Oct. 29, 1963 H. SWINDELLS ETAL 3,108,700

RECLAIMING AND BLENDING MACHINES FOR BULK MATERIALS

Filed Sept. 20, 1960 4 Sheets-Sheet 1

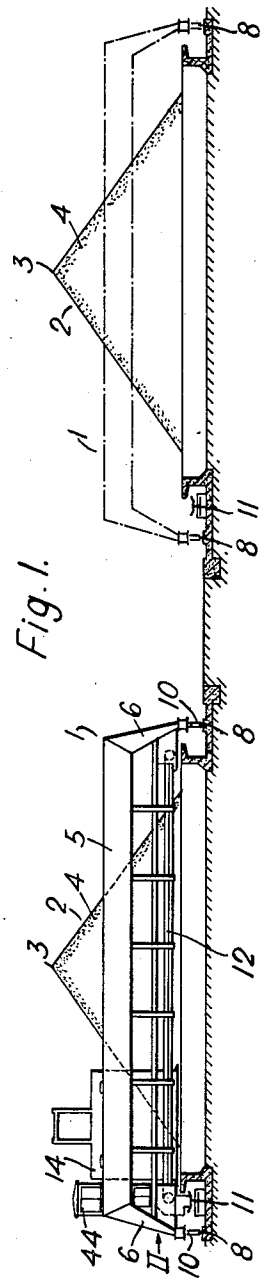


Fig. 1.

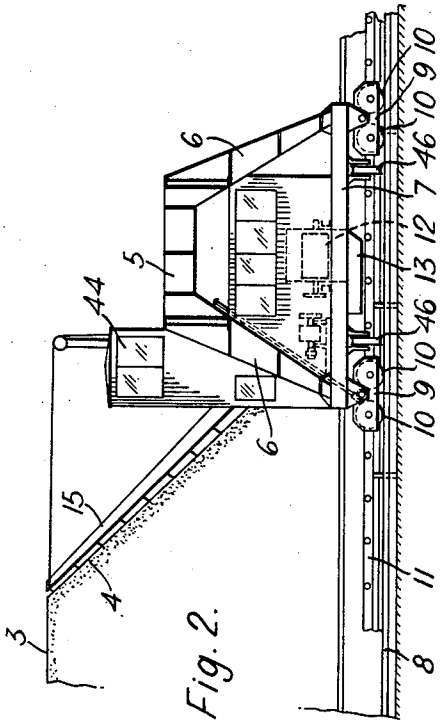


Fig. 2.

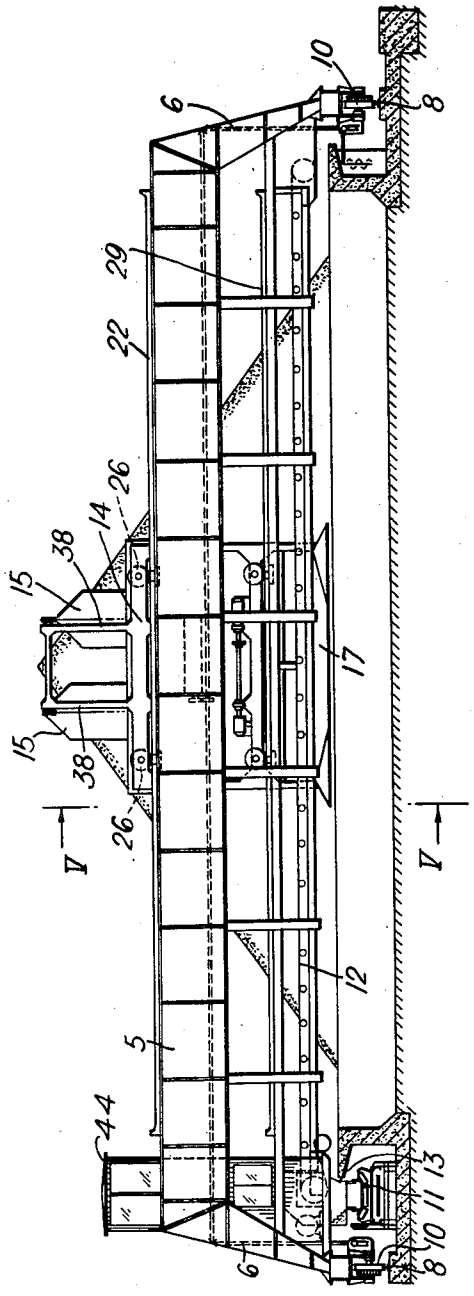
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Fig. 3.



