United States Patent [19]

Clayhold et al.

[11] **3,859,809**

[45] **Jan. 14, 1975**

[54] **PIPE BURYING RIPPER AND METHOD**

[76] Inventors: **Archie J. Clayhold,** 1617 Virginia St.; **Walter F. Hanson,** 2326 Linden St., both of Dos Palos; **Louis F. Wells,** 6110 Columbia Rd., Firebaugh, all of Calif.

[22] Filed: **Feb. 13, 1973**

[21] Appl. No.: **331,747**

[52] **U.S. Cl.** **61/72.5,** 61/11, 61/72.6

[51] **Int. Cl.** **E02f 5/10,** E02b 11/00

[58] **Field of Search** ..... 61/72.6, 72.1, 72.2, 72.5, 61/72.7, 11, 41 A; 37/193

[56] **References Cited**

UNITED STATES PATENTS

2,209,726	7/1940	Fleming	61/72.2 X
2,738,745	3/1956	Harpold	61/72.1

FOREIGN PATENTS OR APPLICATIONS

1,801,608	5/1970	Germany	61/72.6
1,244,400	2/1971	Great Britain	61/72.5

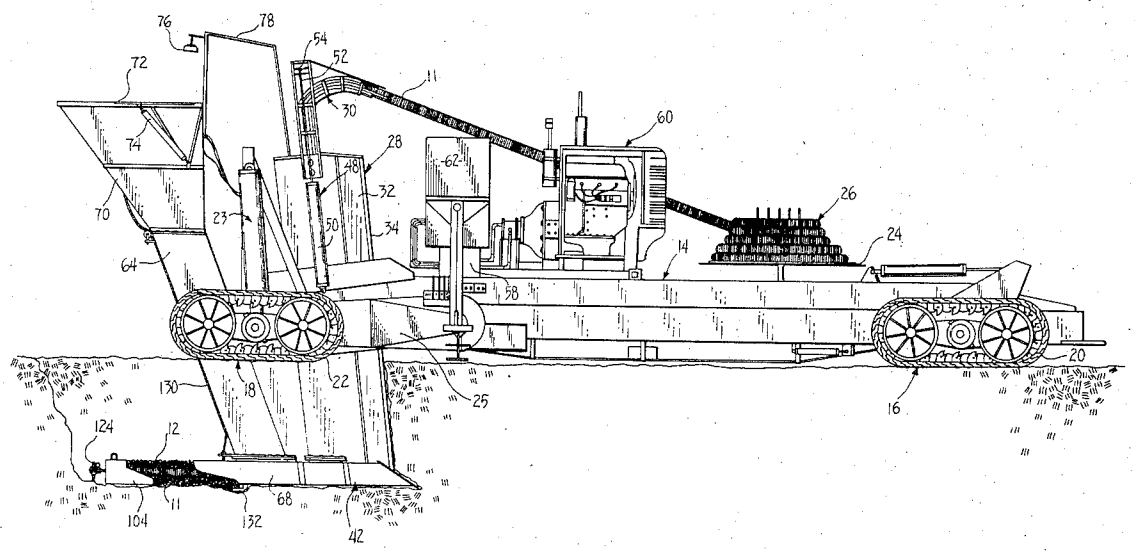
Primary Examiner—Jacob Shapiro

Attorney, Agent, or Firm—Townsend and Townsend

[57] **ABSTRACT**

Apparatus and method for placing a flexible conduit below the surface of the ground and for depositing a uniform layer of gravel around the conduit as the ground is being continuously ripped or opened. A hollow soil ripper carried on a movable support rips the soil to a predetermined depth and allows the conduit to be fed therethrough to the lower end thereof at which a gravel distributor in the form of an auger directs the conduit rearwardly and uniformly distributes gravel in an envelope about the conduit as the gravel gravitates through a chute rearwardly of the ripper. The support can be elevated to permit the ripper to be moved over the ground to and from a job site. Also, the ripper can be elevated relative to the support to effect grade changes.

