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West

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[54] **DIRT MOVING APPARATUS**

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[58] **Field of Search** 172/63, 801, 802, 784, 172/276, 190, 741, 742, 67

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[57] **ABSTRACT**

A dirt moving apparatus for leveling the spoil banks left after a strip pit or surface mining operation is provided for attachment to a tractor and includes a blade which engages the earth at an angle to the path of travel of the tractor and an elongated, rearwardly extending, laterally adjustable landside for controlling the side draft of the blade. An elongated, vertical roller is disposed adjacent the trailing end of the landside and extends beyond the planar outer surface of the same for engagement with the earth thereby reducing the friction that would otherwise be encountered as a result of the landside bearing against the face of the cut made by the blade. Positioned adjacent the rearmost end of the blade is a horizontally disposed rotatable disc having a plurality of upright vanes for scattering and redistributing the dirt as it is being displaced by the blade, thereby effecting a leveling of the spoil banks. The vanes may be provided with freely swingable outer sections or the like are encountered, thus avoiding damage to the disc and vane assembly. The apparatus is tiltable about an axis parallel to the path of travel of the tractor for insuring that proper engagement with a bank is maintained as the tractor moves longitudinally along the sideslope thereof.

6 Claims, 6 Drawing Figures

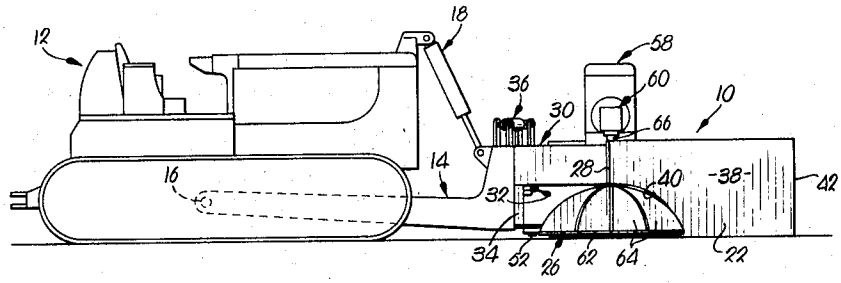


Fig.5.
Fig.3.
Fig.2.
Fig.4.
Fig.6.
Fig.1.

DIRT MOVING APPARATUS

This invention relates to a dirt moving apparatus for attachment to a vehicle, such as a large track-type industrial tractor, for use in land reclamation projects, particularly in areas where strip mining has resulted in the formation of large piles of earth and other material commonly referred to as spoil banks. Land reclamation has become mandatory in areas where surface mining takes place creating the need for heavy-duty equipment which is capable of quickly and economically redistributing large quantities of earth to leave it in a somewhat level condition resembling the terrain as it appeared before the mining operation.

The spoil banks are normally arranged in windrows spaced 70–80 feet apart and are approximately 16 feet in height. The height and spacing of these banks will depend on the type and size of mining equipment used, and adding to the problem of moving such volumes of earth is the fact that the typical spoil bank runs about one-third rock in a dirt matrix. Because of this rocky condition, the equipment must not only be capable of moving large volumes of earth but must also be able to withstand the abrasive effects of the rock.

It is, therefore, a very important object of this invention to provide a dirt moving apparatus for quickly and economically leveling and reclaiming terrain, particularly that which has been rendered unusable as a result of strip mining operations.

It is a still further very important object of my invention to provide a dirt moving and leveling apparatus which may be readily attached to a conventional industrial type tractor and which is especially adapted for use in transferring and redistributing dirt and rocks which have been previously formed into spoil banks or windrows.

Yet another very significant object of my invention is the provision of a dirt moving apparatus having the capability of counteracting the side draft normally encountered when an angularly disposed blade engages the ground, such capability being an important factor in maintaining the path of travel of the vehicle and apparatus in the desired direction with a minimum of deviation therefrom, especially in equipment of the size herein referred to.

Yet another important object of the invention, corresponding closely to the foregoing object, is to reduce the friction between a landside portion of the apparatus and the earth to minimize the power requirements of the vehicle to which the apparatus is attached.

Yet another very important object of my invention is to provide a dirt moving apparatus having the capability of scattering and distributing the dirt and rock as it is being displaced by the blade, such redistribution serving to level the terrain.

Another object of the invention is to so construct the apparatus, particularly that part which redistributes the earth, such that it will not be readily damaged by the rocks with which the blade comes into contact.

It is a further object of the invention to provide a dirt moving attachment which is tiltable relative to the tractor for operation on side-sloping terrain.

In the drawing:

FIG. 1 is a side elevational view of a dirt moving apparatus made pursuant to the present invention and attached to a heavy-duty, earth-working track-type tractor;

FIG. 2 is a plan view of the dirt-moving apparatus and the tractor to which it is attached;

FIG. 3 is a fragmentary, side elevational view showing that side of the dirt-moving apparatus opposite that seen in FIG. 1 and having the adjustable landside;

FIG. 4 is a cross-sectional view taken along line 4—4 of FIG. 2 showing the means for adjusting the landside as well as the means for adjusting the lateral tilt of the apparatus with respect to the tractor;

FIG. 5 is a front elevational view of the apparatus and tractor showing the relative disposition of the apparatus with respect to the tractor when the blade initially engages the ground as the tractor commences to proceed longitudinally along the sideslope of a spoil bank; and

FIG. 6 is a plan view of a modified form of the earth-scattering disc, the upright vanes having free-swinging, hinged, outer sections.