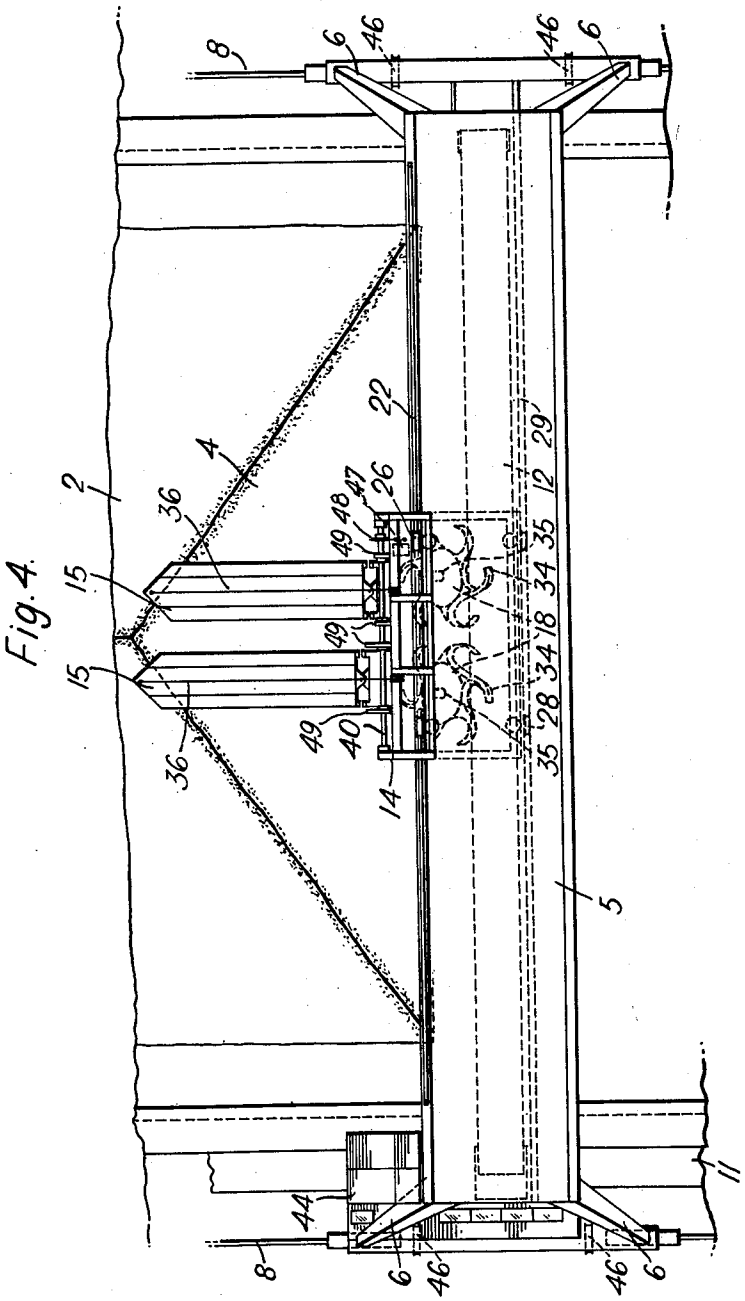
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Fig. 4.