10 Claims, 7 Drawing Figures



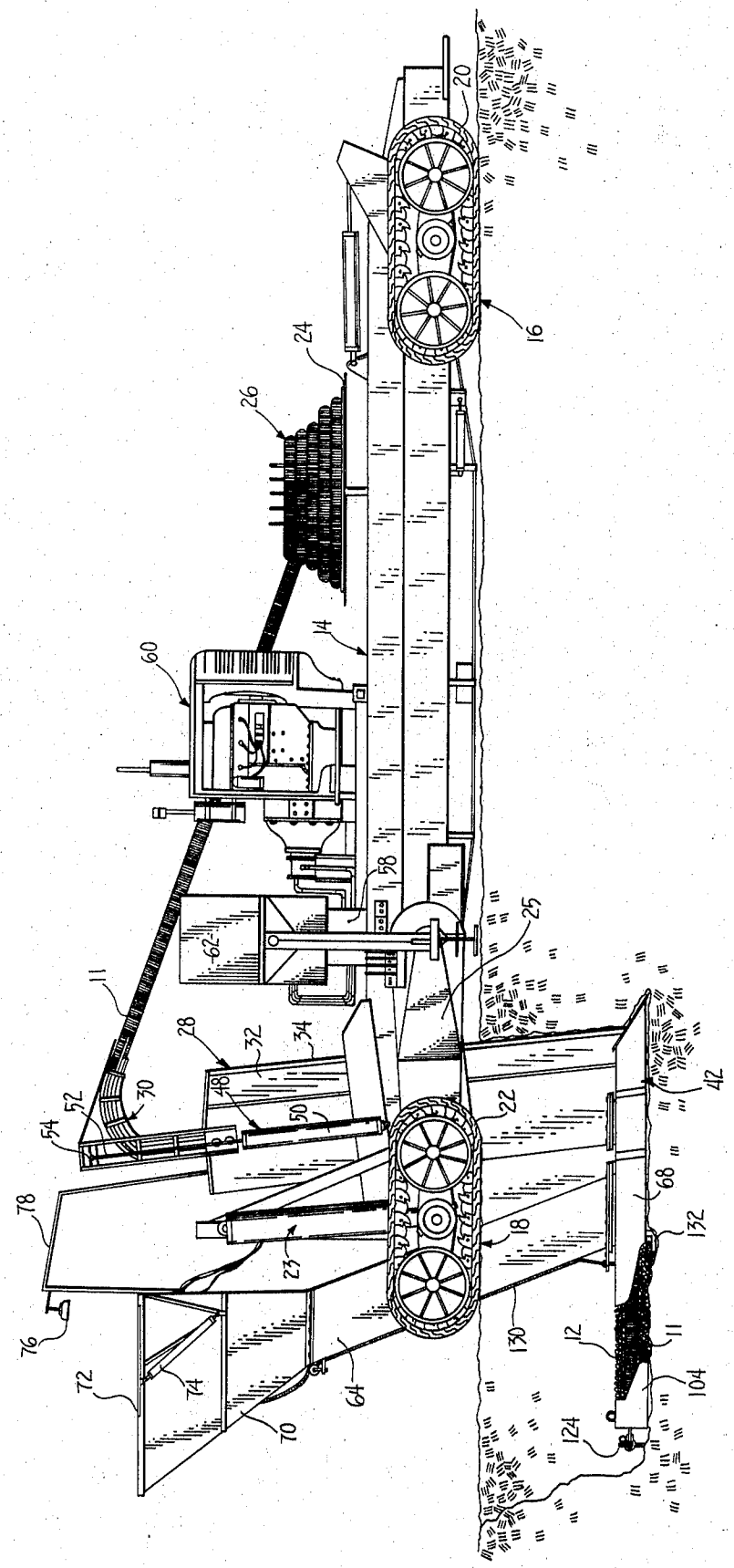

20
16
24
26
14
60
58
62
25
11
28
32
34
48
52
54
70
50
22
42
68
132
18
23
78
76
72
74
70
64
130
12
11
104
124

