This invention relates to surfacing machines for trapezoidal canals, whether the machine be for working the soil surface or for applying a lining to the canal surfaces.

Prior canal lining machines conventionally have been formed in a rigid cross-sectional configuration, the various dimensions and angles of the canal cross-section varying from one project to another. This required the machining of new machines for each particular project to the desired specifications. Prior machines utilized tracks along the side of the canal ditch for support of the machine as it travelled along the length of the canal. Subsequent machines have been mounted on crawler tracks to eliminate the temporary placement of tracks along the length of the canal. Some of these machines have been self-lifting, normally by linkages connected from the side of a rigid surfacing machine frame to the supporting crawler track assemblies. The present invention is designed to simplify the structure of such a machine and to make the structure more flexible so that it can be utilized on canals having varying degrees of slope at their side surfaces. The machine also is self-lifting so that it can be raised from a canal and moved to a new location under its own power.

It is a first object of this invention to provide an adjustable self-lifting surfacing machine that is capable of operations along the bottom and sloped sides of a canal as it travels along the length thereof.

Another object of this invention is to provide a machine that can be made in a larger size than conventional rigid frame machines so as to accommodate wide modern canal projects.

These and further objects will be evident from a study of the following disclosure, taken together with the accompanying drawings which illustrate one preferred form of the invention. It is to be understood that this form of the invention is not intended to limit or restrict the scope of the invention, which is set out in the claims that follow.

In the drawings:

FIGURE 1 is a front view of the machine as it operated along a canal, the canal configuration being shown in cross-section;

FIGURE 2 is a front view of the machine in its lifted position while travelling along a level surface;

FIGURE 3 is a top view of the apparatus as shown in FIGURE 1;

FIGURE 4 is an enlarged cross-sectional view taken along line 4-4 in FIGURE 1; and

FIGURE 5 is an end view taken from the left in FIGURE 2 at an enlarged scale.

The apparatus shown in the accompanying drawings generally illustrates a canal trimmer having rotating augers and digger wheels to remove several inches of soil from the surfaces of a canal ditch that has been excavated. This disclosure is not primarily concerned with the structure of the trimming mechanism, but rather with the supporting framework and apparatus for the surfacing equipment. It is to be understood that the present invention is equally applicable to any type of surfacing machine for canals of this nature. Such machines include excavators, trimmers, lining machines or slipforms, and various finishing machines for the canal surfaces. The trimmer apparatus illustrated is only exemplary and for this reason, much of the detail of this equipment itself has been omitted from the disclosure.

As shown in the drawings, the apparatus includes a central rigid frame structure generally designated by numeral 10. The frame 10 includes transversely directed triangular trusses 12 that are rigidly mounted on the basic frame structure 10. At the bottom of frame 10 is surfacing equipment including a bottom auger 13 having a rear screw 11. At each end of the auger 13 are digging wheel assemblies 14. The auger 13 is designed to move soil to the digging wheel assemblies 14, which elevate loose soil contacted thereby and spill this soil on conveyors 31, as will be described below.

Extending outwardly from the digging wheel assemblies 14 are side augers 15 that extend along the sloped sides of the canal walls. The side augers 15 are pivotally mounted on the frame 10 so as to be moveable about an axis parallel to the intended direction of movement of the frame 10 along the length of a canal. As seen, the upper end of each auger 15 is carried in a pivot bearing 16 mounted on a crawler track unit 17 by means of a rigid bracket 18. Therefore, each auger 15 can be swung in a vertical direction about its lower pivot and is free to accommodate any particular angle as defined by the relative positions of the frame 10 and the crawler track unit 17.

Extending outwardly from frame 10 along the augers 15 are front and rear parallel arm assemblies 20, 21. Each assembly of parallel arms includes both upper and lower arms pivoted at their respective ends to the frame 10 and to the conventional crawler track unit 17. Therefore, the angle of the crawler track units 17 will remain constant relative to the frame 10 due to the connection of these parallelogram arms. For stability, it will be noted that the parallel arm assemblies 20, 21 diverge outwardly from the frame 10 (FIGURE 4).

The relative positions of the crawler track unit 17 and frame 10 are controlled by means of powered extensible elements extending outwardly from the apex of the triangular braces 12 to the crawler track units 17. These extensible units include two telescoping rigid elements.

