Aug. 8, 1961 C. DOMENIGHETTI 2,994,974

DEEP TRENCH EXCAVATOR

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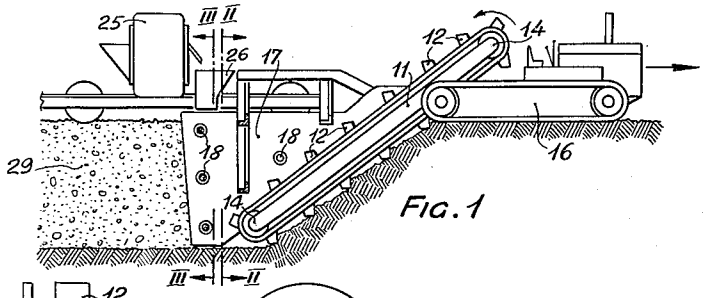


FIG. 1

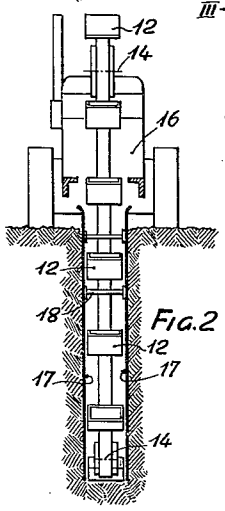


FIG. 2

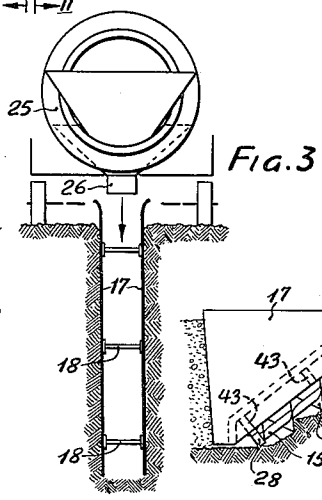


FIG. 3

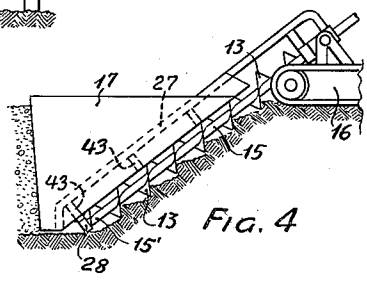


FIG. 4

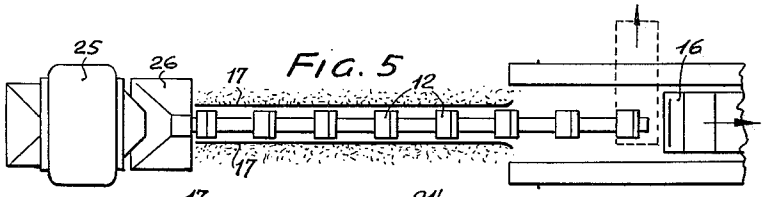


FIG. 5

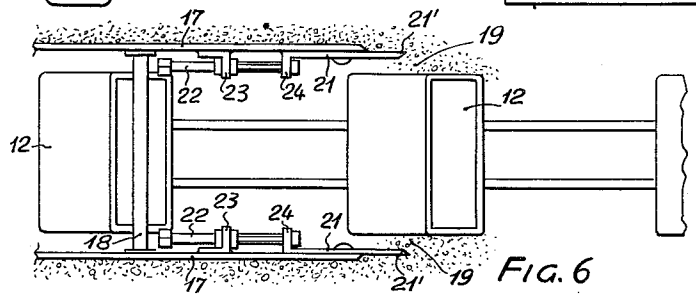


FIG. 6

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DEEP TRENCH EXCAVATOR

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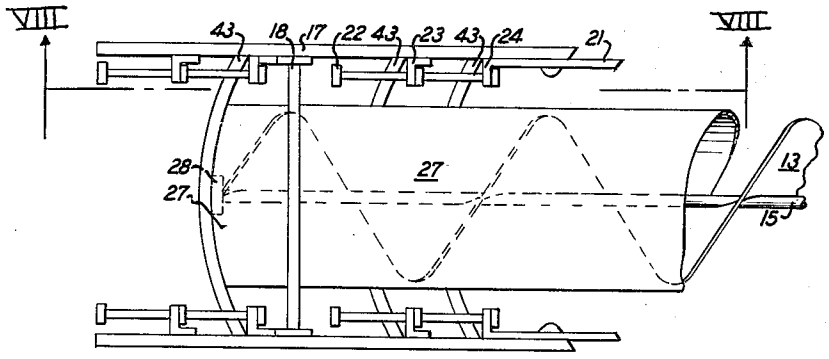