FIG 1

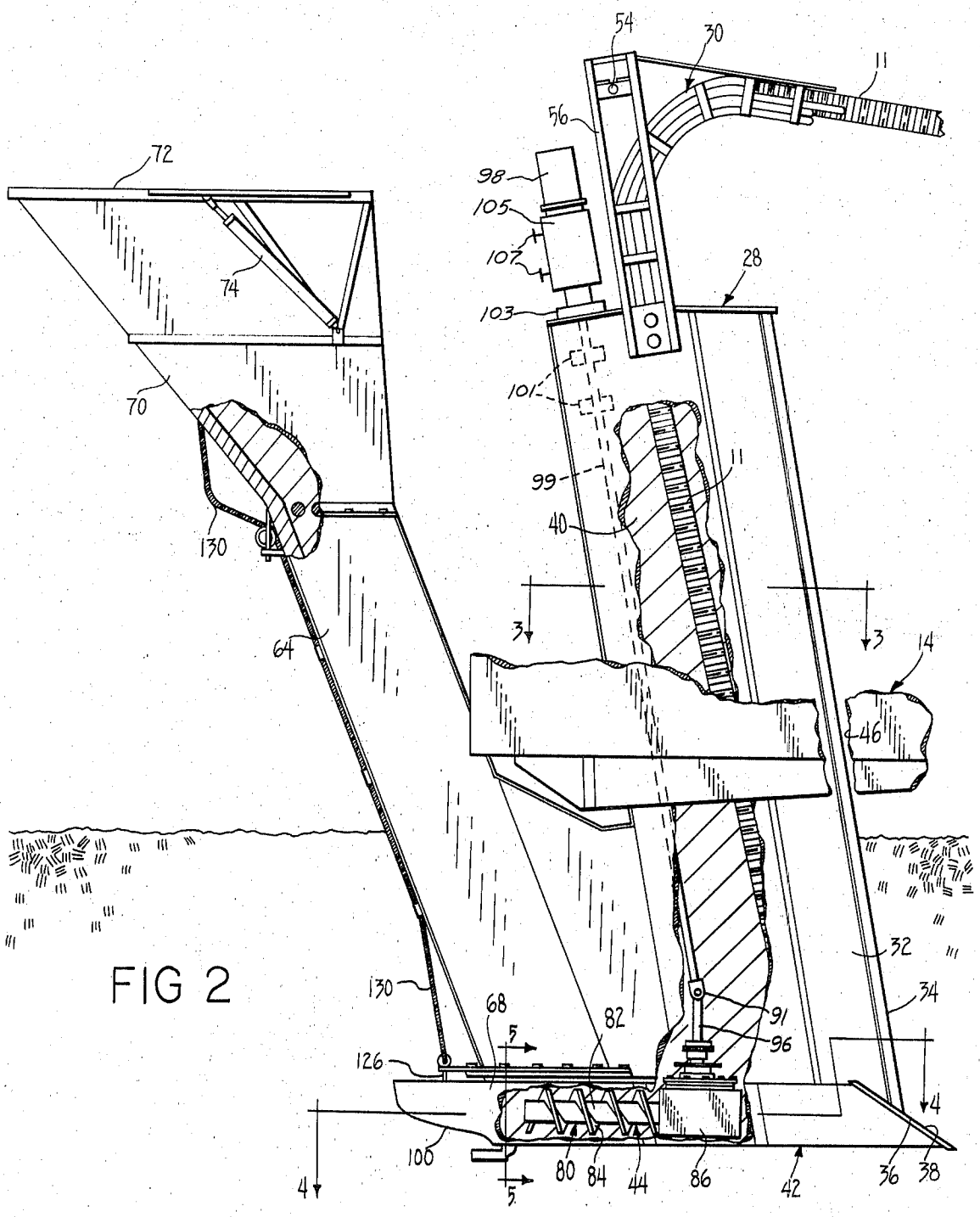
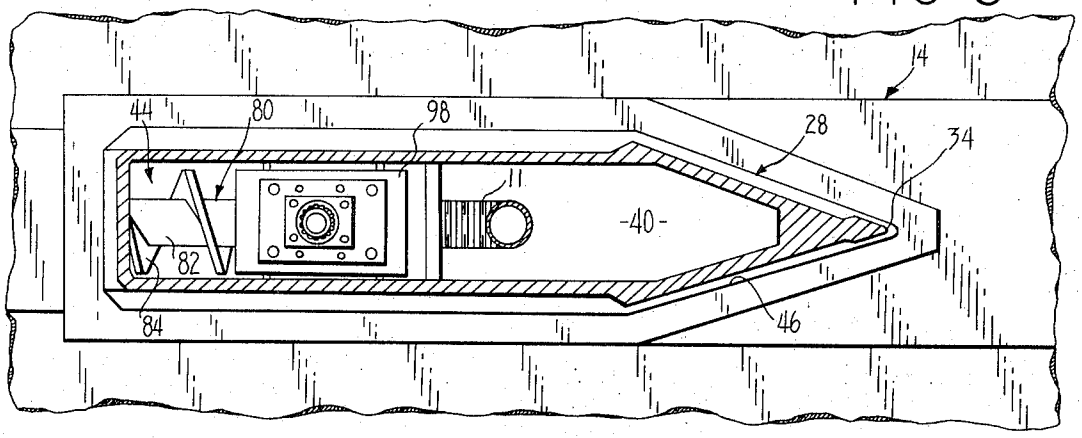

54
30
11
56
72
98
105
107
28
74
103
101
70
99
11
40
130
3
3
14
64
46
32
130
68
82
91
34
5
96
126
4
100
80
84
44
86
42
36
38
4
5

