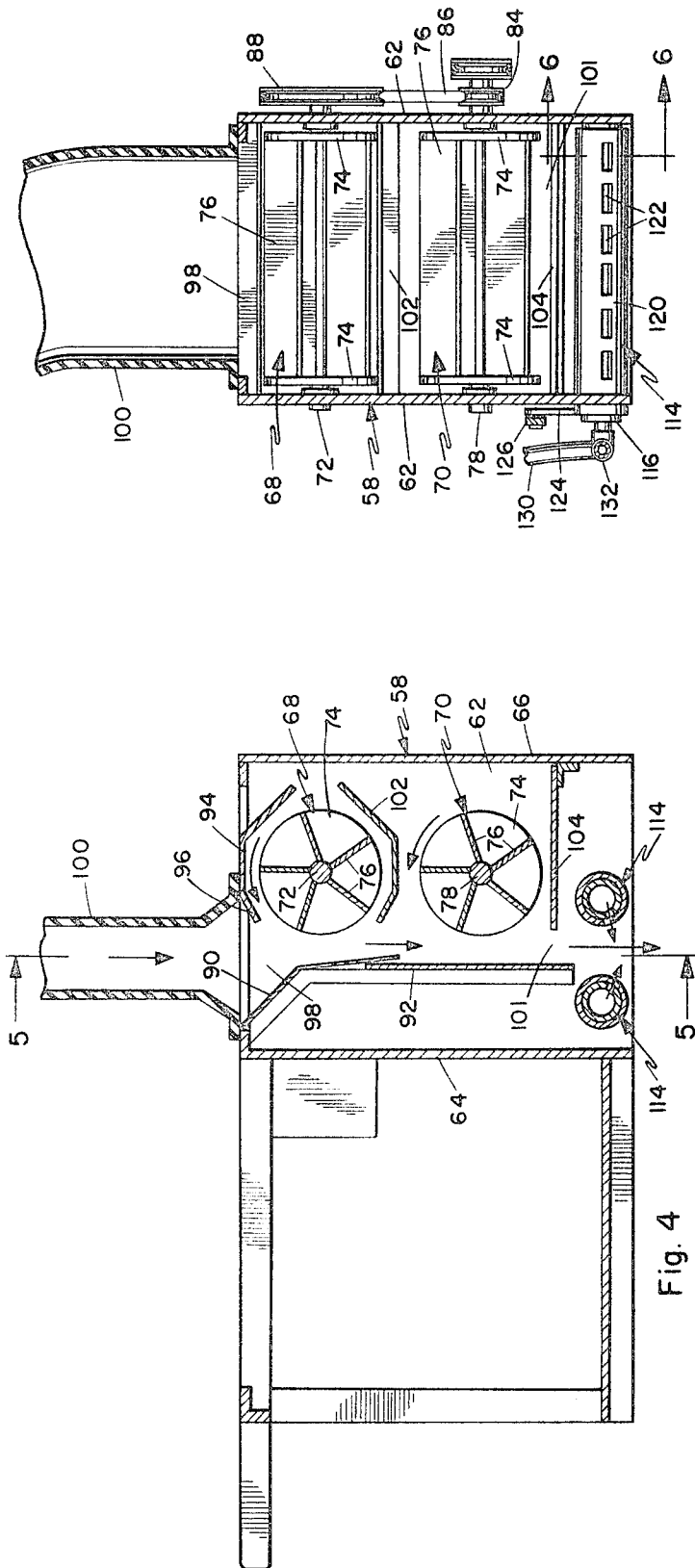


Fig. 5

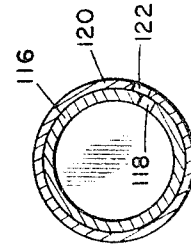


Fig. 6

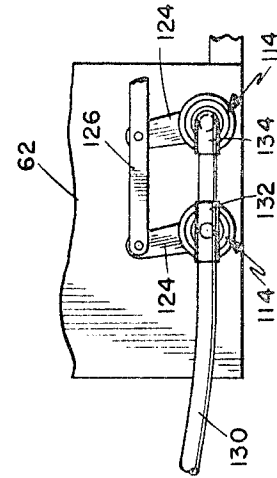


Fig. 7

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EXCAVATION REFILL PACKER

BACKGROUND OF THE INVENTION

The present invention relates to earth-working equipment and specifically to a ditch packer.

In the usual method of filling or packing excavations such as a ditch, the soil is first dumped into the excavation, then water is applied to moisten the soil, the final compaction being performed by hammer-type mechanical tampers. This involves three or more pieces of apparatus and a number of operators. The distribution of moisture is not usually consistent and more soil must often be added as tamping proceeds. One serious problem with mechanical tamping is the damaging of buried pipes and conduits, this being particularly true in urban areas where water pipes, drain lines, telephone cable conduits and the like may follow or cross a ditch dug for a specific purpose. Soil specifications often call for a high degree of compaction and the heavy surface tamping required has been known to break conduits more than 10 feet below the surface.