FIG. 7

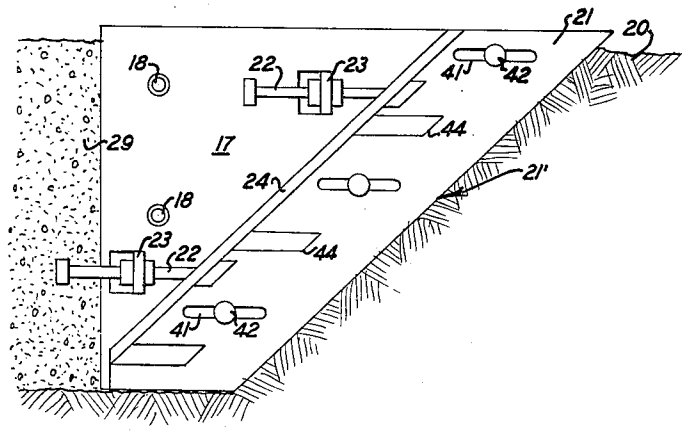


FIG. 8

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2,994,974

# DEEP TRENCH EXCAVATOR

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1 Claim. (Cl. 37—81)

The present invention relates to a new machine suited to dry excavate deep trenches in sliding and loose materials consisting of a plurality of excavating elements distributed in a series (chain of earth buckets, series of helicoidal knives mounted on a shaft or the like) inclined with respect to the horizontal line, so as to create an excavating front, the inclination of which, in the longitudinal direction of the digging, is less than the angle of ground settling, so as to eliminate any danger of sliding in the front part where the excavating members attack the material laterally. The walls left behind by the digging are vertical and are protected by lateral plates acting as shields. In order to prevent the total slipping of the material, the forward edge of said vertical plates towards the inclined excavated front has the same slope as the excavation front, but is placed far enough behind the excavated front part as to allow the partial sliding of part of the excavated front part so that the two plates advancing together with the excavating members may move through material already slipped and hence encounter the minimum possible resistance. As it is particularly important to control the distance between the front side of the lateral containing plates and the digging front, depending on the nature of the ground to be excavated, each plate may present a sliding front edge portion adjustable with respect to the main body of the plate and with respect to the excavating front of the machine.

The lateral containing plates may also contact the inclined tranch front in the case of slidable material so as to prevent any slip of the material on the two sides of the trench. However, depending on the sliding characteristics of the ground, the front edge of the plates may be placed at such a distance from the digging front that a partial slip of the material facilitates the penetration into the ground of the plates themselves using the slipping or settling angle of the material to be excavated, thereby preventing any slip of the lateral walls for a length equal to the length of the plates. The containing of the ground by means of plates may be also extended by inserting into the trench other additional containing plates, before the two main plates fixed with the excavating equipment are removed from the excavated trench. The accompanying drawings diagrammatically represent some embodiments of the machine according to the present invention, and more precisely:

FIG. 1 shows a longitudinal sectional view of the complete digging equipment in working position.

FIG. 2 is a cross-sectional view along the lines II—II of FIG. 1.

FIG. 3 is a cross-sectional view along the lines III—III of FIG. 1.

FIG. 4 represents a portion of the excavating equipment in longitudinal sectional view whereby a screw conveyor is used instead of the chain of earth buckets.

FIG. 5 is a plan view of FIG. 1.

FIG. 6 is an enlarged plan view of the front portion of the digging equipment showing the containing plates used in the embodiment of FIG. 1.

FIG. 7 is a plan view of the front portion of the digging equipment and the containing plates used in the embodiment of FIG. 4.

FIG. 8 is a vertical sectional view along lines VIII—VIII of FIG. 7 to show a containing lateral plate with its adjusting device for the leading edge thereof.



The equipment substantially consists, as shown in FIG. 1, of a digging unit **11** consisting of a series of buckets **12** or, as shown in FIG. 4, a helicoidal screw conveyor **13**. The buckets **12** are mounted about horizontal axes **14** and the screw **13** is mounted on a longitudinal axis **15**, said axes **14** or axis **15** being driven by an engine which may be for instance the engine of the tractor **16** provided for the advancement of the whole unit or any other conveniently placed engine.