FIG 2

FIG 3



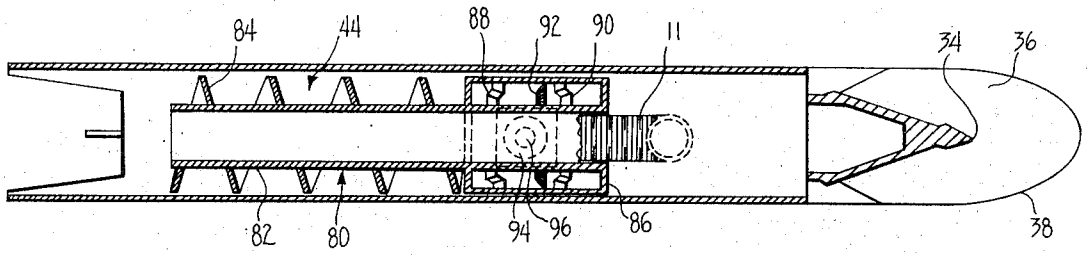


FIG 4

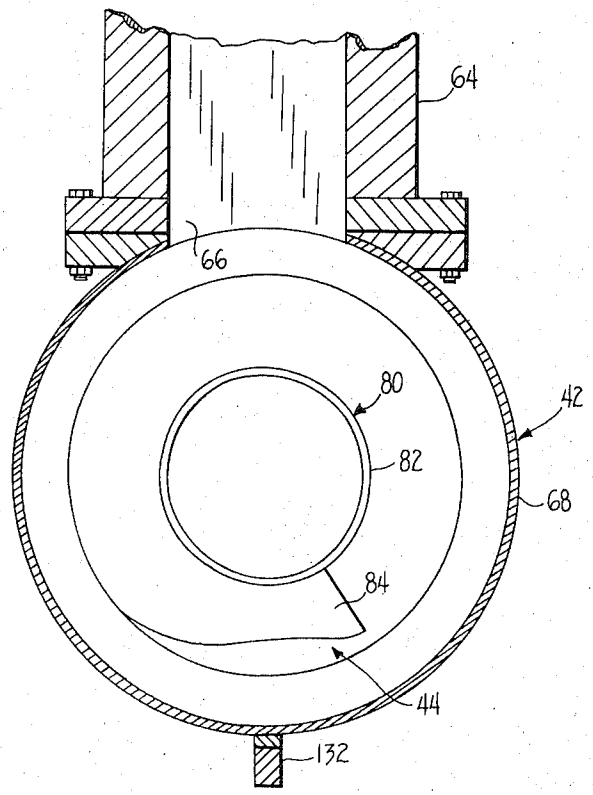


FIG 5

FIG 6

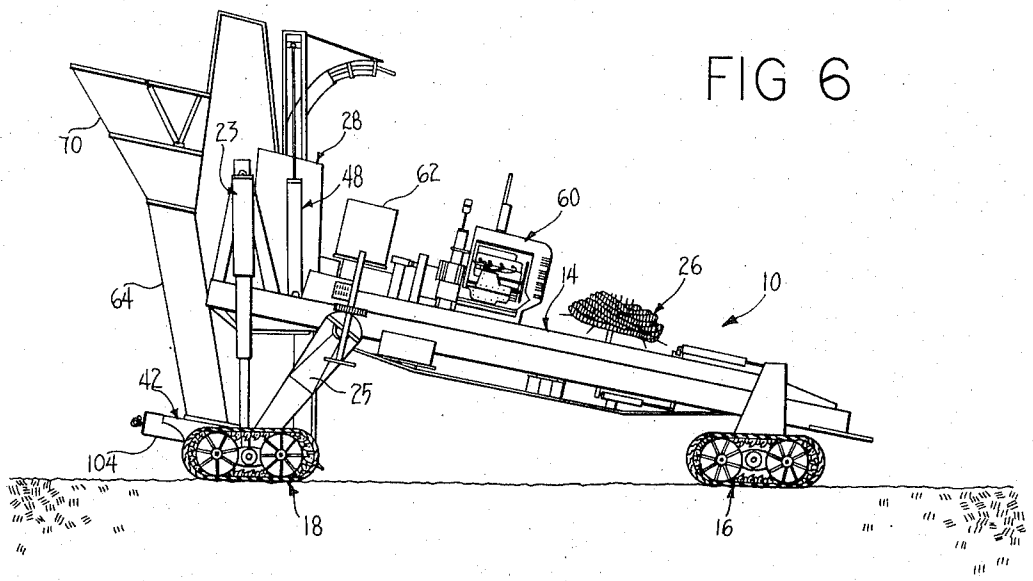
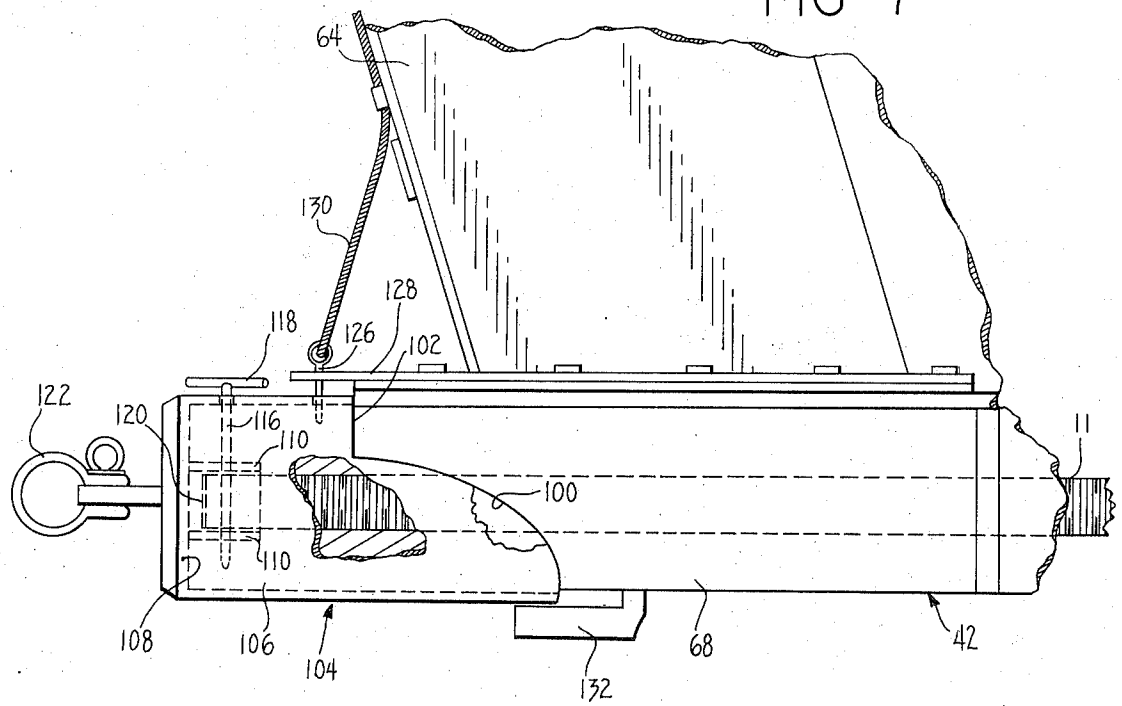

