Title: SAFEWAY DEEP UTILITY DITCH CLEANING MACHINE

Abstract: A ditch cleaning apparatus (10) is formed by a prime mover (18) driving a chassis (12) having endless metal belts (20) for moving along the bottom (74) of a vertical wall ditch and supporting an upright frame (14) having a rearwardly and upwardly inclined elevator (16) depositing debris on a first horizontal conveyor discharging debris laterally of a ditch position. A second horizontal conveyor (68), supported by the frame (14) above the chassis (12), receives loose soil from the elevating conveyor (16) for deposit on the ditch bottom rearwardly on the chassis. Sweep wings (84) extend rearwardly in diverging relation from the depending forward end of the elevating conveyor (16) to guide debris toward the entrance end of the elevating conveyor. An operator position (62) in the frame, above the upper limit of a ditch to be cleaned, is provided with controls (102) for moving the machine (10) and its several operating components in a ditch cleaning action.
SAFEWAY DEEP UTILITY DITCH CLEANING MACHINE

Technical Field

This invention relates to ditch cleaning machines, and more particularly to a ditch cleaning apparatus for cleaning debris from the bottom of a deep utility ditch. Municipal lines are buried in relatively deep vertical wall ditches. In many locations the soil in these ditches is unstable as a result of sand or other formations tending to allow the walls of the ditch to cave in. Since these ditch walls are some several feet above the height of workmen it creates a dangerous endeavor since utility contractors heretofore must rely on workmen entering such ditches to clean debris therefrom before installing a line. This invention overcomes this problem by providing a ditch cleaning apparatus which may be lowered by a boom into a ditch and moved therealong by an operator seated in the apparatus near or above the upper limit of the soil in which the ditch is formed and out of harms way in the event of a cave in. The apparatus is self propelled and moves longitudinally in a ditch to pick up debris from the bottom thereof and move it laterally of the ditch walls by deposit on the surface of the earth or in a suitable receptacle traveling with the debris removing apparatus.

Background Art

United States patent no. 4,872,275 issued October 10, 1989 to Beckett for Ditch Cleaning Machine discloses a machine which comprises a frame supported by a pair of inline forward and rearward wheels moving longitudinally
in a ditch. The frame is supported against lateral tilting
by outrigger wheels. The machine includes a pair of
downward converging rotors cleaning the sides of upwardly
diverging walls of an irrigation ditch, or the like, by
elevating debris to a transversely disposed conveyor
depositing the debris at a selected side of the ditch.

United States patent no. 1,241,880 issued October 2,
1917 to Penington for Stone Gatherer and United States
patent no. 2,640,306 issued June 2, 1953 to Dietl for Stone
Gathering Machine are believed to represent the further
state-of-the-art. Both of these patents disclose a mobile
frame having apparatus driving an elevator conveyor
depositing gathered debris on a laterally projecting
horizontal conveyor for depositing the debris in a recepta-
cle moving with the frame or stone gathering machine.

This invention is believed distinctive over the
above and other patents by providing a prime mover driving
endless metal belts which are laterally moveable to
compliment the width of the bottom surface of a vertical
wall ditch and move longitudinally of the ditch throughout
its length while supporting an upright frame having a
rearwardly and upwardly inclined elevator depositing debris
on an elevated horizontal laterally extending conveyor.
An operator’s position in the frame above the upper limit
of a ditch is provided with controls for moving the
apparatus and operating its several components.

Disclosure of the Invention

A self propelled ditch bottom cleaning apparatus is
formed by a chassis supporting an upright frame and having
pairs of sprocket wheels driving pairs of endless metal
belts. The wheel and belt assemblies are pivotally
connected with a central frame support panel for lateral
spaced-apart adjustment in accordance with the width of the
ditch bottom and are driven by an engine mounted in the
frame. An elevating conveyor extends rearwardly and
upwardly into the frame for depositing screened soil as
pipe supporting berms on the ditch bottom and depositing
debris on a laterally projecting horizontal conveyor
1 discharging debris above the surface of the earth laterally
2 of the position of the apparatus as it moves forwardly.
3 Wing members at the forward end of the elevating conveyor
4 converge rearwardly toward the entrance of the elevating
5 conveyor and are controlled by the operator for diverting
6 debris into the elevating conveyor.

