

[54] **FEED CHUTE FOR UNDERGROUND CABLE LAYING PLOW**

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[51] **Int. Cl.**..... **F16l 1/00, A01f 11/00**

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

[56] **References Cited**

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[57] **ABSTRACT**

Structure incorporated into, attached to or otherwise associated with a cable laying plow to define a chute or guide for feeding a cable or cables, conduit, pipe or the like downwardly and in a curved manner for discharging the same in trailing relation to the plow. A wing used in combination with the chute or independently of the chute to provide the capability of installation of a ground wire or wires simultaneously with installation of the cable, conduit, pipe or the like by the chute or installation of the ground wire or wires where cable, conduit, pipe or the like has already been previously installed.

8 Claims, 7 Drawing Figures

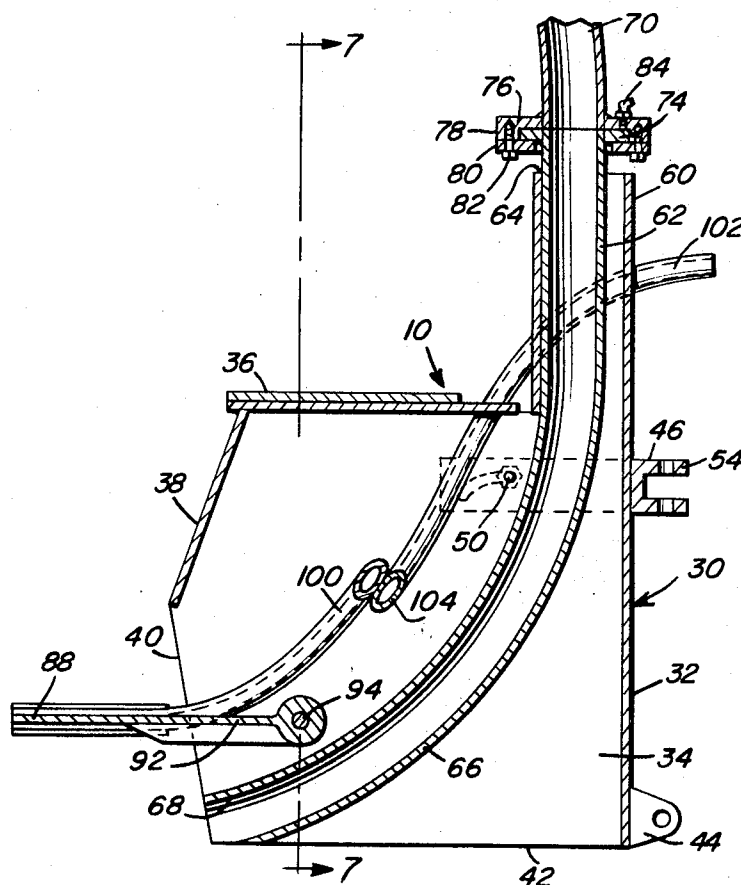


Fig. 1

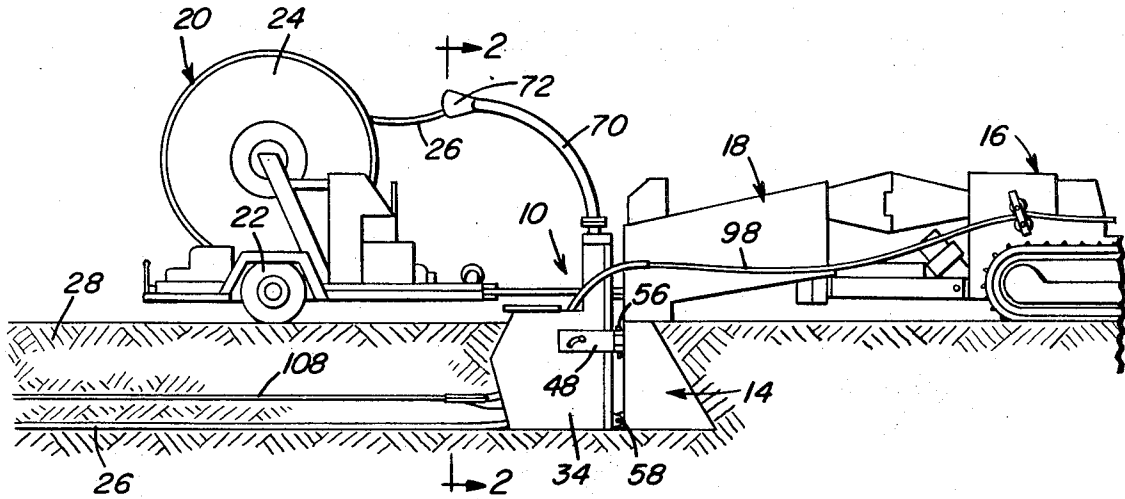


Fig. 2

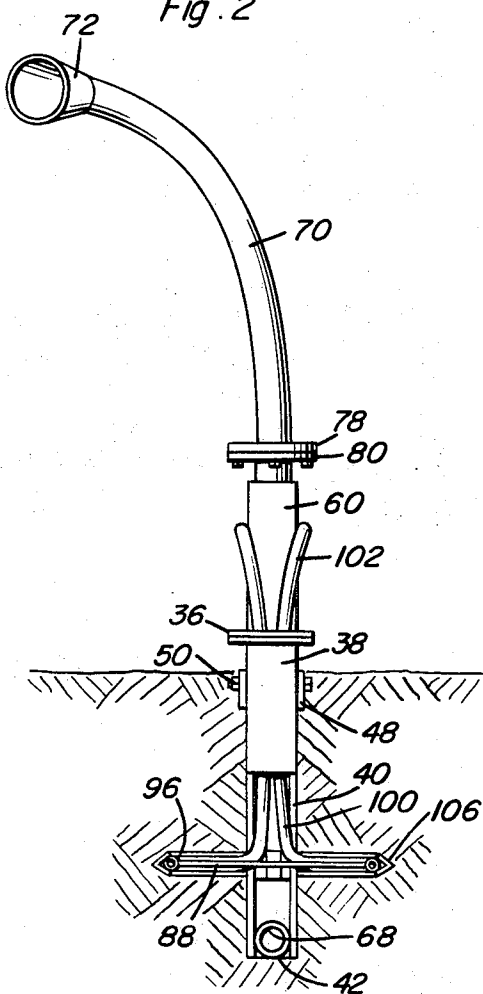
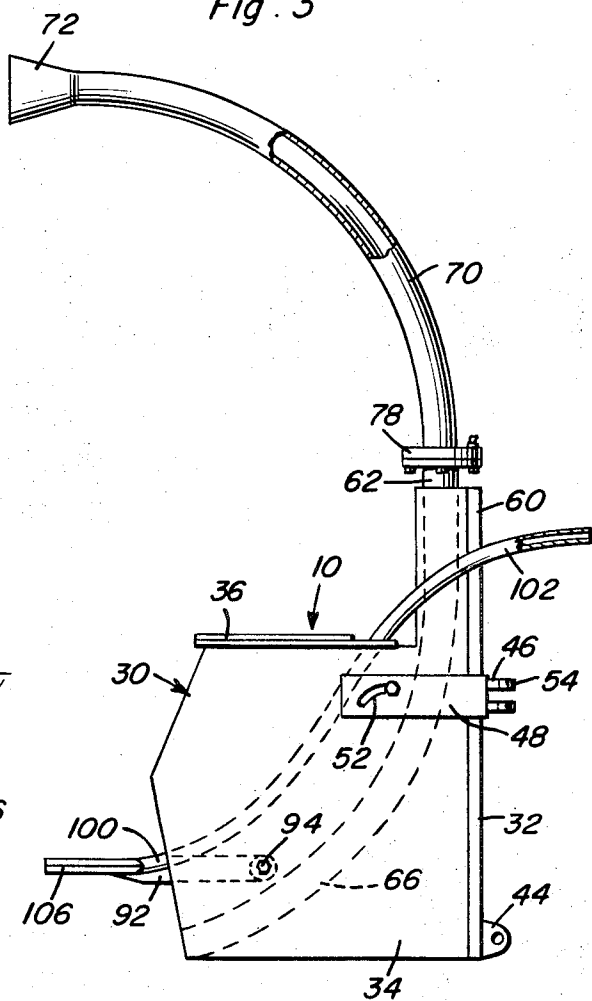
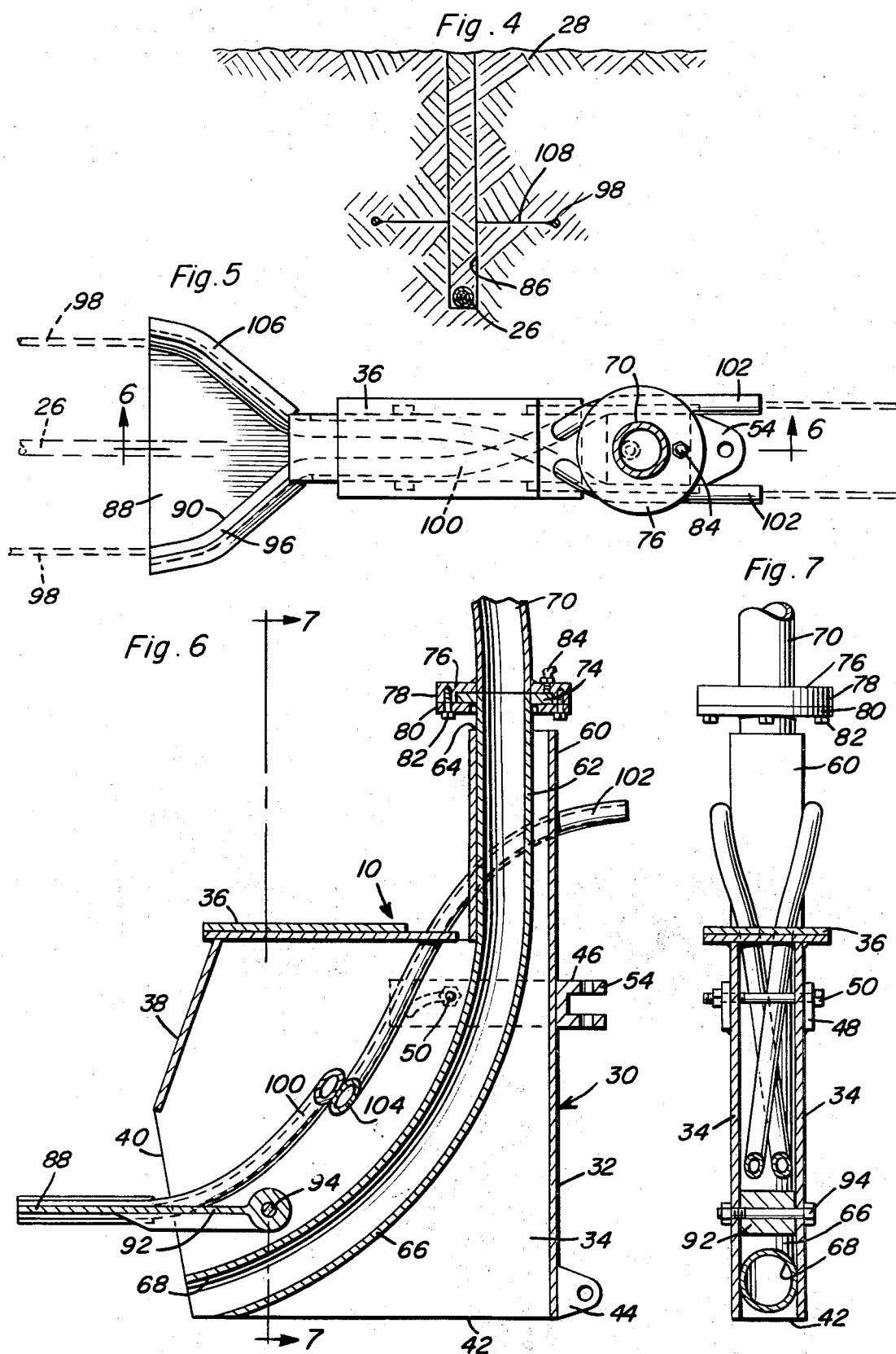


Fig. 3





FEED CHUTE FOR UNDERGROUND CABLE LAYING PLOW

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to an apparatus for installing underground cable, conduit, pipe or the like which includes a cable laying plow provided with a feed chute connected in trailing relation thereto for feeding a cable, conduit, pipe or the like downwardly in a smoothly curved manner for positioning in the underground bed or area formed by the plow in which the plow itself forms no particular part of the invention except in its association with the feed chute. This invention also relates to a wing for installing ground wires either simultaneously with the cable, conduit, pipe or the like or independently thereof to enable the ground wires to be installed after the cable, conduit, pipe or the like is in place.