70
23
28
48
62
60
64
14
26
10
42
25
104
18
16

FIG 7


64
130
128
118
126
102
122
120
116
110
100
11
110
108
106
104
132
68
42

PIPE BURYING RIPPER AND METHOD

This invention relates to improvements in the laying of pipe below ground and, more particularly, to apparatus and a method for simultaneously laying pipe to a predetermined depth below the ground and placing gravel around the pipe in a uniform pattern.

Drainage pipe is oftentimes required in fields to drain water soaked areas to eliminate certain salts present in the water brought into the fields for irrigation. This problem can be acute in the salty silt-land of the San Joaquin Valley in California and, if the soil is not purged or these salts by removal of the water therefrom, the soil will become a wasteland encrusted with the plant-killing salts.

The laying of drainage pipe to eliminate this problem is not new. However, the conventional methods used to accomplish this require apparatus which is slow in operation and is cumbersome, with the result being that the unit cost of laying drainage pipe is relatively high. For instance, the conventional way of laying drainage pipe below ground requires that a trench be first dug in the ground, then the pipe is laid at the bottom of the trench followed by filling the trench with the soil removed from it.

Large soil rippers have been utilized in the past for laying pipe and gravel. However, they have been generally unsatisfactory for a number of reasons, including the fact that while they can adequately lay pipe below ground level, they cannot deposit gravel around the pipe in a uniform envelope or layer in a soil of fluid mud pressure.

The present invention is directed to apparatus and a method for laying drainage pipe below ground and simultaneously forming a uniform layer of gravel around the pipe. The apparatus for carrying out the present method is relatively simple in construction notwithstanding its massive size and can be pulled over the ground to cause the soil to be readily ripped as the pipe is fed continuously through the soil ripper structure to a predetermined depth and as gravel is positioned uniformly about the pipe at the desired depth below ground. The uniformity of the cross section of the gravel layer will assure that the pipe will properly receive drain water and will allow the water to enter the pipe without clogging the same. Gravel is fed by gravity from a hopper through a chute to the location at which the pipe is being laid, and an improved gravel distributor is located below the chute in the path of the gravel to cause it to be placed in a sheath or envelope of uniform thickness about the pipe.

To achieve the uniform distribution of the gravel, the distribution device surrounds a generally horizontal feed tube through which the pipe passes into the soil at the lower end of the ripper. The distributor device comprises an auger which directs the gravel rearwardly and about the aforesaid feed tube so that the gravel forms the sheath having a substantially uniform thickness throughout its length notwithstanding variations in the terrain over which the machine passes as the pipe is being laid.

The apparatus is also constructed to permit the ripper to be raised to an inoperative position so that the apparatus can be moved over the ground to and from a job site. Also, means is provided to vary the depth of the ripper so that the pipe can be laid along a particular grade.

The primary object of this invention, is therefore, to provide improved apparatus and method for simultaneously laying a flexible drainage pipe at a predetermined depth below ground level and feeding gravel in a uniform envelope about the pipe as the apparatus moves continuously in a predetermined direction and rips the soil to a predetermined depth.

Another object of this invention is to provide an apparatus and method of the type described wherein the gravel is automatically shaped so that it forms a sheath or envelope of uniform thickness around the pipe as the latter is being laid below ground level.

A further object of this invention is to provide an apparatus for laying drainage pipe in the manner described wherein the apparatus utilizes a rotatable augar surrounding a feed tube through which the pipe exits as it is laid below ground so that gravel directed to the augar from a hopper thereabove can be shaped and will surround the pipe as the latter issues from the feed tube.

Other objects of this invention will become apparent as the following specification progresses, reference being had to the accompanying drawings for an illustration of the apparatus of the invention. In the drawings:

FIG. 1 is a side elevational view of the apparatus in an operative position for feeding flexible, perforated drainage pipe and gravel into a location below ground level;

FIG. 2 is an enlarged, fragmentary, side elevational view, partly broken away and in section, of the rear end of the apparatus;

FIG. 3 is a cross-sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is a cross-sectional view taken along line 4—4 of FIG. 2;

FIG. 5 is a cross-sectional view taken along line 5—5 of FIG. 2;

FIG. 6 is a view similar to FIG. 1 but showing the apparatus in position for movement to and from a job site with the soil ripper thereof in an elevated, inoperative position; and

FIG. 7 is an enlarged, fragmentary, side elevational view of the lower rear part of the apparatus, showing the way in which the upstream end of the pipe is anchored at the beginning of a pipe laying operation.

