Fig. 8.
Since the machine may be required to work over rough or undulating ground, the angle between the leading edge of the tine and the line of the laid pipe may vary. To compensate for this, the guide may be pivoted to the tine so that the rear end thereof through which the formed pipe emerges can remain in contact with the bottom of the trench despite changes in angle between the leading edge of the tine and the line of the laid pipe.

In one form of the invention the tine carries a bar round which the strip passes on its way to the guide. Where the guide is pivoted, this bar is preferably also pivoted and so connected to the guide as to tilt through approximately half the angle by which the guide tilts in relation to the tine. This enables the strip to be fed to the bar or roller at an unvarying angle in relation to the tine, despite the tilting movements of the guide.

The invention may be performed in various ways and a specific embodiment will now be described by way of example with reference to the accompanying drawings, in which:

FIGURE 1 is a fragmentary side view of a tine of a pipe-laying machine, partially broken away to show the guide;

FIGURE 2 is a sectional plan view taken on the line II--II in FIGURE 1;

FIGURES 3 to 7, inclusive, are sections of the guide taken respectively on the lines III--III to VII--VII in FIGURE 1; and

FIGURE 8 is a perspective view of the strip material being converted into tubular form, the surrounding parts of the apparatus being omitted for clarity.

Referring to the drawings, a tine 10 is mounted on a pipe-laying machine (not shown) with its lower end at a predetermined depth below ground level so that, as the machine advances, the tine forces its way through the ground and forms a narrow trench.

The tine has a sharp V-section leading edge 11 raked at an angle of approximately 45° to the vertical. The forward lower end of the leading edge 11 is provided with a share 12 the lower edge 13 of which is shaped to form a half-round bed for the formed pipe at the bottom of the trench.

The tine is provided with side plates 14. Between the side plates 14 and pivotally connected thereto by pivot pins 15 is a guide carrier 16. At its rear end the guide carrier 16 is connected to a die 17 having an aperture of oval cross-section. Connected to the front of the die and supported by the carrier 16 is a guide 18. At its forward end this guide is substantially flat, but is provided at top and bottom with channels 19. Regarded in cross-section, the shape of the guide changes progressively from right to left in the drawings, as shown in FIGURES 3 to 7, the channels 19 coming progressively closer together as shown in FIGURES 3 and 4, and then turning inwardly as shown in FIGURE 5. Between the section planes V--V and VI--VI the channels 19 meet and merge into a V-shaped portion 20 (FIGURE 6), the guide finally forming a complete oval at the section plane VII--VII as shown in FIGURE 7.

Strip material 21 for forming the pipe, as described in my said copending application Serial No. 73,869 filed December 12, 1960, and further illustrated in FIGURE 8, is fed from a reel (not shown) down through the tine in FIGURE 1 until it meets a pivotally-mounted bar 22 of round cross-section. This bar is mounted on a yoke 23 which is pivotally mounted on the pins 18. The bar may be fixed to the yoke so that the strip slides round it, or it may be rotatably mounted so that it acts as a roller.

Having passed round the bar 22, the strip enters the guide 18, its longitudinal marginal edges 43 (FIGURE 8) engaging in the channels 19. As is apparent from FIG-
URES 3 through 8, the strip 21 is progressively curved towards a tubular form as it passes through the guide 18. The edges of the strip are provided with alternate notches 42 and projections 41 (FIGURE 8), and as shown in FIGURES 6 and 7 these edges eventually overlap and interlock as shown at 24 in FIGURES 6 through 8, thus forming a strip of oval cross-section.

The yoke 23 which carries the rod 22 has rearwardly-extending arms 25 which are attached by a link 26 to the mid-point of a lever 27 pivoted by its front end to the tine 10 at the point 28. The rear end of the lever 27 is pivotally connected by a link 29 to a portion 30 of the carrier 18 which extends forwardly of the pin 15. The carrier 16 is urged in the downward direction by a compression spring 31, so that the die 17 is pressed against the bottom of the trench formed by the tine 10 and the share 12.

If, owing to unevenness of the ground, the tine 10 tilts in the fore-and-aft vertical plane so that the angle between the leading edge 11 of the tine 10 and the line of the laid pipe (i.e. the pipe which has already emerged from the die 17) varies, this movement is accompanied by a pivotal movement of the guide carrier 16 about the pivot pin 15 relatively to the tine 10, and a corresponding movement of the lever 27. For any given angular movement of the tine 10 relatively to the guide carrier 16, the mid-point of the lever 27 will move up or down through half the distance moved by the rear end of this lever. Consequently, since the pivots at the upper ends of the links 26 and 29 are at equal distances from the pivot pin 15, the rod 22 will be tilted through half the said angle of movement of the tine 10 relatively to the guide carrier 16. Consequently, the strip 21 will continue to be fed correctly into the guide 18, even though its path as far as the rod 22 may change.