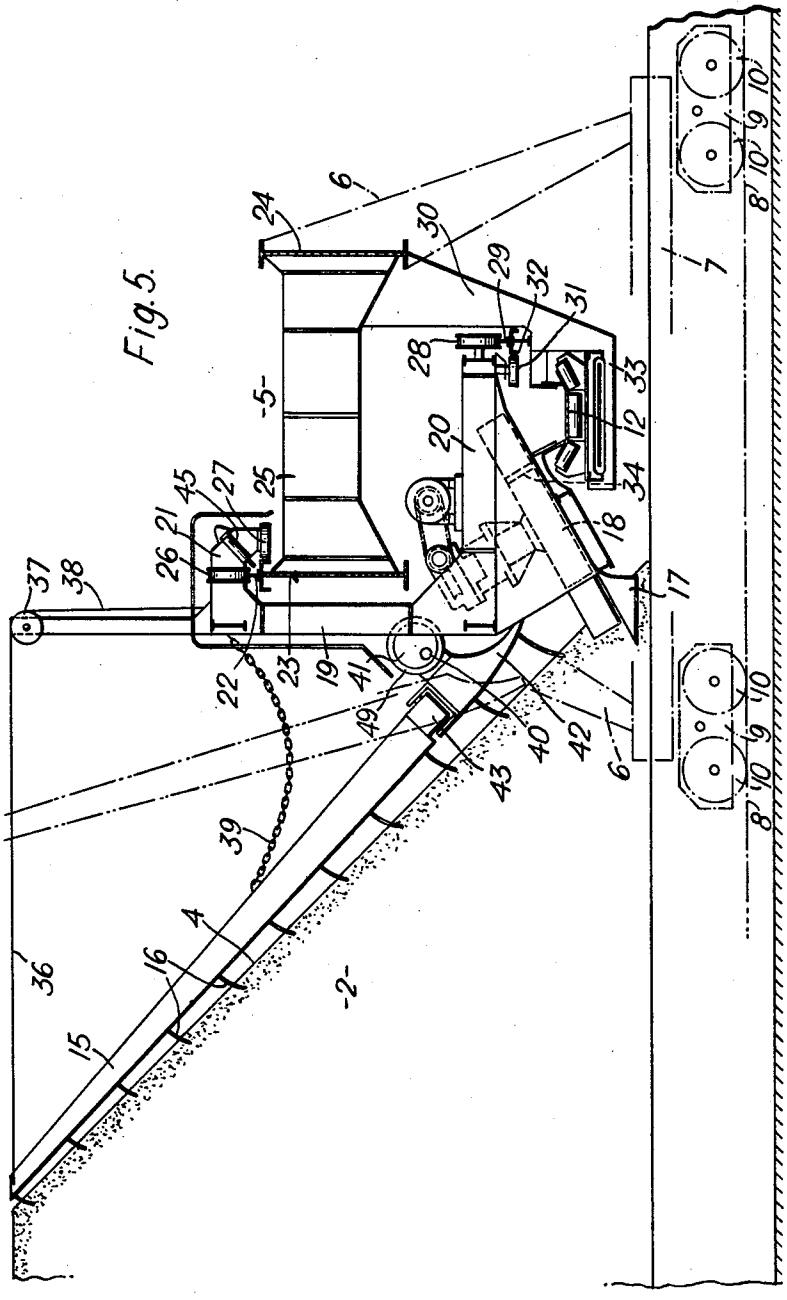
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Fig. 5.



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RECLAIMING AND BLENDING MACHINES FOR BULK MATERIALS

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4 Claims. (Cl. 214—10)

This invention relates to machines for reclaiming bulk materials, such as ore, coal and like materials, from a stock-pile, such machines comprising a main frame which is supported at each end on suitable travelling wheels which are adapted to run on rails or like supports, the distance between the travelling wheels at the two ends of the main frame being greater than the width of the pile of material upon which the machine is adapted to operate, the machine further comprising at least one agitator or rake which is adapted to engage against the pile of material and to loosen and remove material therefrom, the material thus removed being carried by conveyor means associated with the machine to further conveyor means which will deliver the material to a preselected point such as, for example, a loading or charging station for a blast furnace, or to a loading station for railway or other vehicles.