The apparatus of this invention is broadly denoted by the numeral 10 and is shown in its entirety in FIGS. 1 and 6, FIG. 1 showing the apparatus in an operative position for laying a flexible drainage pipe 11 and a sheath or envelope 12 of gravel below ground level and FIG. 6 showing the apparatus in an inoperative position for movement to and from a job site. The pipe is of conventional construction. It has a corrugated sidewall provided with perforations therethrough permitting drainage water in water-soaked fields to pass thereinto and to be conducted along the same.

Apparatus 10 includes an elongated support 14 which can be of any suitable construction, such as an elongated beam. Support 14 has front and rear wheel assemblies 16 and 18 which, for purposes of illustration, include endless tracks 20 and 22, respectively. Support 14 and the wheel assemblies 16 and 18 define a vehicle adapted to be moved in a forward direction over the ground, the forward direction being to the right when viewing FIG. 1.

Rear wheel assemblies 18 are carried on the rear ends of a pair of legs 25 whose front ends are pivotally

mounted by pins to support **14**. A pair of fluid piston and cylinder assemblies **23** (FIGS. **1** and **5**) are used to raise and lower the rear end of support **14** relative to rear wheel assemblies **18** and about the axle of front wheel assemblies **16**. Each assembly **23** has a cylinder whose upper end is pivotally mounted to a brace **27** secured to and extending upwardly from support **14** and has a piston rod whose lower, outer end is secured to the axle **29** of the adjacent wheel assembly **18**. Each assembly is coupled by hydraulic lines to a hydraulic pump **58** carried on support **14**, whereby assemblies **23** can be simultaneously actuated to selectively raise or lower support **14** relative to wheel assemblies **18**.

Support **14** has a platform **24** for mounting a coil **26** of pipe **11** thereon in a compact condition. The platform may be rotatable, whereby the pipe may pay out from the soil and move rearwardly into the open top of an upright, hollow ripper **28** shiftably mounted on support **14** near the rear end thereof for up and down movement with respect thereto. Guide structure **30** coupled with the upper end of ripper **28** directs the pipe from its upwardly and rearwardly extending path into the ripper and along a downwardly extending path.

Ripper **28** includes a housing **32** having a leading, soil-cutting edge **34** (FIGS. **3** and **4**) and is adapted to move forwardly through the ground to rip the soil to a predetermined depth. Ripper **28** also has a lowermost, forward, plow-like extension **37** having a convex leading edge **38** (FIG. **4**) operable to hold the ripper against upward movement as it advances through the ground. Ripper **28** has a passage **40** therethrough to permit pipe **11** to pass therethrough to its lower, open end.

A sleeve **42** secured to and extending transversely to and rearwardly from the lower end of ripper **28** has an opening (not shown) communicating with passage **40** so that pipe **11** can enter the sleeve after passing through the lower end of the ripper. The pipe then changes direction and extends rearwardly and passes into and through gravel distributor **44** hereinafter described. Distributor **44** is housed within a rear portion **68** of sleeve **42**, the latter having an open rear end **46** spaced rearwardly from distributor **44**.

Support **14** has a rear opening or slot **46** (FIG. **2**) through which ripper **28** passes and is allowed to shift up and down with respect to the support. A pair of fluid piston and cylinder assemblies **48**, only one of which is shown in FIGS. **1** and **6** are provided for raising and lowering ripper **28** with respect to support **14**. To this end, each assembly **48** includes a cylinder **50** having a lower end mounted on support **14** and a piston rod **52** extending upwardly and outwardly from cylinder **50**, the upper end of rod **52** being pivotally connected to the upper end **54** of a frame **56** rigid to and extending upwardly from the upper end of ripper **28** (FIG. **2**). Actuation of assemblies **48** causes the ripper to be selectively raised and lowered with respect to the support **14**. Thus, the depth to which the ripper penetrates the soil can be varied.

Assemblies **48** are coupled by hydraulic lines (not shown) to pump **58** mounted on the support **14** forwardly of ripper **28**. Pump **58** is driven by a power source **60**, such as an internal combustion engine or the like, also carried on support **14**. A reservoir **62** above pump **58** supplies hydraulic fluid thereto. It is to be understood that piston and cylinder assemblies **48** can be pneumatic, if desired.

A gravel chute **64** rigidly secured to the ripper rearwardly thereof has a lower, open end **66** (FIG. **5**) which is generally at the same level as the level open end of ripper **28**. Open end **66** communicates with rear portion **68** of sleeve **42**, portion **68** defining a housing or guard in surrounding, spaced relationship to gravel distributor **44** described in more detail hereinafter.

A gravel hopper **70** coupled with and extending upwardly from the upper end of chute **64** is adapted to receive a mass of gravel and to direct the same into the chute. Hopper **70** has an upper, open end for receiving the gravel and may be provided with a top grill **72** which can be raised and lowered by a fluid piston and cylinder assembly **74** coupled with pump **58** to screen the size of the gravel entering the hopper and also to stop dirt clods. Any suitable means can be provided to deposit the gravel in the hopper. A mirror **76** carried by a brace **78** above the open top of hopper **70** can be used to view into the hopper from beneath to same to determine the level of gravel in the hopper.

