

Sept. 25, 1956

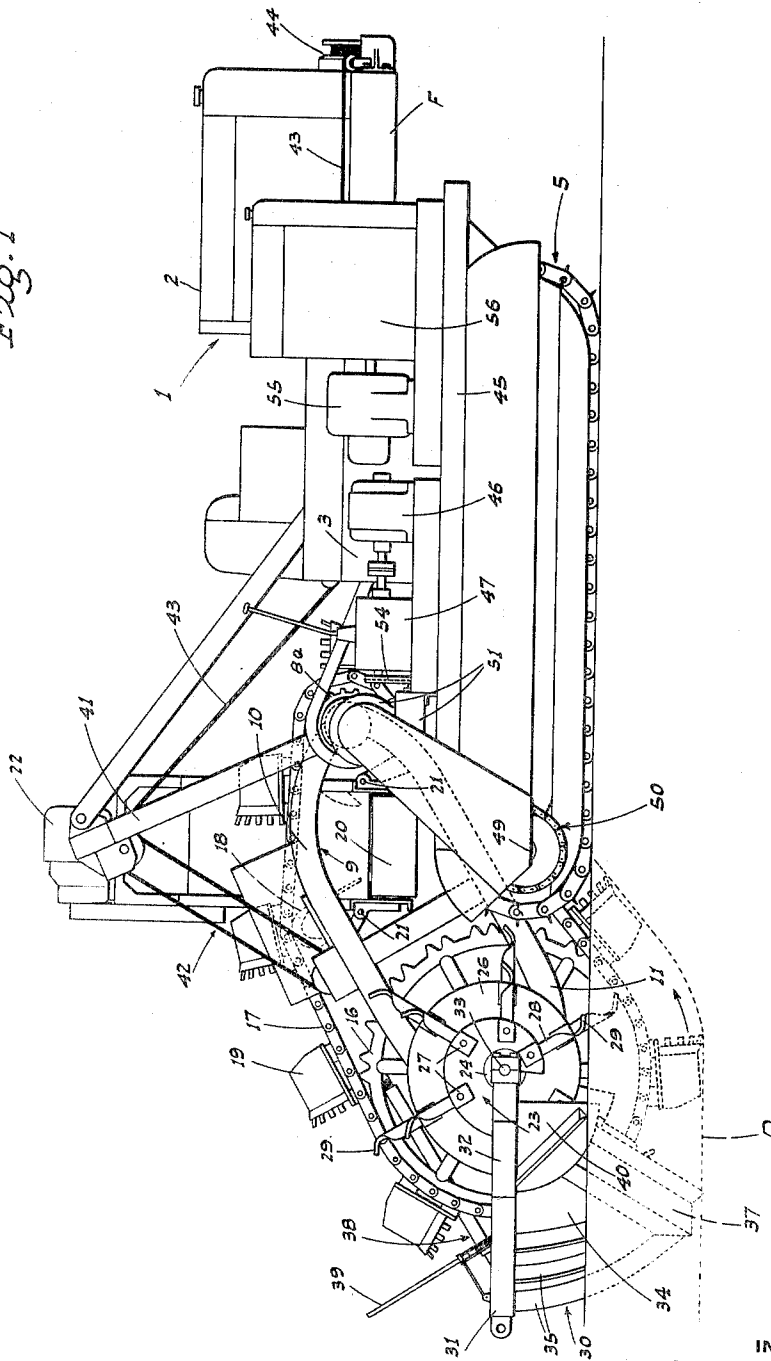
W. F. EARLEY
DITCH FORMING MACHINE

2,763,941

Filed July 23, 1954

3 Sheets-Sheet 1

Fig. 1



INVENTOR

Wilbur F. Earley

BY

Wm. W. Weller