The main object of the present invention is to provide an improved construction of such a machine which will progressively traverse the end of and reclaim material from a stock pile by continuously removing the material from the end face of the pile and throughout the whole depth thereof, thus blending, in the course of reclaiming, the materials which have been deposited in successive layers.

A further object is to provide a form of machine which, while being adapted to take material from throughout the complete depth of the pile, may be retracted from the pile without fouling uneven ground from which the, or at least part of the, pile has been removed.

Other objects, advantages and improved features of the invention will be apparent from the following description wherein one form of reclaiming machine incorporating the features of the invention will now be described by way of example and with reference to the accompanying diagrammatic drawings wherein:

FIGURE 1 represents an end view looking along the stockpile and showing the arrangement of the machine relative to the pile.

FIGURE 2 is an end view as seen in the direction of the arrow II in FIGURE 1 and to a somewhat larger scale.

FIGURE 3 is a more detailed view of the machine as seen in FIGURE 1.

FIGURE 4 is a plan of the apparatus shown in FIGURE 3 and,

FIGURE 5 is a sectional view taken on the line V—V in FIGURE 3.

The machine comprises a main frame 1 of length greater than the width of a stock-pile 2 which is to be reclaimed. The stock-pile, of which two are shown end on in FIGURE 1, are each substantially rectangular in plan with the peak 3 extending centrally along the length of the pile. Reclaiming is effected by taking material from one sloping end face 4 of a pile.

The main frame 1 consists of a box girder 5 which is supported at each end on two outwardly inclined legs 6 united at their lower ends by a horizontal stay 7. Fixed rails 8 are laid one on each side of the site of each stock-pile.

Beneath each leg 6 there is provided a bogie 9 with two aligned wheels 10 adapted to run on one of the

rails 8 so that the main frame is supported at each end on four wheels 10 running on a rail. An electric motor drive is provided for the wheels, the drive including reversing means to provide for advancing of the machine towards the pile as material is reclaimed therefrom, and withdrawal of the machine from the pile when necessary.

An endless conveyor belt 11 is permanently installed between one of the rails 8 and the adjacent side of the site of the stock-pile. This conveyor serves to carry material which is fed onto it by the reclaiming device to a discharge point, not shown in the drawings, which may, for instance, be a loading or charging station for a blast furnace or a loading station for railway or other vehicles.

The second conveyor belt 12 extends along the length of the main frame 1 and is driven in the direction to carry material fed to it towards the first mentioned conveyor belt 11. The delivery end of the second conveyor belt 12 is located above the first conveyor and a chute 13 is provided so that material discharged by the second conveyor 12 will be delivered through the chute 13 onto the first conveyor 11.

There is provided a sub-frame 14 which is adapted and mounted for traversing backwards and forwards across the main frame. The movement of the sub-frame can be effected by means of a rope haulage and a reversible gear to reverse the direction of movement of the sub-frame when it reaches each limit of its traversing movement.

The sub-frame, as viewed in the direction of traversing movement is substantially of L-form comprising, as shown in FIGURE 5, a vertical portion 19 in front of the main box girder element 5 of the main frame and a lower horizontal portion 20 extending rearwardly underneath the box girder.

The box girder comprises two I beams 23 and 24 extending parallel with one another throughout the length of the main frame and connected together at intervals by bracing members 25. A rearward projection 21 from the top of the vertical portion 19 of the sub-frame extends over a rail 22 mounted on top of the front beam 23 of the box girder 5. This rearward projection 21 provides a mounting for flanged wheels 26 running on the top of the rail 22. Also the rearward projection 21 supports the rollers 27, the axes of which are vertical, adapted to engage a rearwardly facing vertical guide face extending parallel with the rail 21 and disposed behind and below the rail. As shown in FIGURE 5 this guide face is formed on the upper flange of the beam 23. The purpose of the rollers 27 is to prevent this part of the sub-frame from being displaced in a forward direction, that is, towards the left-hand in FIGURE 5.