Distributor **44** includes a rotatable auger **80** having a central, tubular body or feed tube **82** and an auger flight **84** rigidily secured to the outer surface of body **82**. The front and rear ends of body **82** are open to allow pipe **11** to pass therethrough as body **82** rotates and as ripper **28** moves forwardly with support **14**. Thus body **82** serves as a guide for pipe **11**.

The front end of body **82** extends into a gear box **86** secured in any suitable manner within sleeve **42** near the lower, open end of ripper **28**. Gear box **82** contains a pair of spaced bearings **88** and **90** for rotatably mounting body **82**, the latter having an annular gear **92** rigid to its outer surface between bearings **88** and **90**. A spur gear **94** in mesh with gear **92** is carried by a generally vertical shank **96** rotatably mounted on gear box **86** and extending upwardly therefrom. A universal joint **91** on the upper end of shank **96** near the lower end of the ripper connects shank **96** to the lower end of a rigid link **99**, such as a 2-inch square steel tube. Link **99** passes through ripper **28** and is rotatably coupled thereto by a pair of spaced bearings **101** near the upper end of the ripper. A base **103** secured to the top of the ripper supports a gear transmission **105** coupled to the upper end of link **99**. Transmission **105** has controls **107** whereby the speed of rotation of link **99** can be changed. A hydraulic motor **98** supported on transmission **105** is coupled thereto to cause rotation of link **99**. Motor **98** is coupled in any suitable manner to a source of fluid under pressure, such as pump **58**, whereby, when motor **98** is actuated, link **99** and shank **96** are rotated to, in turn, cause rotation of body **82** and auger **84**.

The purpose of distributor **44** is to shift gravel, which has descended in chute **64**, in a rearward direction and about pipe **11** as the latter emerges from the rear, open end of body **82**. Thus, auger flight **84** is arranged to direct the gravel rearwardly and longitudinally of body **82**. As shown in FIG. **2**, the gravel distributor **44** is aligned with and disposed in spaced relationship beneath the lower, open end **66** of chute **64**. The rear end of body **82** is adjacent to but slightly spaced forwardly of the rear extremity of opening **66** as shown in FIG. **2**. Also, since sleeve **42** is substantially cylindrical, body **82** is generally concentric with the sleeve as shown in FIG. **5**.

Portion **68** of sleeve **42** sufficiently surrounds distributor **44** so as to allow the gravel to form a cylindrical

envelope about distributor **44.** Moreover, sleeve **42** shapes the soil surrounding the same so that a cylindrical bore is formed in the soil to accommodate envelope **12** with pipe **11** therein, the soil having been ripped and thereby loosened by the action of ripper **28.**

The rear, open end of sleeve **42** has a forwardly and downwardly extending rear edge segment **100** below an upper, arcuate edge segment **102.** A pipe anchor **104** having a tubular body **106** has a forwardmost edge which mates with and is complemental to edge segments **100** and **102** as shown in FIG. **7.** Anchor **104** has a rear wall **108** provided with a pair of spaced, forwardly extending projections **110** having respective holes aligned with a hole **114** in body **106.** A rod **116** having a handle **118** thereon is insertable through such aligned holes and through the upstream end **120** of pipe **11** when the latter is disposed between projections **110.**

An eyelet **122** carried by rear wall **108** and extending rearwardly therefrom is adapted to be held in the ground by a stake **124** (FIG. **1**) so as to releasably secure anchor **104** at the starting position of the pipe laying operation. The anchor is releasably secured to sleeve **42** by a pin **126** insertable within the upper portion of body **106** and releasably carried by a rear extension **128** on sleeve **42.** A cable **130** coupled with the pin is movable upwardly when a force is applied to the cable, such as from a remote location by the operator of apparatus **10.** When pin **126** is elevated, the releasable connection between sleeve **42** and anchor **104** is broken; thus, the sleeve can move forwardly with chute **64** and ripper **28,** leaving anchor **104** and the upstream end of pipe **11** in a fixed position. A bracket **132** carried by sleeve **42** supports the lower, forwardmost extremity of anchor **104** when the latter is carried by sleeve **42.** Anchor **104** is recoverable after the pipe laying operation has been operable for a certain distance beyond the anchor. Thus, the anchor can be used over and over again, if desired.

In operation, apparatus **10** is towed to a job site by a suitable self-propelled vehicle, such as a tractor. The front end of support **14** is provided with hitch means thereon for making direct connection to the towing vehicle. The apparatus is in the condition shown in FIG. **6** for towing to the job site, rear wheel assemblies **18** still engaging the ground but legs **25** being in inclined, forwardly extending positions with respect to wheel assemblies **18.** The rear end of support **14** is tilted upwardly about the front wheel assemblies **16** by the actuation of fluid piston and cylinder assemblies **23.** As the apparatus is towed to a job site, ripper **28** and chute **64** remain in their elevated positions out of contact with the ground.