    Brief Description of the Drawings
  Figure 1 is an isometric view of the apparatus;
  Figure 2 is a front elevational view;
  Figure 3 is a rear elevational view; and,
  Figure 4 is a top view of the chassis illustrating
  width adjustment by broken lines.

    Best Mode for Carrying Out the Invention
  The reference numeral 10 indicates the apparatus as
  a whole comprising a chassis 12, including track means 20
  connected with opposite sides of a chassis support panel
  36 supporting an upstanding open framework means 14,
  conveyor means 16, 68 and 86 supported by the frame, and
  prime mover means 18 for driving the chassis and other
  components.
  The chassis means 12 includes pairs of laterally
  spaced front and rearward sprocket wheels 22 and 24,
  respectively having a stub axle 29, for driving the track
  means 20 in tractor fashion. The track means 20 comprises
  a pair of endless metal belts extending around the respec-
  tive inline front and rearward sprocket wheels 22 and 24.
  An elongated wheel beam 26, only one being shown, extends
  longitudinally between the lateral outward side of respec-
  tive inline forward and rearward wheels 22 and 24, on each
  side of the machine, and is connected, at its respective
  ends, with the axle 29 of each pair of wheels 22 and 24 by
  pillow block bearings 28 journaling the lateral end portion
  of the axles 29 of the respective pair of wheels 22 and 24.
  A series of rollers 30, only one example shown, depend from
  the beam 26 to further support the mass of the apparatus
  on the inward surface of the respective track 20. Simi-
  larly a roller 32 on a support 33 underlies the upper
  section of the respective track 20 in the fore-to-aft
1 spacing between the pairs of wheels 22 and 24.
2 A hydraulic motor 34 (Fig. 4) mounted on the inward
3 end of the respective wheel axle 29 drives the chassis 12
4 as presently explained. The chassis means 12 includes a
5 vertical panel 36, of selected width and thickness, which
6 centrally extends longitudinally edgewise substantially
7 equidistant with the spacing between the forward and
8 rearward limits of the track means 20. Forward and
9 rearward pairs of struts 40 (Fig. 4) extend laterally
10 between and are pivotly connected, respectively, with the
11 chassis panel 36 and the beams 26. Two pairs of hydraulic
12 cylinders 42 are respectively pivotly connected at one end
13 on opposite sides of the panel 36 and are pivotly connected
14 by rod end portions with the pairs of struts 40 for
15 positioning the endless track means 20 adjacent opposite
16 sides of the panel 36 as illustrated by dashed lines (Fig.
17 4) or in an expanded lateral position as illustrated by
18 solid lines. The endless tracks may be expanded from a
19 minimum spacing position between opposite outer limits of
20 7.9 cm to 4.4 M.
21 The frame means 14 includes a horizontal rectangular
22 base frame 44 having right and left side members 46 and 47,
23 interconnected by end members 48 and 49 and an intermediate
24 member 50 which longitudinally centrally overlies the
25 chassis support panel 36. A plurality of pairs of frame
26 stabilizers 51 and 52 (Fig. 3) are rigidly connected with
27 the respective frame side members 46 and 47 and respective
28 opposite sides of the panel 36 to maintain the frame means
29 14 vertically upright.
30 Forward and rearward pairs of frame standards 54, 55
31 and 56, 57 respectively extend upright a selected distance
32 from the lateral limits of the forward and rearward ends
33 of the base frame 44. Similarly an intermediate pair of
34 frame standards 58 and 59 project upwardly from an interme-
35 diate position of the base frame 44. Right and left
36 horizontal rails 60 and 61 are connected at rearward end
37 portions to the respective one of the pair of intermediate
38 standards 58 and 59 and project forwardly beyond the
1 forward pair of frame standards 54, 55 a selected distance
2 and form the base portion of an operator's cage 62 over-
3 hanging the forward end portion of the chassis. Forward
4 cage frame standards 64 and 65 project upwardly from the
5 forward end portion of the rails 60 and 61, respectively,
6 equidistant with respect to the upper limit of the frame
7 forward standards 54, 55 and intermediate standards 58, 59.
8 The upper end portions of the frame standards 54, 55 and
9 58, 59 and cage standards 64, 65 are interconnected by cross
10 members and a pair of top rails 66, 67 to substantially
11 complete the frame means 14.
12 The conveyor means 16 includes an upwardly and
13 rearwardly inclined trough 70 having upstanding sidewalls
14 72 and 73. The trough 70 extends from adjacent the ditch
15 bottom 74 between the pairs of frame standards 54, 55 and
16 terminates at a position, between the pair of frame
17 standards 58 and 59, above the horizontal plane of the cage
18 rails 60 and 61. The conveyor trough sidewalls 72 and 73
19 support a pair of forward sprocket wheels 76 on a trans-
20 verse axle 77 and a pair of sprocket wheels 78 at the
21 rearward upper end on an axle 79. A pair of endless chains
22 80 extend between and are supported by a portion of the
23 periphery of the respective cooperating sprockets 76 and
24 78 and are driven by a hydraulic motor 82 connected with
25 the axle 79. A pair of pressure cylinders 83 (Figs. 1 and
26 4) on the forward end portion of the panel 36 are connected
27 with the depending end portion of the trough 70 to support
28 the latter adjacent the ditch bottom surface.
29 A pair of debris sweeping wings 84 are hingedly
30 connected, for horizontal pivoting movement about vertical
31 axes, with a respective forward limit of the trough sides
32 72 and 73. A pair of pressure cylinders 85, only one being
33 shown, are connected between the respective trough sidewall
34 72 and 73 and the respective wing 84 for moving the later
35 in a lateral direction in accordance with the width of the
36 ditch being cleaned to guide soil, rocks and other debris,
37 not shown, into the forward end of the trough 70. Conveyor
38 cross bars 81 engage loose soil, rocks and other debris and
moves it upwardly along the bottom of the trough 70. The upper substantially one third the length of the trough bottom is formed from screen material 63, of selected mesh, (Fig.2) permitting loose soil (not shown) to fall by gravity to a central horizontal, forward-to-rearward, conveyer 68 driven by a hydraulic motor 69, which deposits the loose soil in a rearward receptacle 71, pivoted to empty by a reversible hydraulic motor 75. The receptacle is periodically emptied on the ditch bottom rearwardly of the apparatus 10 to form spaced-apart pipe supporting berms, not shown. Other debris discharged from the conveyer trough 70 falls by gravity on a horizontally disposed conveyer means 86 transversely disposed in the rearward portion of the frame means 14 and projecting at its respective ends, beyond lateral limits of the frame means.