An inner member 22 is pivotally connected at its outer end to the crawler track unit 17. An outer member 23 is pivotally connected at its inner end to the triangular braces 12. The inner member 22 is free to move longitudinally relative to the outer member 23.

The relative positions of the members 22 and 23 can be controlled in any desired manner. As an illustration, a simple winch assembly is shown. This includes a pair of pulleys 25 mounted on a center shaft 24 at the top of the triangular braces 12. Each pulley 25 has a cable 26 passing over it and about a guide pulley 27 at the outer end of the member 23. The cable 26 is anchored at its outer end to the inner end of the member 22, inside the member 23. The remaining end of the cable 26 is wrapped about a winch assembly shown generally as 30.

It can be seen that when the cables 26 are pulled by the winches 30, the inner members 22 will be forced outwardly of the outer member 23, and the extensible elements will therefore cause the frame 10 relative to the crawler track units 17 as seen in FIGURE 2. Likewise, when cables 26 are played out from winches 30, the weight of the frame 10 will cause the frame 10 to be lowered relative to the crawler track units 17 to attain the position shown in FIGURE 1, or whatever position might be desired due to the particular canal cross-sectional configuration.
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For illustrative purposes, a pair of short feed conveyors 31 are shown leading from the digging wheel assemblies 14 to the rear central portion of the machine. These conveyors feed to a discharge conveyor 32 that extends upwardly along one side of the machine and beyond the adjacent crawler track unit 17. As illustrated, the frame 10 carries an engine 33 for the various pumps and motors involved in the particular apparatus. A control panel 34 is provided with a platform for use of an operator. The apparatus as illustrated has a low center of gravity on the frame 10 as contrasted with rigid frames for similar operations which normally have a center of gravity quite high relative to the bottom of the canal ditch.

The present invention provides a very simple mechanical arrangement for supporting the surfacing equipment necessary to finish a trapezoidal canal cross-section in one pass. It is to be noted that the apparatus illustrated could be used on canals of differing cross-sectional configuration wherein the side slopes have different angles relative to the horizontal. The machine is capable of lifting itself from the ditch so that it can move about obstructions such as bridges and so that it can move from one work area to another without the necessity of external equipment to carry it. Due to this, the machine can be made for use on canals having a greater cross-sectional dimension than could be accommodated by a conventional rigid frame apparatus. The improved versatility and adaptability of this machine make it extremely useful in this type of construction.

Various modifications might be made in the basic structure illustrated without deviating from the concept included in it. For these reasons, only the following claims are intended to limit the scope of the invention.

Having thus described my invention, I claim:
1. A self-lifting surfacing machine for canals, comprising:
   a rigid supporting frame having at its lower end surfacing equipment for operations at the bottom surface of the canal;
   side slope surfacing equipment extending outward from said frame and pivoted thereto for operations at the sloped side surfaces of the canal at each side of said bottom surface;
   ground engaging means at the outer ends of said side slope surfacing equipment pivotally connected thereto;
   parallel arm assemblies pivotally connected between said frame and said ground engaging means;
   and powered extensible means pivotally connected to said frame at an elevated position above said surfacing equipment and to said ground engaging means.

2. A self-lifting surfacing machine for canals, comprising:
   a rigid supporting framework of a width substantially that at the width of the canal bottom surfaces;
   surfacing equipment on said framework for operations along the canal bottom surface;
   side slope surfacing equipment extending outwardly from each side of said frame and pivoted thereto for motion about the first axes parallel to the intended direction of travel of said frame;
   ground engaging means at the respective outer ends of said side slope surfacing equipment pivotally connected thereto about axes parallel to said first axes; front and rear sets of rigid parallel arm assemblies pivotally connected to said frame at each side thereof and extending along said side slope surfacing equipment to pivotal connections at the respective ground engaging means;
   and powered extensible means pivotally connected to said frame at an elevated position above said surfacing equipment and extending outward at each side of said frame to pivotal connections at said ground engaging means.

3. A machine as defined in claim 2 wherein said frame has a triangular transverse configuration converging upwardly toward the axes of said extensible means relative to said frame.

4. A machine as defined in claim 2 wherein said parallel arms extend outwardly from said frame in longitudinal directions as well as transverse directions, the front and rear sets of arms at each side of said frame diverging outwardly from the frame.

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