Behind the tine 10 there is fitted a chute 32 the lower rear portion of which is open at 33 so that gravel or the like can be tipped down the chute and discharged into the trench over the pipe as it emerges from the die 17.

What I claim as my invention and desire to secure by Letters Patent is:

1. Plow apparatus for forming an elongated trench and simultaneously depositing a continuous length of an elongated flexible member, comprising: a hollow plow tine defining foot means for forming a trench by forcing forwardly through the ground, an elongated rearwardly extending guide means within and pivoted to the tine, and a guide means having a forward end portion, means in the tine enabling feeding of a continuous length of flexible material down the interior of the tine to the foot means and rearwardly through the guide means and into the formed trench, said means enabling feeding comprising a bar pivotally mounted in the interior of the tine at the forward end portion of the guide means, the continuous length of flexible material passing around and in contact with the bar and being directed by the bar toward the guide means, the bar being connected to the guide means by pivot means enabling the pivoting of the bar in the same direction and through approximately half the angle by which the guide means pivots in relation to the tine for the limited changes of angular attitude of the plow tine.

2. Plow apparatus according to claim 1 wherein the pivoting means comprises a lever pivoted to the tine, a first link connecting the bar to a first point of the lever, and a second link connecting the guide means to a second point of the lever, the radial distance from the pivot axis of the lever to the first point being one-half the radial distance from the pivot axis of the lever to the second point.

3. Plough apparatus according to claim 1 wherein the tine comprises a hollow coulter having a rearwardly-inclining leading edge and a hollow casing depending from the rear edge of the lower part of the coulter and having a normally horizontal lower edge, the guide means being mounted within the hollow casing.

4. Plough apparatus according to claim 3 and further including duct means located behind the coulter and having a downwardly open mouth at its lower end behind the rear end of the guide means for discharging material having mutually interlockable marginal edge portions formed with alternate projections and notches and for laying the pipe in the trench, said apparatus including elongated hollow guide means having a longitudinal axis and including an inlet end portion, an outlet end portion and an intermediate portion disposed along said longitudinal axis, the inlet end portion having one substantially flat wall portion disposed in a plane substantially parallel to said longitudinal axis, the outlet end portion having a substantially complete tubular internal cross-section with a dimension parallel to the plane of the wall which is substantially less than the transverse width of the wall as measured in the same sense, the intermediate portion having a smoothly profiled internal surface which merges from the cross-section of the inlet end portion to that of the outlet end portion, an internal deflector on the side of the intermediate portion away from the flat side wall of the inlet end portion and extending a limited distance inwardly toward the opposite side of the intermediate portion for progressively urging both marginal edge portions of the strip material inwardly into interlocking relationship as it passes through said guide means, and a bar guide for the strip material pivotably mounted in the hollow tine at the inlet end of the hollow guide means, the bar guide being connected to the hollow guide means by pivot means controlling the pivoting of the bar through approximately half the angle by which the hollow guide means pivots in relation to the tine means comprising a lever pivoted to the tine.

5. A pipe laying machine comprising an inclined hollow tine for forming a trench and apparatus connected to and disposed at least partly within said hollow tine and comprising: a continuous pipe from a strip of flexible material having mutually interlockable marginal edge portions formed with alternate projections and notches and for laying the pipe in the trench, said apparatus including elongated hollow guide means having a longitudinal axis and including an inlet end portion, an outlet end portion and an intermediate portion disposed along said longitudinal axis, the inlet end portion having one substantially flat wall portion disposed in a plane substantially parallel to said longitudinal axis, the outlet end portion having a substantially complete tubular internal cross-section with a dimension parallel to the plane of the wall which is substantially less than the transverse width of the wall as measured in the same sense, the intermediate portion having a smoothly profiled internal surface which merges from the cross-section of the inlet end portion to that of the outlet end portion, an internal deflector on the side of the intermediate portion away from the flat side wall of the inlet end portion and extending a limited distance inwardly toward the opposite side of the intermediate portion for progressively urging both marginal edge portions of the strip material inwardly into interlocking relationship as it passes through said guide means, and a bar guide for the strip material pivotably mounted in the hollow tine at the inlet end of the hollow guide means, the bar guide being connected to the hollow guide means by pivot means controlling the pivoting of the bar through approximately half the angle by which the hollow guide means pivots in relation to the tine means comprising a lever pivoted to the tine.

6. A pipe laying machine according to claim 5 wherein the pivot means comprises a lever pivoted to the tine, a first link connecting the bar guide to a first point of the lever, and a second link connecting the hollow guide means to a second point of the lever, the radial distance from the pivot axis of the lever to the first point being one-half the radial distance from the pivot axis of the lever to the second point.