2. Description of the Prior Art

Cable laying plows for positioning a cable or pipe below ground have been developed and are used in many installations rather than previously known trenching systems in which a trench was formed, the cable or cables laid and the trench backfilled. Subsequent to development of such plows, various improvements and modifications have been made regarding the manner in which the plows are connected with towing vehicles in order for the plows to be effectively towed. Examples of such arrangements are disclosed in U.S. Pat. Nos. 3,032,903; 3,500,564 and 3,526,980. These patents also disclose, but not in detail, the plow structure including a vertically disposed blade or coulter and a mole at the lower end thereof. While such previously known devices have been utilized, some difficulties have been encountered in laying certain types and arrangements of cables, conduits and the like with the plow.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a feed chute for cable laying plows mounted articulately to the rear edge portion of the plow and including vertically extending guide means provided at the smoothly curved rearwardly extending lower portion that terminates at the rear lower edge portion of the chute.

A further object of the invention is to provide a feed chute in which the guide set forth in the preceding paragraph also includes an upwardly extending and smoothly curved upper end portion swivelly connected with the chute to enable the orientation of the upper portion of the guide to be varied so that cables may be fed from a trailer or other support in trailing relation to the chute or from any other position in relation to the chute.

Another very important object of the invention is to provide a feed chute in accordance with the preceding objects in which a horizontally disposed wing is attached to the chute and includes tubular guide members associated therewith for guiding wires downwardly to a position underground horizontally spaced from each other and vertically spaced from the cable being fed down through the guide on the feed chute thereby enabling a plurality of cables endwise to be laid underground during one pass of the underground cable laying plow with the multiple cables being vertically

spaced, horizontally spaced or otherwise arranged in a desired relationship to each other.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view illustrating schematically the orientation of the feed chute of the present invention associated with a cable laying plow and a trailer carrying a supply spool of cable to be laid.

FIG. 2 is a rear elevational view, taken substantially upon reference plane 2—2 of FIG. 1 illustrating the orientation of the feed chute in relation to the ground when laying cables.

FIG. 3 is a side elevational view of the construction of FIG. 2 illustrating further structural details of the invention.

FIG. 4 is a vertical sectional view similar to FIG. 2 but illustrating the position of the main cable and wires after they have been laid.

FIG. 5 is a plan view, on an enlarged scale of the lower portion of the feed chute illustrating the structural details thereof.

FIG. 6 is a vertical, sectional view taken substantially upon a plane passing along section line 6—6 of FIG. 5 illustrating further structural details of the guide for the main cable and the guides for the wires.

FIG. 7 is a vertical, sectional view taken substantially upon a plane passing along section line 7—7 of FIG. 6 illustrating further structural details of the feed chute.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now specifically to the drawings, the feed chute of the present invention is generally designated by reference numeral 10 and is illustrated in association with an underground cable laying plow 14 which is associated with a towing vehicle 16 in a well known manner and connected thereto by a supporting and connecting mechanism generally designated by the numeral 18 with the plow 14, vehicle 16 and supporting and connecting mechanism 18 generally conforming with previously known structure such as disclosed in the previously mentioned prior patents with this construction forming no particular part of the invention except for the association of the plow 14 with the feed chute 10. Also connected with the plow and supporting and connecting mechanism is a trailer generally designated by the numeral 20 which is of conventional construction and may be provided with ground engaging support wheels 22 and a reel or spool 24 of cable 26 to be laid in underground position. It is pointed out that the trailer is only representative of the manner in which the cable spool may be supported or the cable may be supplied by various means. In addition, pipes, conduits or other similar devices may be positioned underground by using the cable laying plow 14 which forms a slit in the ground 28 rather than forming a wide trench as is necessary in conventional trench installation methods when positioning underground cable.