Referring initially to FIGS. 1–5, an attachment in the form of a dirt-moving apparatus, broadly designated by the numeral 10, is adapted to be mounted on a mobile vehicle such as a track-type tractor 12. The apparatus 10 is attached by means of a generally U-shaped frame 14 which extends forwardly from the tractor 12 and is pivotally mounted to swing vertically about a horizontal axis 16 disposed transverse to the direction of travel of the tractor 12. A hydraulic piston and cylinder assembly 18, operably coupled with the tractor 12, interconnects the frame 14 and the tractor 12 at the latter's forward end, the assembly 18 being attached to a front cross member 20 of the frame 14.

The apparatus 10 is comprised of an upright, horizontally elongated blade 22 disposed to engage the dirt at an angle to the path of travel of the tractor 12, a laterally swingable, elongated landside 24 and a horizontally disposed, vaned disc 26 rotatably mounted adjacent the rearwardmost or trailing end 28 of the blade 22. A frame structure 30 for the blade 22, the landside 24 and the disc 26 is attached to the frame 14 through the use of a pivot pin assembly 32 which interconnects a rear face plate 34 of the structure 30 with the cross-member 20 such that the apparatus 10 is tiltable laterally about the assembly 32 on an axis parallel to the path of travel of the vehicle 12. A second hydraulic piston and cylinder assembly 36 mounted on the cross piece 20 and attached to the structure 30 is also operably coupled with the tractor 12 and serves to maintain the apparatus 10 selectively positioned relative to the vehicle 12 and the frame 14 by controlling the extent of tilt of the apparatus 10 about the pivot assembly 32.

The blade 22 is provided with a forwardly facing, dirt engaging, planar face 38 and a disc clearing notch 40 in the region of its normally rearmost, lower quadrant. Also included as a part of the blade 22 is a leading, ground-engaging point 42 behind which the rearwardly extending landside 24 swings laterally about an upright axis 44, the axis 44 being located at the forward end of the landside 24. A hydraulic piston and cylinder assembly 46, also operably coupled to the tractor 12, interconnects the structure 30 with the land slide 24 adjacent the latter's trailing end.

An elongated, vertically disposed roller 50 is mounted at the trailing end of the landside 24 for rotation about an upright axis 52, the roller 50 being of a diameter and mounted such that its outer periphery or

curved surface **54** extends beyond the outer, longitudinal face **56** of the landside's skid plate **48.**

The disc **26,** which is powered by an auxiliary engine **58** mounted on the structure **30** and operably coupled to the disc **26** through the use of a gear box **60,** is comprised of a horizontally disposed plate **62,** on substantially the same plane as the lower edge of the blade **10,** and a plurality of vertically positioned vanes **64** extending upwardly from the plate **62** and projecting radially outwardly from the axis **66** of the disc **26.** As is best shown in FIGS. **1** and **2** the disc **26** partially underlies the blade **22,** at the notch **40,** such that the end **28** thereof is adjacent the axis **66** of the disc **26.**

In operation, as the tractor **12,** to which the dirt moving apparatus **10** has been attached through the use of the frame **14,** proceeds longitudinally along the spoil bank or windrow, near the top thereof, the piston and cylinder assembly **18** is manipulated to cause the frame to lower such that the point **42** engages and digs into the ground to "plow" or form a furrow **70** as illustrated in FIG. **5.** As is well known by those having experience in operation equipment such as this, the engagement of the point **42** with the ground tends to cause the blade **22** to be drawn sideways into the bank of dirt on the upside of slope as viewed in FIG. **5,** this action being called side draft. To compensate for this undesirable side draft, which is especially significant in working with the large scale equipment as here anticipated, the landside **24** is made adjustable in order that the point **42** may be "guided," thus counteracting, through the use of the piston and cylinder assembly **46** and the pivot **44,** the effect of the side draft. It is contemplated that the piston and cylinder assembly **46** could be coupled into the steering mechanism (not shown) of the tractor **12** such that when the operator makes a correcting adjustment in the steering of the vehicle **12** to counteract the side draft that the assembly **46** would correspondingly readjust or reposition the landside **24** relative to the blade **22,** thereby assisting in "guiding" the apparatus **10** in a substantially straight path of travel corresponding to that intended for the vehicle **12.** It is to be understood that the piston and cylinder assembly **46** might also be activated by the operator independently of the tractor steering mechanism rather than in conjunction therewith as mentioned earlier.

The engagement of the surface **54** of the roller **50** with the vertical wall **72** of the furrow **70** causes less friction than would otherwise be the case if the face **56** of the skid-plate **48** were in direct contact with the wall **72.** With the roller **50** thus taking the side load rather than the fixed skid plate **48,** the power requirement of the tractor **12** is correspondingly reduced.