At the extreme end of the lower horizontal portion 20 of the sub-frame there are mounted flanged wheels 28 having their axes horizontal and running on a guide rail 29 mounted on the main frame and parallel to the last mentioned rail 22. This second rail 29 is supported on a number of bracket members 30 attached to and extending downwardly from the box girder 5 and behind the lower horizontal portion 20 of the sub-frame. This guide rail 29 is located on the front of a vertical portion of the bracket members 30. Forwardly of and slightly below this last mentioned guide rail 29 there are mounted on the rear ends of the lower horizontal portion 20 of the sub-frame, rollers 31 having their axes vertical and adapted to bear against a forwardly facing vertical guide surface 32 which extends parallel with the rail 29.

The sub-frame 14 carries in a lowermost position a plough plate 17 the front edge of which is lowermost and is intended to engage the base of the pile at the bottom of its sloping end face 4. This plough plate is in-

clined so as to slope upwards in a rearward direction to a position above the second conveyor 12.

Mounted upon thet plough plate 17 and adapted for rotation about axes at right angles to its surface are two feed units 18. Each feed unit 18 comprises a number of curved blades 34 extending generally radially outwards from the centre of each unit so that when the feed units 18 are driven in rotation about their axes 35 the blades 34 will engage any material on the plough plate 17 and carry that material towards the rear edge of the plough plate so that it will be discharged onto the conveyor 12. The length of the blades is such they extend beyond the upper edge of the plough plate so that the material will be swept by them over this edge to fall onto the conveyor 12. The blades 34 are curved in a clockwise direction on one feed unit 18 and in an anti-clockwise direction on the other feed unit and the two feed units are rotated in opposite directions.

The supports for the second conveyor 12 are provided by lower forwardly extending portions 33 of the above mentioned bracket members 30.

The sub-frame also supports two agitators of which one is in the form of a boom 15 which is pivotally mounted on the sub-frame above the plough plate. On the underside of each boom there are mounted downwardly extending and slightly curved tines 16. The inclination of each boom is controlled by a hawser 36 extending from the top of the boom over a pulley 37 fixed to the upper end of a support 38 upstanding from the top of the sub-frame to a winch mounted thereon. By means of this hawser the boom 15 can be set at such an angle that the tines 16 will engage the sloping end face 4 of the pile. The angle of inclination of the boom will normally be substantially the angle of repose of the material of the pile. A safety chain 39 is permanently connected between the sub-frame and the boom.

A horizontal driving shaft 40 driven from a motor 47 through a chain sprocket 48 on the sub-frame is provided with eccentric lobes 41 which engage in suitable strop bearings 49 on the lower ends of the booms. This arrangement provides for the lower end of each boom to be given a circular movement about the axis of the driving shaft 40. It will be appreciated that this circular movement decreases in extent from the lower towards the upper end of a boom so that at the point where each boom is connected to its hawser 36 the movement will be a longitudinal reciprocation, the angle of inclination of the boom being set so as to be substantially the same as or somewhat less than the angle of repose of the material in the pile. The driving shaft 40 is rotated in such a way that is anti-clockwise as seen in FIGURE 5, that the tines 16 effect a raking action on the surface of the pile, that is to say, the boom is raised away from the pile at its lower end during its upward or idle stroke and then is lowered so that the tines 16 are moved onto the surface of the pile during the working stroke.

Each boom 15 is adapted to have limited freedom for swinging movement. For this purpose the boom is made in two parts namely the main portion 15 carrying the tines 16 and an inner end portion 42 which is actually the portion which is in driving connection with the above mentioned driving shaft 40. The two parts are connected by a pivotal coupling 43 the axis of which is in a vertical plane and is at right angles to the axis of the driving shaft. In addition to providing for limited swinging movement of the main portion 15 of the boom the pivotal coupling 43 prevents that movement from being transmitted to the mechanism which couples the boom to the driving shaft 40.