ATTORNEYS

Sept. 25, 1956

W. F. EARLEY

2,763,941

DITCH FORMING MACHINE

Filed July 23, 1954

3 Sheets-Sheet 2

Fig. 4

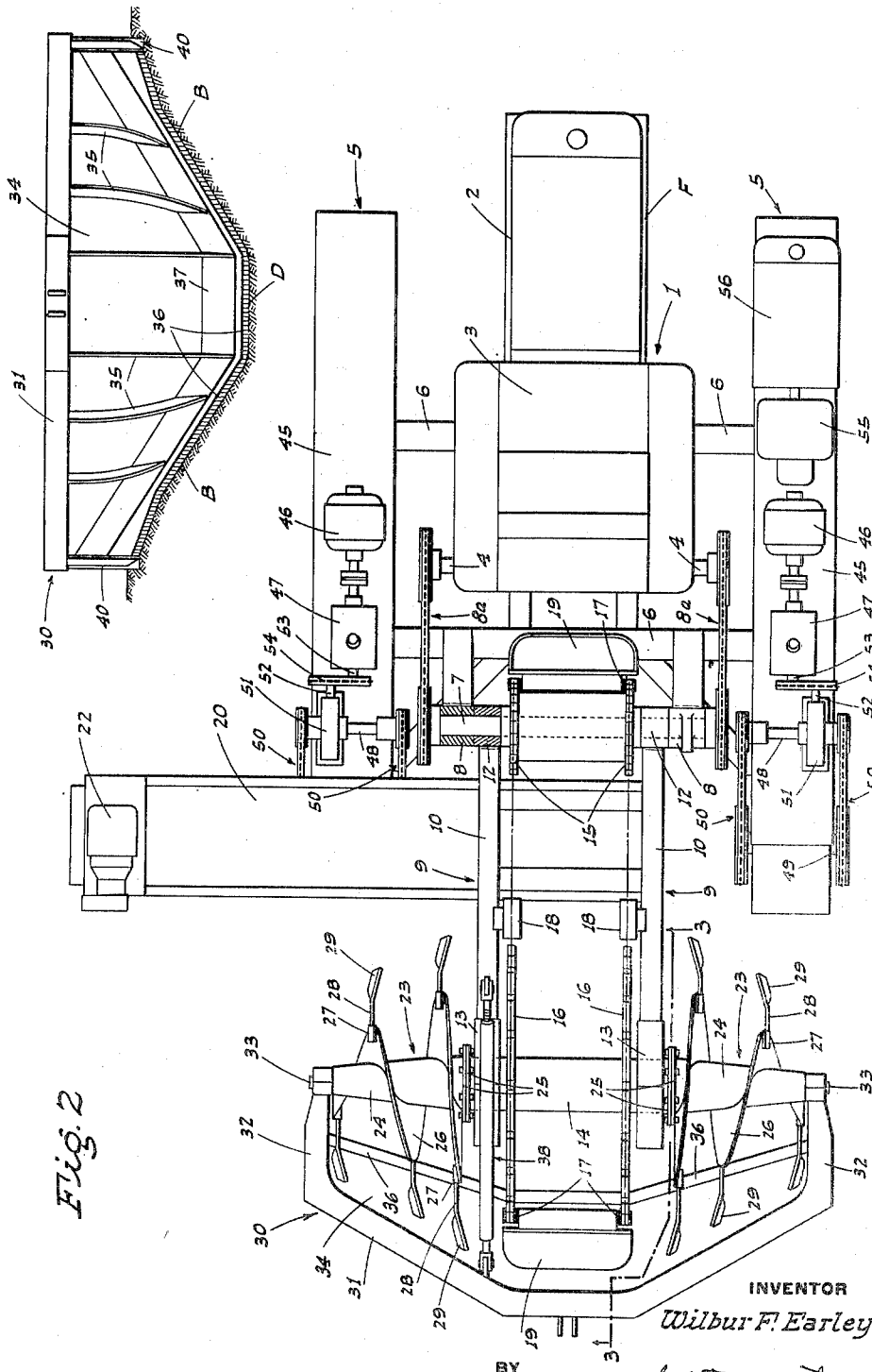
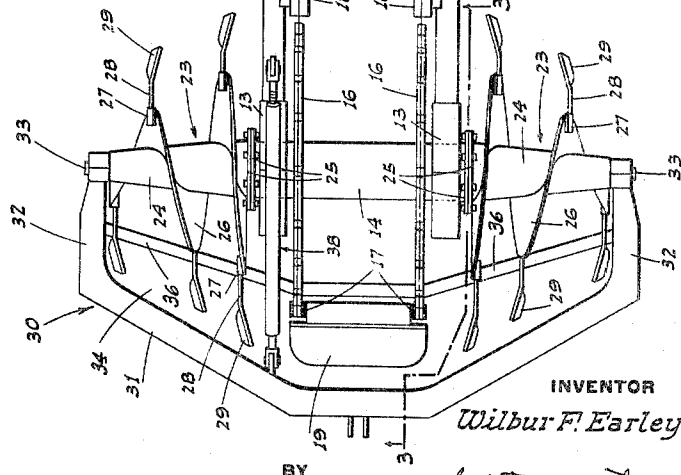