The feed chute 10 includes a vertically oriented housing or casing 30 which is relatively narrow in a

transverse direction but relatively elongated vertically and in a fore-and-aft direction. The housing includes a front wall 32 and spaced parallel side walls 34 rigid with the front wall 32, a partial top wall 36 and a partial rear wall 38 interconnecting the side walls 34 thus providing an open rear portion 40 and an open bottom portion 42.

For attaching the feed chute to the plow 14, the lower end of the front plate or wall 32 is provided with a forwardly projecting lug 44 at the bottom thereof and a forwardly projecting lug 46 spaced above the lug 44 with the lug 46 being connected with side brackets 48 extending along the outer surface of the side plates 34 and being connected thereto by a through bolt 50 that extends through arcuate slots 52 in the bracket plates 48. The lug 46 includes two vertically spaced ears 54 apertured for receiving a vertically oriented pin 56 and the lug 48 is provided with a horizontal opening receiving a horizontal pin 58 which construction provides for a limited degree of relative movement between the feed chute 10 and the plow 14 with the pins 56 and 58 connecting the feed chute with the plow 14 so that it moves in trailing relation thereto.

The portion of the feed chute above the top plate 36 which is in the form of a double thickness plate is provided with an upward extension 60 which may be square or rectangular in cross-sectional configuration and forms a continuation of the front portion of the housing or casing 30 as illustrated in FIG. 6. Mounted vertically in the extension 60 is a tubular guide 62 that may be rigidly affixed to the rear surface of the extension 60 as by welding 64 or the like. The tubular guide 62 extends downwardly and curves smoothly towards the rear as indicated at 66 and terminates in a discharge end 68 generally at the juncture between the bottom edge 42 and the rear of the housing 30 thereby providing a smoothly curved and rearwardly extending guide.

Attached to the upper end of the tubular guide 62 is an upwardly extending tubular member 70 having a smoothly curved configuration and terminating in an outwardly flared, funnel-shaped entrance end 72 for receiving the cable 26. The tubular guide 70 is swivelly attached to the tubular guide 62 so that the angular orientation of the tubular guide 70 may be oriented to enable the guide funnel 72 to be disposed forwardly, rearwardly or to any angular position desired to facilitate guiding of the cable into the tubular guide. FIG. 6 illustrates the swivel construction and includes a flange 74 on the upper end of the tubular guide 60 and a corresponding flange 76 on the tubular guide 70 with the flanges 74 and 76 being in abutting engagement with each other. The flange 76 is larger than the flange 74 and includes a depending edge portion 78 which encircles the circumference of the flange 74. Attached to the edge portion 78 of the flange 76 is a retaining plate 80 secured in place by removable bolts 82 to enable disassembly of the device with the plate 80 serving to rotatably connect the flanges 74 and 76. A lubrication fitting 84 may be provided on the flange or plate 76 in order to lubricate the relatively movable surfaces defining the swivel connection between the tubular guide 70 and the tubular guide 62.

With this construction, the cable 26 is fed downwardly by the feed chute 30 with the cable being laid smoothly in a slit 86 formed in the earth's surface 28 which slit is formed to a width only sufficient to enable

passage of the plow 14 and the feed chute 10 which has a transverse dimension only slightly greater than the dimension of the cable. The curvature of the tubular guide 62 and the tubular guide 70 is such that the cable will not be curved or bent around sharp corners which can be damaging to certain types of cable. For example, the minimum radius of curvature may be greater than the minimum radius that a particular cable can follow without damage to the cable.