At the job site, a backhoe initially digs a short trench and then apparatus **10** is moved into positions so that ripper **28** and chute **64** can be lowered into the trench with pipe **11** extending through passage **40** and sleeve **42** and releasably coupled by rod **116** to anchor **104.** At the beginning of the pipe laying operation, pin **126** is elevated by lifting cable **130,** thereby releasing the anchor from sleeve **42.** Gravel will have been deposited in hopper **70** and allowed to gravitate in chute **64** into rear portion **68** of sleeve **42.** Also, pump **58** will have been actuated by the starting of motor **60,** whereby fluid will be directed to hydraulic motor **98** to cause rotation of body **82** of gravel distributor **44.**

The means for advancing support **14** forwardly can be of any suitable construction. For instance, the towing vehicle can be moved a distance forwardly of support **14,** such as 100 feet or more, and the vehicle provided with a cable and winch assembly, can be maintained in a stationary position so as to push the support forwardly by operation of the cable and winch assembly. The movement of the support can be continuous until it approaches the towing vehicle, whereupon the vehicle can then be moved forwardly along incremental distance to repeat the operation.

As support **14** moves forwardly, ripper **28** rips the soil in advance of edge **34** to loosen the soil and to allow pipe **11** to be laid to a predetermined depth in the ground. Also, gravel deposited in chute **64** gravitates continuously into sleeve **42** at rear portion **68** thereof and the rotation of body **82** causes auger flight **84** to direct the gravel within rear portion **68** of sleeve **42** to be directed rearwardly and about pipe **11** in a generally cylindrical sheath or envelope of uniform cross section as shown in FIG. **2.** Grade changes can be made by actuating fluid piston cylinder assemblies **48** so as to raise or lower ripper **28** with respect to support **14.** As the pipe is laid, it pays out from the coil of pipe on platform **24.**

The coil is replenished as needed so that apparatus **10** can be operated continuously until the desired length of pipe has been laid in the ground. Also, gravel is periodically dumped into the hopper **70** so as to assure a continuous supply for forming envelope **12** around pipe **11** below ground level.

At the end of the pipe laying operation, piston and cylinder assemblies **23** are actuated to elevate ripper **28** and chute **64** into the inoperative position shown in FIG. **6.** Then, the apparatus can be driven over the ground to a storage location or to a new job site.

We claim:

1. Apparatus for laying a flexible, drainage pipe comprising: a support; means mounting the support for movement over the ground; means carried by the support for ripping the soil to a predetermined depth as the support is moved over the ground, said ripping means having tubular structure for receiving the pipe and for feeding the same rearwardly into the ground at said predetermined depth as the ripper means moves forwardly through the ground; means adjacent to said ripping means for directing a mass of gravel to said structure; power actuated means within said structure for distributing the gravel in a substantially uniform layer about the pipe after the latter has been received in said structure; and power means coupled with said distributing means and carried by said ripping means adjacent to the ripper and thereof for actuating said distributing means.

2. Apparatus as set forth in claim **1,** wherein said ripping means includes a generally upright, hollow housing said structure including a tube near the lower end of the housing, the tube extending transversely of and in communication with the housing.

3. Apparatus as set forth in claim **1,** wherein the directing means includes a chute having a lower open end, said structure having a portion aligned with said lower end of the chute.

4. Apparatus as set forth in claim **1,** wherein is included means coupled with the support for varying the depth of said ripper.

5. Apparatus for laying a flexible drainage pipe at a predetermined location below the ground comprising: an elongated support having means thereon for mount-

ing the same for movement over the ground, said support adapted to carry a length of said pipe; a hollow soil ripper shiftably carried by the support near one end thereof, said ripper having a length sufficient to permit it to extend into the ground and to rip the soil as the support is moved forwardly over the ground, said ripper having an upright passage therethrough to permit a pipe to be fed from the support to the lower end of the ripper when the latter extends into the ground; means carried by the support rearwardly of said ripper for directing gravel to a location adjacent to and rearwardly of the lower end of the ripper; a rotatable auger at said location and having a tubular body extending rearwardly of and communicating with said passage, said body having an open rear end to permit a pipe passing therethrough to exit therefrom; and a motor carried by the support exteriorly of the ripper and coupled with said auger for rotating the same relative to the ripper, whereby gravel directed to said location will be uniformly placed in an envelope about the pipe as the latter exits from said rear end of the body.

6. Apparatus as set forth in claim **5,** wherein is included means coupled with the support for mounting the rear end thereof for up and down movement with respect to the ground, said ripper and said directing means being adjacent to said rear end of the support.

7. Apparatus as set forth in claim **5,** wherein said directing means includes a chute having a lower open end, and a sleeve communicating with the chute and surrounding said auger, said sleeve having an open rear end.

8. Apparatus as set forth in claim **5,** wherein said motor is carried at the upper end of the ripper, and including a rigid link coupling said motor and said auger together.

9. Apparatus as set forth in claim **8,** wherein is provided a gear box connected to the front end of the auger, said gear box having a vertical, rotatable shank, and a U-joint interconnecting the upper end of the shank and the lower end of the link.

10. Apparatus as set forth in claim **5,** wherein is included a cylindrical guard coupled to said directing means and disposed in surrounding, spaced relationship to said auger, said guard having an open rear end, and a pipe anchor for releasable attachment to the rear end of said guard, said anchor having means thereon for releasably securing the same in a fixed position below the ground and provided with structure for releasably connecting one end of said pipe thereto.

* * * * *