The horizontal conveyer means 86 comprises an endless belt 88 extending around cylinders 90 at respective ends of the conveyer 86 and driven by a hydraulic motor 89 connected with a cylinder 92. The cylinders have axles 91 and 93 which are journaled by elongated conveyer side supports 94 and 95 in turn supported by the frame standards 56, 57 and 58, 59.

A debris deflecting panel 96, supported by the frame standards 56 and 57, opposite the discharge end of the conveyer trough 70 deflects debris to the surface of the transverse conveyer belt 88. Transverse rollers 97 interposed between the belt 88 and the upper surface of the support members 94, 95 support the mass of the debris deposited on the transverse conveyer means 86.

The prime mover means 18 includes a motor 98 supported by the base frame 44 between the intermediate and rearward frame standards 58, 59 and 56, 57, respectively, and supplied by fuel from a tank 100. The motor 98 drives a hydraulic pump P supplying hydraulic fluid pressure to the respective hydraulic motors 34 driving the chassis wheels, conveyors and pressure cylinders, through control valves, not shown, on a control panel 102 mounted in the operator's
1 cage 62. An operator’s chair 104 is mounted in the
2 operator’s cage and supported by the frame forward stan-
3 dards 54,55. Expanded metal 106 forms a floor between the
4 rails 60,61 and a wall between the frame standards 54,55
5 behind the seat 104.
6 The frame means 14 is further provided with a
7 lifting eye 108 on its upper limit, substantially above the
8 center of gravity so that a crane or the like, not shown,
9 may lift the apparatus 10 into and out of a ditch.
10
11 Industrial Application
12 In operation, assuming the apparatus 10 is within a
13 ditch to be cleaned, the operator seated in the operator’s
14 cage 62 starts the motor 98 which powers up the hydraulic
15 system. By using the controls of the control panel 102
16 the track members 20 move the device 10 in a forward
17 direction. The depending end of the conveyor 16 is
18 disposed adjacent the ditch bottom surface 74. The sweep
19 wings 84 are adjusted to position the forward vertical
20 edges in selected spaced relation with respect to the ditch
21 sidewalks. As the device moves in a forward direction
22 rocks and other debris, not shown, are moved by the wings
23 84 toward the entrance of the conveyor 16 to be picked up
24 by the cross bars 81 and moved up the conveyor through 70.
25 Loose soil falls on the conveyor 68 and other debris is
26 deposited, by gravity, on the endless conveyor belt 88 and
27 moved to a position laterally of the position of the ditch
28 and apparatus, completing one cycle of operation.
29 It is believed obvious the apparatus may be employed
30 to remove debris from other soil, such as beach sand.
31 Obviously the invention is susceptible to changes or
32 alterations without defeating its practicability. There-
33 fore, we do not wish to be confined to the preferred
34 embodiments shown in the drawings and described herein.
Claims