The machine operates in the following manner. It is brought along the rails 8 into such a position that, with the booms 15 inclined at the desired angle, the tines 16 will engage the end surface 4 of the pile 2 which is to be reclaimed. The conveyors 11 and 12 are set in motion and also the rotary feeding devices 18 are set in operation. The forward end of the plough plate will be in engagement with the base of the pile of material.

At one end of the main frame 1 there is provided a housing 44 containing the necessary control equipment. The sub-frame 14 is at one end of the main frame 1. The drive to the booms is set in operation to begin the raking process and at the same time the sub-frame is set in motion so that it will begin its traversing movement from one end to the other of the main frame. As the sub-frame traverses across the pile the tines 16 dislodge material from its surface, thus causing this material to fall onto the plough plate 17 from which it is removed by the rotary feeding members 18 and discharged onto the second conveyor 12. This conveyor 12 discharges the reclaimed material onto the first conveyor 11 which in turn carries away the material to the required discharge position rearwardly of the reclaiming apparatus. During this process the reclaiming mechanism is slowly moved into the pile by driving the first mentioned bogie wheels 10. At the end of the traversing movement of the sub-frame in one direction tripping means cause the direction of traversing drive to be reversed so that the sub-frame will then proceed in the opposite direction.

In order to control the rate of reclaiming as the sub-frame traverses the face of the pile, with the object of maintaining the rate substantially constant or at least within practicable limits, the arrangement for controlling the angle of inclination of the boom may be automatically altered by tripping means mounted at appropriate positions along the path of traverse to vary the angle of inclination of the boom at one or more positions as it moves across the pile. The usual requirements would be for the angle of inclination to be increased. This increase of the angle of inclination will not be large and there may be provision for lowering the boom automatically to its original angle when the sub-frame reaches the end of its working strokes.

In the arrangement shown in the drawings the sub-frame is provided with an agitator device comprising two booms. In a modification there may be provided two such sub-frames each carrying means for agitating the material to be reclaimed and also a plough plate and rotary means for feeding the material from the plough plate to the second conveyor 12. The two sub-frames would be mounted for simultaneous movement on the main frame during the reclaiming operation. The two sub-frames may be spaced apart by a distance less than half the width of the pile so that their path of movement overlaps in the central position. This arrangement is particularly suited for dealing with wide piles as it serves to avoid extreme fluctuations in the rate of feed of the material to the conveyors. Consequently it also enables the complete apparatus to be moved into the pile at a speed greater than the maximum speed which would be practicable if a single sub-frame were used in the same circumstances.

When the pile has been completely reclaimed or when it is required to move the apparatus to the site of another pile it is desirable to raise the plough plate so that when the apparatus is moved away from the pile the plough plate will not foul any ground irregularities.

Towards the rear end of the rearward projection 21 at the top of the sub-frame there is mounted at least one hydraulic jack 45 (FIGURE 5) having its axis inclined downwardly and forwardly at about 45°. By applying power to the jack 45 it can be caused to bear against the abutment provided by the upper surface of the beam 23 at the base of the rail 22 and thereby lift the forward part of the sub-frame. This would preferably be effected when the sub-frame is at one or either end of the main frame.

The arrangement is such that the whole of the sub-frame tends to turn about the top of the lower rear guide rail 29 on the main frame. The guide wheels 28 remain in engagement with the guide rail 29 and the sub-frame

actually pivots about a horizontal axis extending substantially through the point of engagement between the wheels 28 and the rail 29. The upperforward wheels 26 are lifted off the associated guide rail 22. Also both sets of rollers 27 and 31 move away from the associated guide surfaces, such as the guide 32 associated with the rails 31, on the main frame. The effect of this movement is to raise the whole of the front of the sub-frame and thus lift the plough plate 17 off the ground. The machine can now be moved rearwardly across the surface from which material has been reclaimed without fouling of the plough plate by any surface irregularity of the ground or by loose material which may remain on the ground.