Fig. 2



INVENTOR

Wilbur F. Earley

BY

Attorneys

Sept. 25, 1956

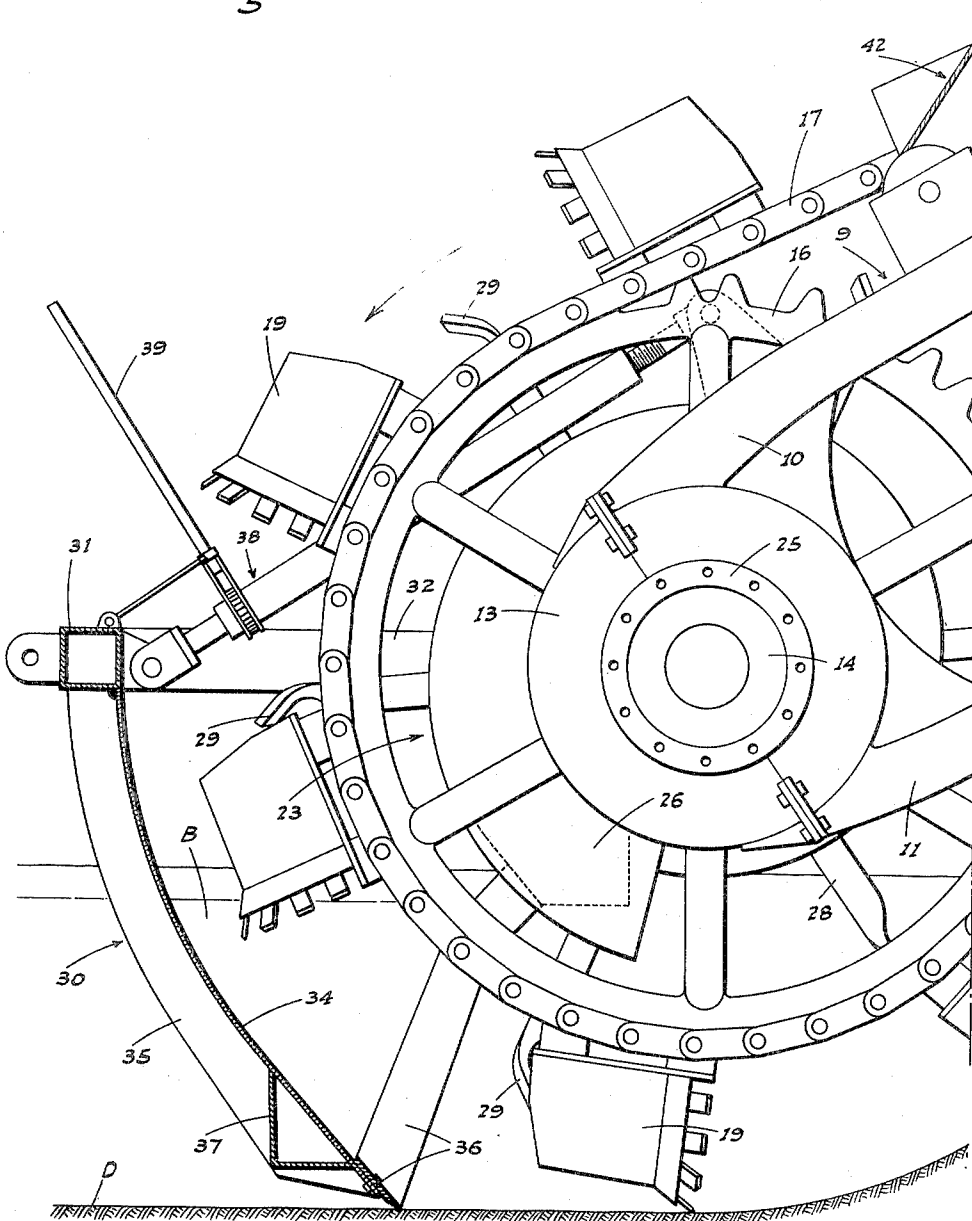
W. F. EARLEY
DITCH FORMING MACHINE

2,763,941

Filed July 23, 1954

3 Sheets-Sheet 3

Fig. 3



INVENTOR
Wilbur F. Earley
BY *Robert T. Webster*
ATTYS

1

2,763,941

DITCH FORMING MACHINE

Wilbur F. Earley, Stockton, Calif., assignor to Guntert & Zimmerman, Ltd., Stockton, Calif., a partnership

Application July 23, 1954, Serial No. 445,364

2 Claims. (Cl. 37--90)

This invention relates to ditch digging and forming machines; the major object of the invention being to provide a machine for the purpose by means of which a ditch having widely flaring sides will be dug and formed or sized to accurate dimensions with a single pass or operation of the machine. At the same time the machine is arranged so that if desired the flaring side forming elements of the machine may be removed, and the machine used to dig a relatively narrow straight side ditch instead of one with flaring sides.