As the vehicle and the apparatus are proceeding along the bank **68** the dirt that is displaced by the blade **22** is received and flung laterally by the disc **26** with its vanes **64,** the disc being rotated in the direction of the arrow **74** by the auxiliary engine **58.** The disc **26** is rotated at a sufficiently high speed (200–300 R.P.M.) to throw the dirt and other material approximately half the distance between the spaced-apart windrows, which elsewhere in this specification were said to be from 70 to 80 feet apart. The angularity of the blade **22,** along with the forward movement of the tractor **12,** is sufficient to cause the dirt to move rearwardly along the face **38** of the blade **22** and to come into contact with the vanes **64.**

Successive passes are made along the bank **68** moving downwardly and inwardly with each pass or cut. In order to compensate for the slope of the spoil bank and yet maintain a fairly level cut and to also control the trajectory of the material as it is being thrown by the disc **26** the apparatus **10** is swingable laterally about the pivot assembly **32,** this being controlled by the operator through the piston and cylinder assembly **36.** A pass is made along one side of the bank **68** throwing the material in one direction and a return pass is then made on the opposite side or slope of the bank throwing the material in the opposite direction until such time as the bank **68** had been worked down to a desired level.

Referring now to FIG. **6,** there is shown a modified disc **126** having a plurality of radially disposed vanes **164** extending outwardly from the axis of rotation **166** and which are provided with freely swingable outer sections **176** pivotal about an upright axis **178.** The disc **126** with its freely swingable outer sections **176** is especially adapted for use in rocky conditions, the outer sections **176** swinging or folding back when encountered by a rock thus minimizing the damage which might otherwise be inflicted.

The currently preferred apparatus **10** is of a size adapted for use with a tractor of about 270 horsepower for making a cut about 3 feet wide and 3 feet deep utilizing a blade approximately 4 feet in height with the disc **26** being about 6 feet in diameter and the vanes approximately 2 feet in height. With such apparatus the volume of material moved can approach 1 cubic yard per second. These dimensions and parameters are given merely to provide some indication of the heavy duty nature of the apparatus and to illustrate the magnitude of the side draft that must be dealt with when such volumes of dirt are to be redistributed quickly and economically. The recitation of these dimensions and horsepower requirements is by way of example only and are in no way to be construed as limiting factors of this invention inasmuch as the apparatus could be constructed of any suitable size depending on its application.

From the foregoing description, it will become readily apparent that there has been here presented a novel dirt moving apparatus which may be readily attached to a conventional power unit for quickly and economically reclaiming land that has been disturbed by mining operations. The adjustability of the landside **24** greatly reduces the amount of power required of the propelling vehicle by aiding in the steering of the same to resist the side draft caused by the tendency of the point **42** to draw the blade **22** further into the ground than desired while the roller **50** reduces the friction between the landside and the wall of the furrow. Coupled with the blade and its adjustable landside, the rotating disc **26** quickly scatters the large volume of earth displaced by the blade and cooperates with the blade by scattering the material from the spoil banks into the low spots therebetween.

It is to be understood that minor modifications may be made in the invention as described and illustrated without departing from the true spirit of this invention. Accordingly, the invention should be limited only by the fair scope of the following claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a dirt-moving apparatus;

a mobile vehicle;

a blade mounted on said vehicle for engaging the dirt to be moved at an angle to the path of travel of said vehicle;

a landside extending rearwardly from adjacent the forward extremity of said blade and mounted for swinging movement about an upright axis;

means operably coupled with said landside for generally horizontally shifting the landside about said axis and selectively positioning said landside relative to said path of travel, said landside being normally disposed at an angle relative to said path of travel for controlling the sidedraft of the blade and for exerting a direction guiding force on said vehicle;

dirt scattering means mounted adjacent said blade for continuously scattering dirt being displaced by the blade, said scattering means including a rotatable, generally horizontal disc disposed adjacent the rearward extremity of the blade for rotation about an upright axis; and

power means operably coupled with said disc for drivingly rotating the same.

2. A dirt-moving apparatus as claimed in claim **1**, wherein there is provided a rotatable, dirt-engaging roller mounted on said landside adjacent the rear extremity thereof to reduce the friction between said landside and the dirt as the vehicle moves in its path of travel.

3. A dirt-moving apparatus as claimed in claim **2**, wherein said landside has an outer, substantially upright, planar surface, said roller extending outwardly beyond the plane of said surface.

4. A dirt moving apparatus as claimed in claim **1** wherein there is provided a plurality of vertically disposed vanes on said disc, said vanes projecting radially from said axis.

5. A dirt moving apparatus as claimed in claim **4** wherein said disc underlies said vanes and is disposed in a generally common horizontal plane with the lower edge of said blade.

6. A dirt moving apparatus as claimed in claim **5**, wherein said vanes each have a hinged outer section that is freely swingable about a respective vertical axis.

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