When two sub-frames are mounted on the main frame, both sub-frames may be provided with the means for angularly tilting them relative to the main frame. Arrangements may be provided to permit the two sub-frames to be moved to opposite ends of the main frame prior to being raised.

In order to facilitate traversing movement of the complete apparatus from, for instance, the position shown in full lines in FIGURE 1 to another position adjacent another pile, as shown in broken lines in FIGURE 1, there are mounted on the underside of the ends of the main frame auxiliary wheels 46 which are normally raised out of engagement with the ground. These wheels are mounted on the power driven jacks so that when necessary they can be moved into engagement with auxiliary tracks and by applying power to the jacks the whole machine can be raised to lift the main running wheels 10 off the rails 8. The auxiliary wheels 46 have their axes at right angles to the axes of the main running wheels 10 so that when the apparatus is supported only on the auxiliary wheels it can be moved in a direction at right angles to the direction of the rails 8.

In the process of laying down a stock-pile of bulk material, the pile may be constituted of different grades or qualities of the material arranged in substantially horizontal layers. If such a pile is reclaimed by means of, for instance, so-called, grabs, there is a considerable risk that in general the quality or grade of the material so taken at any one time may be different from that taken at another time and from a different part of the pile. By using the apparatus which is the subject of the present invention, the engagement of the agitating means with the end of a pile and its traversing movement over the complete face of that end, ensures that the reclaimed material will contain a substantially constant blending of all the layers of the pile.

What we claim then is:

1. A machine for reclaiming bulk material from a stock pile, comprising an elongated main frame with track-engaging supporting means on its ends, and a conveyor on and extending lengthwise of the main frame, a sub-frame mounted for movement on and lengthwise of the main frame and, on the sub-frame, an agitator for engaging a sloping end surface of a stock pile, a plough plate having a lower edge for engaging the base of the stock pile and inclining upwardly from that edge to a position above the conveyor, transfer means mounted on the plough plate for transferring material from the plough plate to the conveyor.

2. A machine for reclaiming bulk material from a stock pile, comprising an elongated main frame with track-engaging support means on its ends, a conveyor on and extending lengthwise of the main frame, a sub-frame mounted for movement on and lengthwise of the main frame and, on the sub-frame, an agitator for engaging a sloping end surface of a stock pile, a plough plate having a lower edge for engaging the stock pile and inclining upwardly from that edge to a position above the conveyor, and transfer means mounted on the plough plate for transferring material from the plough plate to the conveyor, and there being also mounted on the sub-frame means for raising the sub-frame, and thereby the plough plate, in relation to the main frame.

3. A machine for reclaiming bulk material from a stock pile, comprising an elongated main frame with track-engaging supporting means at its ends and a conveyor on and extending lengthwise of the main frame, parallel tracks on and extending lengthwise of the main frame, a sub-frame mounted for movement along said parallel tracks, an agitator for engaging a sloping end surface of a stock pile, a plough plate for engaging the base of the stock pile, transfer means mounted on the plough plate for transferring material from the plough plate to the conveyor, and said agitator and plough plate being mounted on the sub-frame and there being provided means for raising the sub-frame, and thereby the plough plate, by angularly displacing it about one of said parallel tracks.

4. A machine as claimed in claim 3 in which the parallel tracks for mounting the sub-frame consist of two rails, there are provided on the main frame vertical guide surfaces extending parallel with the rails, one rail is lower than and rearwardly of the other rail, one guide surface is below and rearwardly of the higher rail and the other guide surface is below and forwardly of the lower rail, the sub-frame is angularly movable about the line of its engagement with the rearmost of the two rails between a lower position in which the sub-frame is in engagement with both rails and a raised position in which it is clear of the forward rails, and guide members mounted on the sub-frame bear on the guide surfaces when the sub-frame is in its lower position and are dis-engaged from the guide surfaces when the sub-frame is raised relatively to the main frame.

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