The machine includes a row of relatively narrow digging buckets which dig and define the central portion of the ditch, and another object of the invention is to provide means whereby all the dirt which is cut to form the flaring sides will be deflected to the bottom of the ditch to be picked up and delivered to a lateral discharge conveyor by said buckets. In this manner, all the dirt as dug is discharged from the ditch onto a lateral conveyor much narrower than the width of the ditch.

The ditch digging structure is mounted as a unit with a tractor movable along the ground over the line of the ditch to be dug, and which tractor includes ground engaging traction elements. A further object of the invention, therefore, is to employ the power plant on the tractor to drive the digging structure, and independent power units to drive the traction elements. In this manner separate control of the speed of operation of the digging structure and of the traction elements may be more easily effected than would otherwise be the case, and the entire power of the power plant may be utilized to operate the digging structure without starving the traction elements and thus affecting the forward speed of the machine, and vice versa.

Still another object of the invention is to provide a practical, reliable, and durable ditch forming machine, and one which will be exceedingly effective for the purpose for which it is designed.

These objects are accomplished by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings:

Fig. 1 is a side elevation of the machine as in operating position.

Fig. 2 is a top plan view of the machine, somewhat diagrammatic and with certain parts omitted and others in section.

Fig. 3 is an enlarged fragmentary sectional elevation of the rear end of the digging structure, taken substantially on line 3--3 of Fig. 2.

Fig. 4 is a rear end elevation of the ditch shaping and dirt deflecting assembly, as disposed in the ditch.

Referring now more particularly to the drawings, and to the characters of reference marked thereon, the machine comprises a tractor, indicated generally at 1, which includes the usual housed power plant, indicated at 2, and a transmission housing 3 from both sides of which a driven transverse shaft 4 projects. The tractor also in-

2

cludes endless track units 5 of generally conventional form, and which are rigidly connected to the main tractor frame F by lateral frame beams 6.

The ditch digging structure is mounted on the tractor in the following manner:

Disposed a relatively short distance rearwardly of and above the shaft 4 is a cross shaft 7 journaled adjacent its ends in bearings 8 supported from the rearmost cross beams 6 and connected at its ends to shaft 4 by chain drive units 8a.

Disposed between the bearings 8, and extending rearwardly therefrom, are rigidly connected swing frame members 9, each of which includes an upper beam 10 and a lower beam 11. The beams of each member converge at their ends to rigid connection with a front end hub 12 turnable on shaft 7, and with a rear end hub 13 in which an enlarged tubular shaft 14 is turnable.

Transversely spaced drive sprockets 15 are fixed on the shaft 7 between hubs 12, and similarly spaced, enlarged sprockets 16 are fixed on shaft 14; endless chains 17 extending about and between sprockets 15 and 16. The lower run of the chains extends straight between the sprockets, but the upper run is caused to deviate upwardly intermediate its ends, to give more clearance between the runs near their forward end, by idler rollers 18 mounted on beams 10 intermediate their ends and over which idler rollers the chains are trained, as shown in Fig. 1.

A series of toothed digging buckets 19 are mounted on and span the distance between the chains outwardly of the same; the buckets being open at the end thereof facing in the direction of rotation of the sprockets, which is such that the lower run of the chains moves upwardly and forwardly.

The filled buckets, as soon as they move upwardly about the front sprockets 15, face rearwardly and discharge onto the lower end of a transverse discharge conveyor 20. This conveyor is supported by swing frame 9 under and from the upper beams 10 thereof, as shown at 21 in Fig. 1, and extends laterally thence at an upward angle to an outer end termination well clear of the adjacent side edge of the ditch, as indicated in Fig. 2. The conveyor is driven at its outer end by an electric motor 22 supported by said conveyor, and current for which is supplied by the generator of the tractor.