Also attached to the housing 30 is a transversely extending plate or wing 88 which is substantially perpendicular to the trailing end 40 of the housing 30 with the forward edges of the plate 88 converging inwardly at 90 and extending between the side walls 34 of the housing 30 with the forward terminal end of the plate designated by numeral 92 being sufficiently narrow to pivot or swing between the side walls 34 and provided with an enlargement that is apertured for receiving a pivot bolt 94 thereby enabling the wing or plate 88 to pivot about the transverse axis defined by the pivot pin or bolt 94. Attached to the outer edges of the wing 86 are tubular guides 96 which receive wires 98 from tubular guides 100 which extend between the side plates 34 and vertically upwardly through the top plate 36 with the guides then extending along either side of the upward extension 60 of the housing 30 with the upper terminal end portion of the guides being designated by numeral 102. As illustrated, the guides cross at 104 interiorly of the housing 30 and may be in the form of semi-rigid or tubular conduits, hoses or the like which are connected with and form continuations of the tubular guides 96 to provide passage for and guidance for the wires 98. To provide wear surfaces for the outer edges of the wing 86, generally V-shaped edge members 106 are provided on the wing 86 rearwardly of the housing 30 with the apex of the V-shaped wall members 106 being disposed outwardly as illustrated in FIG. 2. With the wing 88 disposed above the outlet end 68 of the tubular guide 62, the wires 98 will be vertically spaced from the cable 26 and also horizontally spaced in relation to each other and horizontally spaced from the vertical slit 86 with the wing 88 and the reinforced edge 106 thereof which defines substantially a cutting edge forming a narrow horizontal slit 108 in communication with the vertical slit 86 thereby laying the wires 98 at the same time that the cable 26 is laid. While the wing 86 is capable of some movement in a vertical direction, the scope of pivotal movement is limited so that a predetermined orientation of the wires 98 may be provided. The wires 98 are normally bare and serve as ground wires to protect the cable or underground pipe which is required for certain installations.

This arrangement enables both the cable, such as a coaxial cable employed in communications systems and ground wires to be placed underground in a desired or required vertical and horizontal relationship with an appropriate spacing therebetween by the single pass of the cable laying plow and feed chute thereby eliminating the necessity of first laying the cable and then subsequently laying the ground wires which, in effect, requires two operations. In actual practice, the passage of the plow and chute through the ground compacts the soil and also effectively moves rocks or stones away from the cable or pipe to protect it from abrasion and impact after installation. As the ground compaction is released after passage of the plow and feed chute, a uniform radial support is given to the installed cable

and wires and they will be maintained in the desired relationship to each other and will not be subjected to uneven pressures and abrasions caused by the backfilling of dug trenches.

The feed chute is maintained with a minimum horizontal dimension as compared with the cable diameter which can be fed down through the tubular guide with the transverse dimension of the feed chute generally approximating the transverse dimension of the rear of the plow so that it will effectively follow the plow and effectively feed the cable and wires into position with a minimum towing force requirement.

For the purposes of this invention, the term cable, conduit, pipe or the like encompasses single or multiple elongated members having sufficient flexibility to enable them to assume the radius of curvature defined by the chute.

Also, it is pointed out that while the wing 88 and its associated structure is disclosed in use with the cable chute, it is within the purview of this invention to use the chute without the wing and to use the wing without the chute. This enables laying only the cable, simultaneous laying of the cable and ground wires or laying of the ground wires only when it is desired to install ground wires where the cable or conduit has previously been installed or where it is only necessary to install ground wires. In the event that only a ground wire or wires are to be installed, the wing and associated structure may be connected with the feed chute 30 which will not be used as a chute or connected directly to the plow in any suitable manner so that the ground wires will be disposed in a desired location below the ground surface.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. A feed chute for an underground cable laying plow comprising a vertically disposed hollow housing defined by generally parallel side surfaces, a tubular guide extending vertically and curving downwardly and rearwardly to an exit point at the rear lower end of the housing, means on the housing adapted to connect it to the trailing edge of an underground cable laying plow, and an upwardly extending curved tubular guide attached to the housing and curved in a manner to receive a cable for guiding the cable downwardly with it exiting from the feed chute at the bottom rear corner thereof, and a wing in the form of a plate attached to the rear portion of the housing, said wing including side edge portions which diverge outwardly and rearwardly, tubular guides along the side edges of the wing, said housing including tubular guide members communicating with the forward edges of the tubular guide members on the edges of the wing and extending upwardly from the housing for receiving wires with the wires exiting from the rear edges of the wing, said wing being disposed vertically above the exit for the cable guide and the side edges and tubular guide members on the wing being spaced horizontally from the vertical plane of the exit for the cable guide thereby positioning the cable

and wires in vertical and horizontal spaced relation to each other.