1. A ditch cleaning machine (10), comprising:
   2 a prime mover (18) driving chassis means (12) including a
   3 vertical support panel (36) and laterally spaced forward
   4 and rearward pairs of sprocket wheels (22,24) journaled by
   5 stub axles (29) at respective ends of a pair of wheel beams
   6 (26) secured to opposite sides of the support panel (36)
   7 for respectively driving endless metal belts (20) and
   8 longitudinally moving the chassis on a ditch bottom surface
   9 (74); upright frame means (14) supported by the chassis
   10 means (12) and extending a predetermined distance above the
   11 upper limit of a ditch to be cleaned; an operator station
   12 (62) adjacent the upper limit of the frame (14); elevating
   13 conveyor means (16) including a debris receiving trough
   14 (70) inclined rearwardly and upwardly a selected distance
   15 from the lowermost forward portion of said chassis into
   16 said frame means (14) for moving debris through said trough
   17 during forward movement of said chassis, said trough (70)
   18 having upstanding side walls (72,73) and having a flat
   19 bottom terminating, adjacent the upper limit thereof, in
   20 a screen bottom for separating loose soil from other
   21 debris; horizontal belt conveyor means (86) transversely
   22 supported by and projecting, at respective end portions,
   23 beyond opposite side limits of said frame means for
   24 discharging debris, falling by gravity from the uppermost
   25 end of said trough, laterally of said frame means;
   26 other horizontal belt conveyor means (68) longitudinally
   27 supported by said frame above said chassis (12) for
28 discharging soil, falling by gravity from the screen bottom
29 portion of said trough (70), rearwardly of said chassis
30 (12); and, sweep means (84) pivotally secured to the
31 forward end portion of said trough side walls for horizon-
32 tal pivoting movement about vertical axes and guiding soil
33 and debris toward the elevating conveyor means.
1 2. The machine according to claim 1 and further
2 including: receptacle means (71) supported by said frame
3 means adjacent the rearward limit of said other conveyor
4 means (68) for receiving soil discharged from said other
5 conveyor means and periodically dumping said soil on the
6 ditch bottom (74).
1 3. The apparatus according to claim 1 and further
2 including: a hydraulic system including a hydraulic pump;
3 hydraulic motor means (34, 69, 89) for driving the respective
4 wheel and said elevating (16) and horizontal (68, 86)
5 conveyor means; and, pressure cylinder means (83, 85) for
6 adjusting the position of said elevating conveyor (16) and
7 said sweep means (84) relative to the surface of a ditch
8 bottom (74).
1 4. The apparatus according to claim 2 in which said
2 chassis includes: struts (40) extending horizontally
3 between and pivotally connected at their respective ends
4 with said support panel (36) and said wheel beams (26);
5 and, other pressure cylinder means (42) extending between
6 said support panel (36) and said struts (40) for adjusting
7 the spacing between said endless metal belts (20).
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
   IPC(7) :E02F 5/00; E01H 1/02
   US CL :37/352; 15/3
   According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
   Minimum documentation searched (classification system followed by classification symbols)
   U.S. : 37/91, 92, 93, 94, 95, 96, 97, 189, 363, 347, 352; 15/3, 80, 93.3
   Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
   
   Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
   WEST, EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>US 5,027,534 A (SACKETT) 02 July 1991, see entire document.</td>
<td>1-4</td>
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<tr>
<td>A</td>
<td>US 5,003,712 A (MITCHELL) 02 April 1991, see entire document.</td>
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<td>US 4,848,068 A (STAFFANSON) 18 July 1989, see entire document.</td>
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<td>A</td>
<td>US 4,109,336 A (FORD) 29 August 1978, see entire document.</td>
<td>1-4</td>
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Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search
24 MAY 2001

Date of mailing of the international search report
20 JUN 2001

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