7. Apparatus for forming a continuous tube from flexible strip material having mutually interlockable marginal edge portions of alternate projections and notches, comprising an elongated hollow guide member through which the strip material can be moved, said guide member having a longitudinal axis and including an inlet portion at one end of said axis, an intermediate portion extending along said axis, and an outlet portion at the other end of said axis, said inlet, outlet and intermediate portions being substantially aligned along said axis, and inlet portion having one substantially flat wall portion, said outlet portion having a substantially complete tubular internal cross-section with a dimension parallel to said flat wall portion and transversely of said axis which is substantially less than the width of the wall measured in the same sense, said internal deflector comprising a smoothly profiled internal surface which merges from the cross-section of the inlet portion to that of the outlet portion, said guide member having successive internal cross-sections from inlet to outlet for bringing the longitudinal marginal edges of the strip material progressively toward each other about said longitudinal axis on the opposite side of said axis from said flat wall and then bringing the longitudinal marginal edges further inwardly toward said longitudinal axis along the edges intersect and
interlock through the alternate projections and notches, said internal cross-sections including an internal deflector formation formed in the intermediate portion on the opposite side of the longitudinal axis relative to said flat wall portion but toward said outlet portion, said internal deflector extending toward said longitudinal axis so as to urge the marginal edges of the strip material toward said axis into interlocking engagement.

8. Apparatus according to claim 7, wherein said deflector is integral with said guide member.

9. Apparatus according to claim 7, wherein the intermediate portion of the guide member has an opening in the side thereof away from said flat wall portion of the inlet portion, and includes channeled edges at the transverse extremities of said opening facing away from said opening for receiving the marginal edges of the strip therein, the channeled edges converging progressively and terminating short of said deflector.

10. Apparatus according to claim 9, wherein the longitudinal axis passes through the center of the tubular outlet portion, and said channeled edges adjacent the deflector and on the side thereof toward the inlet portion are directed inwardly towards the said longitudinal axis.

11. Apparatus according to claim 7, in which the intermediate portion of said guide member has an opening in the side thereof opposite said flat portion of the inlet portion and progressively-inturned marginal portions on opposite longitudinal edges of said opening, which edges are channeled in opposite directions to have the channels face away from the opening, said progressively-inturned marginal portions converging progressively towards one another along the length of said intermediate portion and meeting at an angle, and in which the deflector comprises an inwardly directed V-sectioned longitudinal rib formed at the meeting of said marginal portions and extending along the interior of said guide member substantially to the end of the outlet portion.

12. Apparatus according to claim 7, including a bar guide for the strip material mounted adjacent the inlet portion of said hollow guide member, the bar guide having a longitudinal axis lying in a plane parallel to the plane of said flat wall portion of the inlet portion.

13. Apparatus according to claim 12, in which the axis of said bar guide is inclined at an acute angle to the longitudinal axis of said hollow guide member.

14. Apparatus according to claim 12, in which said bar guide is pivotally mounted in relation to said guide member, and the attitude of the axis of said bar guide is variable in the plane containing said axis.

15. A pipe laying machine comprising an inclined hollow tine for forming a trench, and apparatus connected to said hollow tine for forming a continuous pipe from a strip of flexible material having mutually interlockable marginal edge portions formed with alternate projections and notches on the long axis of said strip, said apparatus comprising an elongated hollow guide member through which the strip material can be moved, said guide member having a longitudinal axis and including an inlet portion at one end of said axis, an intermediate portion extending along said axis, and an outlet portion at the other end of said axis, said inlet, outlet, and intermediate portions being substantially aligned along said axis, said inlet portion having one substantially flat wall portion, said outlet portion having a substantially complete tubular internal cross-section with a dimension parallel to said flat wall portion and transversely of said axis which is substantially less than the width of the wall measured in the same sense, said intermediate portion having a smoothly profiled internal surface which merges from the cross-section of the inlet portion to that of the outlet portion, said guide member having successive internal cross-sections from inlet to outlet for progressively bringing the longitudinal marginal edges of the strip material toward each other about said longitudinal axis on the opposite side of said axis from said flat wall portion and then bringing the longitudinal marginal edges further inwardly toward said longitudinal axis until the edges intersect and interlock through the alternate projections and notches, said cross-section including an internal deflector formation formed in the intermediate portion on the opposite side of the longitudinal axis relative to said flat wall portion but toward said outlet portion, said internal deflector extending toward said longitudinal axis so as to urge the marginal edges of the strip material toward said axis into interlocking engagement.

16. A pipe laying machine according to claim 15, wherein the guide member is pivoted to the hollow tine about a normally horizontal pivotal axis located at the front of the guide member, and further comprising spring member contacting between the rear end of the guide means and the hollow tine to urge the rear of the guide member downwardly relatively to the tine.

17. A pipe laying machine according to claim 15 and further including pivot means pivotally connecting the guide member to the hollow tine to permit relative pivotal movement between the guide member and the tine about the pivot means.

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