2. The structure as defined in claim 1 wherein said wing includes blade defining edge members connected with the side edges thereof, said blade defining edge members being in the form of V-shaped members having the apex thereof facing outwardly.

3. A feed chute for an underground cable laying plow comprising a vertically disposed hollow housing defined by generally parallel side surfaces, a tubular guide extending vertically and curving downwardly and rearwardly to an exit point at the rear lower end of the housing, means on the housing adapted to connect it to the trailing edge of an underground cable laying plow, and an upwardly extending curved tubular guide attached to the housing and curved in a manner to receive a cable for guiding the cable downwardly with it exiting from the feed chute at the bottom rear corner thereof, said tubular guide for the cable extending above the housing and the tubular guide for the cable in the housing being interconnected by swivel means to enable the portion of the cable guide above the housing to swivel about substantially a vertical axis, the upper end of the upper tubular guide for the cable including a funnel-shaped entrance capable of swinging to a desired angular position about the vertical axis for receiving a cable from various positions, and a wing in the form of a plate attached to the rear portion of the housing, said wing including side edge portions which diverge outwardly and rearwardly, tubular guides along the side edges of the wing, said housing including tubular guide members communicating with the forward edges of the tubular guide members on the edges of the wing and extending upwardly from the housing for receiving wires with the wires exiting from the rear edges of the wing, said wing being disposed vertically above the exit for the cable guide and the side edges and tubular guide members on the wing being spaced horizontally from the vertical plane of the exit for the cable guide thereby positioning the cable and wires in vertical and horizontal spaced relation to each other.

4. In combination with a towed plow of the type capable of laying a pipe or cable below ground surface without digging a trench, a chute attached behind the plow for guiding a pipe or cable downwardly from above ground to the bottom of the vertical slit formed by the plow, said chute including a substantially vertically disposed tubular guide having a bottom portion curving rearwardly in a smooth radius and the top curving in a smooth radius to receive a pipe or cable and guiding it downwardly to exit, the radius of curvature of the guide being greater than the radius that the pipe or cable can be bent without damage, said feed chute including horizontally disposed wing means to form one horizontal slit above the bottom of and laterally of the vertical slit, said wing means including guide means for guiding at least one wire into the horizontal slit without digging a trench.

5. The structure as defined in claim 4 wherein said tubular guide includes an upper section and a lower section, and swivel means interconnecting the upper section and lower section to enable the upper section to swing about substantially a vertical axis so that pipes or cables may be received from various angular orientations.

6. The structure as defined in claim 4 wherein said wing means is in the form of a plate, a transversely ex-

7

tending pivot member connecting the forward edge of the plate to said chute above the bottom end of said tubular guide, said plate including rearwardly diverging side edges extending laterally from both surfaces of the chute, said guide means including tubular passages generally paralleling the side edges of the plate for guiding two wires into the horizontal slit with the wires being above and laterally of the cable laid in the bottom of the vertical slit, said plate also including blade defining edge portions forming the diverging side edges of the plate to facilitate formation of the horizontal slit with the horizontal slit extending to both sides of the vertical slit defined by the chute.

7. An apparatus for laying a ground wire or wires at a desired location underground comprising a wing generally in the form of a plate disposed generally in a horizontal plane and adapted to be towed in trailing relation to an underground cable laying type plow, and tubular guide means for ground wires on said plate, said

8

tubular guide means including curved extensions projecting to a point above ground level to receive the ground wires, said plate including rearwardly diverging side edges, said tubular guide means including an open ended tubular member along each side edge of the plate, and blade defining edge members disposed outwardly of the tubular members for forming a horizontal underground slit for receiving the wires as they exit from the rear end of the tubular members.

8. The structure as defined in claim 7 wherein said blade defining edge members on the plate include a generally pointed member having rearwardly diverging sharp edges rigid with the tubular members, and means at the forward end of said plate for pivotally mounting the plate for swinging movement about a substantially horizontal axis extending transversely of the vertical slit formed by the cable laying plow.

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