SUMMARY OF THE INVENTION

The machine described herein performs the complete ditch packing operation in one pass along the ditch, or in progressive passes in other excavations, without the use of the mechanical tamping. Since the principal use is presently conceived in relation to refilling of ditches, this specification will relate particularly to that use. Soil is picked up from the side of the ditch, screened to remove rocks and hard lumps, then driven into the ditch in a high-velocity stream with sufficient force to obtain the required compaction. A closely controlled flow of water is injected into the moving stream of soil to give the proper moisture content uniformly along the ditch. One operator riding on the machine can control the operation and can direct the stream of soil to fill the ditch evenly.

BRIEF DESCRIPTION OF THE DRAWINGS

- FIG. 1 is a side elevation view of the complete machine;
 FIG. 2 is a top plan view, partially sectioned on line 2-2 of FIG. 1;
 FIG. 3 is an end elevation view taken from the left-hand end of FIG. 1;
 FIG. 4 is an enlarged sectional view taken on line 4-4 of FIG. 2;
 FIG. 5 is a sectional view taken on line 5-5 of FIG. 4;
 FIG. 6 is an enlarged sectional view taken on line 6-6 of FIG. 5; and
 FIG. 7 is a fragmentary side elevation view taken from the left-hand side of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The machine rides on a chassis 10 having side rails 12, with front wheels 14 and rear wheels 16. An engine 18 mounted in chassis 10 drives the front wheels 14 through a transmission 20. Alternatively, the rear wheels could be driven and one or both pairs of wheels can be made steerable by any well known means, the specific details of the chassis not being critical.

Mounted on the chassis is a frame 22 having a pair of longitudinal beams 24 fixed in spaced relation. The beams are attached to the forward end of the chassis by hinge blocks 26 having a hinge axis substantially parallel to the chassis wheel axis. At the rear end the frame 22 is connected to the chassis by a linear actuator 28 of any suitable type, so that the frame can be inclined relative to the ground over a limited angular range. Fixed to the forward portion of frame 22 are upright posts 30 braced by rearwardly extending diagonal members 32. Beams 24 project forward beyond posts 30, and secured between the forward ends of the beams and the upper ends of the posts are inclined rails 34, on which is mounted a conventional bucket conveyor 36. A motor 38 mounted at a convenient position on the frame drives the conveyor, or a power takeoff can be made to the engine 18. The rails 34 extend

downwardly below beams 24, so that the buckets 40 are substantially at ground level at the lower end of the conveyor. Adjustment is made by means of actuator 28 to raise or lower the conveyor to suit a particular job. Between the rails 34 and posts 30 is an enclosed hopper 42 with a lower outlet 44. Soil picked up by buckets 40 is dumped into the hopper and passes through screens 46 to remove rocks and hard lumps. Any well-known screen arrangement may be used, with or without vibratory means.

Attached to the lower end of one rail 34 and extending horizontally to one side of the machine is a helical auger 48, driven by a motor 50 to move soil across to the bucket conveyor 36. The auger is supported substantially at ground level on wheels 52 on a simple frame structure 54, the arrangement being well known.

Fixed across the beams 24 just forward of posts 30 is a crossbar 56 extending on both sides of the frame. Suspended from the crossbar 56 on the side opposite to auger 48 is an impeller unit 58, which is balanced by a counterweight 60 on the other end of the crossbar to avoid uneven loading on the machine.

The impeller unit 58 comprises a rectangular box frame with sides 62, a front wall 64 and a rear wall 66, the upper and lower ends being substantially open. Mounted transversely between sides 62 are two vertically spaced impellers 68 and 70. The upper impeller 68 has a shaft 72, on which are circular end plates 74 supporting substantially radial vanes 76 extending axially between the end plates. Lower impeller 70 on shaft 78 has a similar end plate and vane structure and is shown as being of the same size as impeller 68, although the sizes can vary.

Mounted in the impeller unit forward of front wall 64 is a motor 80 driving the lower impeller 70. A belt drive 82 is shown for simplicity, but chain and sprocket means could be used for a more positive connection. On shaft 78 is a small pulley 84, coupled by a belt 86 to a large pulley 88 on shaft 72, so that the lower impeller rotates faster than the upper impeller. Again, chain and sprocket drive could be used. While the ratio and speed of the impellers can vary, in one suitable arrangement the lower impeller rotates at three times the speed of the upper impeller and has a peripheral speed of about 100 f.p.s. At the upper end of the box frame is an inlet ramp 90 leading to a vertical guide plate 92 fixed slightly forward of the impellers, and over the top of the upper impeller is a baffle 94 with a ramp 96 inclined toward ramp 90 to form an inlet 98. The outlet 44 of the hopper is connected to inlet 98 by a duct or boot 100 of flexible and somewhat extensible material such as rubber, to direct soil into the inlet. The stream of soil is deflected by inlet ramp 90 to the upper impeller 68 which drives the soil downwardly in the channel between the guide plate 92 and the impellers. Lower impeller 70 further accelerates the stream of soil, which is ejected through a lower outlet 101. A baffle 102 between the impellers and a baffle 104 under the lower impeller 70 catch any throwoff and confine the main stream of soil to the narrow channel along guide plate 92 with substantially tangential contact with the impellers.