The main characteristic of the invention consists in the fact that the series of excavating elements **12** or **13** is placed inclined with respect to the horizontal line, so as to create an excavating front, the inclination of which in the longitudinal direction of the trench is less than the settling angle of the ground, while laterally the vertical walls created by the digging are protected by lateral plates **17** acting as shields which are kept at a fixed distance by cross members or struts **18** so as to build a containing wall and therefore to eliminate any danger of slip of the ground into the trench.

An important characteristic of said vertical plates forming the shield is that their front edge **21'** turned towards the front **20** (FIG. 8) has the same slope as the series of excavating elements and therefore, as the trench is dug, the plates are situated far enough behind said excavating front so as to allow a partial lateral slip of the material in the region **19** (FIG. 6). Thus, the two plates or shields **17** which advance together with the excavating elements contact already loose material, which therefore offers only a minimum resistance to the advancement of the same.

The distance of the front edge **21'** from the trench front **20** may be conveniently varied, depending on the nature of the excavated material. To provide for this adjustment the two plates **17** are provided with additional plates **21** having slots **41** for sliding parallel to each other on pins **42** mounted on plates **17** and contacting the main plates **17** by means of an adjusting device composed of screws **22** passing through supporting flanges **23**. Depending on the width and height of the plate **17**, two or more adjusting screws **22** may be provided to effectuate the advancing or the backward movements of the additional plates **21** and therefore adjust the leading edge **21'** of the additional plates **21** relative to the plates **17** in the region **19** according to the nature of the ground. The leading edge **21'** is longitudinally adjusted the same distance at all positions of adjustment between the top and bottom of plates **17**. As clearly appears from FIG. 6 the sharp edge **21'** of the additional plates **21** penetrates into a mass of material **19**, which is in the process of sliding down and therefore is sufficiently loose to prevent a frictional resistance which would cause a useless waste of energy and would hinder the advancement of the machine. A concrete mixer **25** may be placed behind the plates **17** acting as shields. The hopper of said concrete mixer can pour its contents directly into the trench excavated by the machine. In this way it is possible to build a supporting wall for the excavated material. In the first embodiment shown by FIGS. 1, 2, 3, 5 and 6, the excavating unit consists of a chain of buckets **12**, while in the second embodiment, shown by FIGS. 4 and 7, said excavating unit consists of an inclined shaft **15** about which a screw conveyor **13** is secured. In the first embodiment the two lateral plates **17** are connected to the framework of the excavating unit in known manner, while in the second embodiment (FIGS. 4 and 7) the plates **17** are connected with the lower end **15'** of the shaft **15** by means of a semicircular frame **27** fixed with the thrust bearing (not shown) by members **28** surrounding the lower end **15'** of said shaft **15**. This semicircular frame **27** is connected by means of arms **43** connected with the lateral plates **17** through slots **44** in the additional plates **21**, so as to

allow the longitudinal displacement of the two additional plates **21** for the adjustment of the slipping region **19** and the further arrangement of allowing plates **17** and additional plates **21** to be raised and lowered with the excavating unit through the connection of arms **43** to plates **17**.

What I claim is:

A machine for dry-excavating deep trenches in sliding and loose ground material and providing a support for the lateral walls of the excavated trenches, comprising an excavating unit set at an inclination with respect to the horizontal less than the natural settling angle of the ground and loose material, two parallel lateral supporting plate means for supporting the sides of the excavated trench in the vicinity of said excavating unit consisting of main plates having longitudinally adjustable auxiliary plates mounted thereon which have leading edges inclined with respect to the trench line at an angle substantially equal to the angle of inclination of said excavating unit, means for maintaining said plate means a fixed distance apart one from the other, means for supporting said plate means from said excavating unit, adjusting means for slidably adjusting the leading edges of said auxiliary plates longitudinally relative to the main plates, the leading edges of said auxiliary plates and said main plates maintaining a parallel relationship at all positions of adjustment, said adjusting means consisting of flanges mounted at spaced intervals along said plate means and screws arranged in said flanges for longitudinally adjusting the leading edges of said auxiliary plates relative to said excavating unit to adjust the slipping region therebetween and thereby substantially decrease the frictional resistance of said plate means as said machine is advanced, and power means for operating and advancing the excavating unit and the plate means into the material to be excavated.

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