Since the conveyor is thus a self-contained unit, which does not require any gear or chain drive connections with the tractor, the mounting means may easily be arranged so that the conveyor may be projected from either side of the swing frame 9, as operating conditions may determine to be the best.

Normally included with the central digging assembly above described are side-bank cutter assemblies 23, one on each side of the central assembly. Each such assembly comprises an enlarged, central, outwardly tapering shaft 24 aligned with, and projecting laterally out from, shaft 14. Shafts 14 and 24 are provided, at their adjacent ends, with enlarged matching flanges 25 detachably bolted together as shown in Fig. 2; these flanges being outwardly of, but close to, the adjacent hub 13.

Secured on shaft 24, and extending continuously from end to end thereof, is a helical vane 26, preferably making two full turns about the shaft and diminishing or tapering in size from its inner to its outer end. The angle of taper is substantially the same as the angle of slope desired for the side banks B of the ditch D to be dug, as illustrated in Fig. 4. Sockets 27 are secured on the vane adjacent its periphery at suitably spaced points in the length thereof; the shanks 28 of suitable ground digging or scraping tools 29, whose working edges slope according to the slope desired for the side banks B, being adjustably and removably mounted in the sockets.

The use of a single helical vane extending along the shaft provides a simple and convenient means for mounting any desired number of cutters in spaced relation axially of the shaft, so that practically the entire area of the ground which is being dug to form the sloping bank B will be engaged and acted on by one or another of the cutters as the cutting assembly rotates.

The taper of the vanes enables all the tool shanks to be of a common length for a predetermined side bank slope and thus interchangeable with each other, while at the same time the shanks being adjustable in the sockets, enables the tools to be set to give a variation in the contour or angularity of the side bank. The assemblies 23 being readily removed, enables other assemblies with a different vane angularity to be substituted therefor, or such assemblies to be omitted entirely if it is desired to dig a narrow rectangular sided ditch.

Removably mounted in connection with the digging structure as a whole, and as above described, is what I term a scraper moldboard assembly 30, which is arranged to not only accurately shape the ditch as dug by the buckets and side bank cutters, but to also deflect the dirt cut by said side bank cutters into the path of movement of the buckets, so that the buckets convey all the dirt to the discharge conveyor.

The assembly 30 comprises a top transverse frame beam 31 substantially horizontal when the digging structure is in digging position, and including short, forwardly projecting arms 32 at the sides pivotally and removably mounted on the outer-end trunnions 33 of shafts 24. The beam as a whole thus extends radially of the digging structure, and its inner edge is spaced from—while being generally parallel to—the path of movement of the buckets and the cutters 29.

A plate 34, braced by depending back ribs 35, depends from and follows the contour of the inner edge of the beam 31, and is also formed so as to be concentric with the axis of the mounting shafts 14 and 24 of the digging structure as shown in Fig. 3.

The lower edge of the plate is spaced above the desired bottom and side face of the ditch a short distance; a scraping and shaping blade unit 36 being secured to the inner face of the plate to engage and shape the cut or dug ground to an accurate grade. A stiffening beam 37 is secured against the back face of plate 34 adjacent its lower edge and extends from end to end thereof; the ribs 35 depending and being secured to said beam 37.

In order to maintain the moldboard assembly 30 rigid with the swing frame 9 and so that the blade 36 may be accurately set to position, a detachable, heavy-duty turnbuckle 38 extends between beam 31 and the top beam 10 of one of the swing frames near its rear end; a lever and ratchet unit 39 being mounted in permanent connection with the outer member of the turnbuckle adjacent its lower end, so that the setting of the turnbuckle may be easily effected.

By reason of the specific form and construction of the moldboard assembly, as above described, not only is the ditch accurately and cleanly shaped as the digging progresses, but the dirt is roughly cut away by the cutters 29 is deflected to the central bottom portion of the ditch in position to be engaged and scraped up by the buckets. The ditch behind the moldboard assembly is therefore in a smooth and clean condition, ready for the application of the cement lining with which the ditch is placed in condition for use.

By reason of the moldboard assembly being pivoted on the trunnions 33, which are coaxial with the various digging members, adjustment of the assembly does not affect the symmetrical arrangement of said assembly relative to the cutting members, and all parts maintain their predetermined relationship to each other, permitting of a very accurate setting of the assembly relative to the digging members.