In order to direct the stream of soil the impeller unit 58 is suspended from crossbar 56 by some type of hinged or flexible means. As shown the unit is suspended on chains 106 attached to couplings 108 substantially at the central balance point of the unit, but other means may be equally suitable. When properly balanced the impeller unit can be moved manually by a control arm 110 extending forwardly to an operator, who is carried on a seat 112 fixed on the rails 34, or other convenient portion of the frame. Facing rearwardly from this position the operator can see the portion of the ditch immediately below the impeller unit and direct the stream of soil to fill the ditch evenly. It will be obvious that power controls could be used to operate the impeller unit, and that controls for all functions of the machine can be brought to the operator's position. Since such controls are conventional and can vary considerably, they are omitted from the drawings for simplicity. In most

ditch packing operations it is necessary to add moisture to the soil, and for consistency this is best accomplished by injecting the water into the stream of soil. In the lower portion of the impeller unit 58 are two parallel spray bars 114, spaced on opposite sides of outlet 101 and extending transversely between sides 62. Each spray bar 114 comprises a fixed inner sleeve 116 having a plurality of spray orifices in the form of slots 118 opening toward the outlet 101 slightly downwardly. Rotatably mounted on the inner sleeve 116 is an outer sleeve 120 with corresponding slots 122, which are brought into register with slots 118 by rotating the outer sleeve, the actual slot area thus being variable to control the water flow. The outer sleeves 120 have arms 124 coupled to a control linkage 126, which is accessible to the operator.

To ensure a uniform flow of water a tank 128 is mounted on the rear portion of frame 22 and is connected by a feed hose 130 to inlet couplings 132 and 134 on the two inner sleeves 116. A supply hose 136, for use with a convenient water supply such as a hydrant, is stored on a reel 138 mounted on the rear end of frame 22 and pays out as the machine advances. The supply hose is connected to the tank through a float controlled inlet valve 140 to maintain a constant head of water in the tank and allow close control of the moisture content of the soil.

As the machine is driven along a ditch, as in FIG. 1, the soil previously removed and piled in a ridge 142 is conducted by auger 48 to the conveyor 36, screened and fed into the impeller unit. The soil, properly moistened, is propelled at high velocity into the ditch 144 and is packed hard into place by the force of the impeller, yet without damaging the conduit 146 laid in the ditch. By moving the impeller unit the stream of soil can be directed as needed, which facilitates packing around other pipes or the like that may cross the ditch at different levels. The flexible boot 100 deflects to follow the motions of the impeller unit and maintains a continuous supply of soil from the hopper 42. Since the soil is packed as the ditch is filled, the soil density will be uniform over the full depth of the ditch. This is not possible with mechanical tamping, unless the soil is applied in layers and tamped in stages, which would increase the possibility of damage to buried conduits and be very time consuming. Instead, the present machine performs the entire operation in a single pass and more efficiently than

prior techniques.

I claim:

1. An excavation refill packing machine comprising:

a mobile chassis having a frame thereon;
soil collecting and conveying means mounted on said frame to pick up soil as the machine advances;
an impeller unit on said frame to receive the soil, said impeller unit having a downwardly directed outlet;
said outlet being shiftable relative to said frame;
means to shift said outlet for better distribution of the soil; and
means for self-compaction of the soil comprising driven impeller means in said impeller unit to propel a stream of soil through said outlet into an excavation with sufficient velocity and force to distributively pack the soil firmly and eliminate the need for tamping.

2. The structure of claim 1 wherein said impeller means includes a rotary impeller having vanes, said vanes directly contacting said stream of soil adjacent to the radially outer ends of said vanes and having a peripheral speed on the order of 100 feet per second.

3. The structure of claim 1, and including a hopper on said frame and a soil conducting flexible boot connecting said hopper to said impeller unit, said impeller unit being suspended from said frame by flexible means and balanced for ease of shifting the impeller unit, said means for shifting comprising manual control means for effecting such shifting to direct highly accelerated soil in a backfilling operation with simultaneous impaction of the backfill soil.

4. The structure of claim 1, wherein said impeller means comprises a plurality of vertically spaced impellers, and means to drive the lower impeller at a peripheral speed considerably greater than that of the upper impeller.

5. The structure of claim 1, wherein said impeller unit has at least one spray bar adjacent said outlet, with orifices directed toward the path of the stream of soil;
and a source of water connected to said spray bar.

6. The structure of claim 5, wherein said orifices are adjustable in area.

7. The structure of claim 6, wherein said source of water is of constant pressure.

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