The fact that the plate 34 and blade unit 36 are rela-

tively close to the path of rotation of the tools 29 and slope forwardly, as shown in Fig. 2, enables the machine to form a ditch having a longitudinal or horizontal curvature without the plate digging into the curve of the ditch on one side or the other. The top beam 31, while being above the level of the top of the ditch has a corresponding forward slope on its side portions, so as to provide for the convenient shaping of the depending plate 34.

In addition to the plate 34 and blade unit 36, the side beam 31 supports depending, straight side skirts 40, depending from the beam arms 32, which skirts are disposed just laterally out from and overlap the plate 34 at its side edges. The skirts at their lower edge cut into the ground to the level of the adjacent ends of the transverse blade unit 36, and define the top side edges of the ditch, as indicated in Fig. 4.

The digging structure, together with the moldboard assembly mounted thereon, is raised from an operating, below-ground position to a position clear of the ground for transport by means of an A-frame 41 mounted on the tractor and overhanging the digging structure at its forward pivoted end.

Block and tackle units 42 extend between the A-frame and the top beams 10 of swing frames 9 intermediate the ends thereof; a control or actuating cable 43 extending forwardly from units 42 to the power control unit 44 of the tractor, as indicated in Fig. 1.

The machine is propelled along the ground by power means independent of the power plant 2 by the following means:

Mounted on top of each endless track unit 5 is a rigid platform 45 on which an electric motor 46 is mounted. The motor drives a manually controlled transmission 47 also mounted on the platform. A transverse shaft 48 mounted on the platform is connected at both ends to the shaft 49 of the rear sprocket of the endless track unit by endless chain and sprocket units 50, as shown in Fig. 2. A housed worm and gear unit 51 of conventional type is connected to shaft 48 and includes an input shaft 52 parallel to the output shaft 53 of the transmission 47. Shafts 52 and 53 are connected in driving relation with each other by an endless chain and sprocket unit 54.

Mounted on the platform 45 of one of the endless track units is an electric generator 55 driven by a housed internal combustion engine unit 56 mounted on the platform. The generator is of sufficient capacity to feed both motors 46; the wiring and control elements between the generator and motors being omitted from the showing since they may be of any conventional type and form no part of this invention.

By employing such a means to drive the endless track units, the speed of operation of the digging mechanism and the speed of advancing movement of the machine along the ground may be separately controlled, without any relatively complicated drive connections between a single power plant and the tracks and digging structure being necessary, and without the possibility of starving one driven mechanism at the expense of the other.

From the foregoing description it will be readily seen that there has been produced such a device as will substantially fulfill the objects of the invention, as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described the invention, the following is claimed as new and useful, and upon which Letters Patent are desired:

1. A machine for digging a ditch having a bottom portion and sides sloping upwardly from the bottom portion, said machine comprising a frame movable along the ground, and a driven digging structure mounted on

the frame in trailing relation; said structure including buckets to dig the bottom portion of the ditch, a rotary driven shaft at the rear end of the structure, and extensions projecting laterally out from the ends of the shaft arranged to dig and generally shape the sloping side walls of the ditch; each extension comprising a shaft portion coaxial with the shaft, a vane secured on the shaft portion and extending helically along the same, cutting tools supported at intervals from the vane and extending substantially radially out from said shaft portion, with the outer ends of the tools different distances from the axis of the shaft portion to conform to the predetermined slope of the side walls of the ditch; and means mounting the tools on the vane for removal or adjustment radially of the vane.

2. A machine, as in claim 1, in which said tool mounting means includes, with shanks on the tools, sockets on the vanes adjacent the periphery thereof in which the shanks slidably fit.

5

10

15

20

336,183
1,239,474
1,347,860
1,407,969
1,472,562
1,477,940
1,519,897
1,762,569
1,863,504
2,539,689
2,617,314
2,627,681
2,631,718
2,686,981

153,071
693,725

References Cited in the file of this patent

UNITED STATES PATENTS

Warrick	Feb. 16, 1886
French	Sept. 11, 1917
Krupp	July 27, 1920
Wickersham	Feb. 28, 1922
Knight	Oct. 30, 1923
Brown	Dec. 18, 1923
Asplund	Dec. 16, 1924
Barber	June 10, 1930
Schmid	June 14, 1932
Bobrowski	Jan. 30, 1951
Everett	Nov. 11, 1952
Diotti	Feb. 10, 1953
Rinehart	Mar. 17, 1953
Vaughn	Aug. 24, 1954

FOREIGN PATENTS

Australia	Sept. 2, 1953
Great Britain	July 8, 1953