

No. 884,764.

PATENTED APR. 14, 1908.

E. O. ROOD,
EXCAVATING MACHINE.
APPLICATION FILED JUNE 12, 1907.

3 SHEETS—SHEET 1.

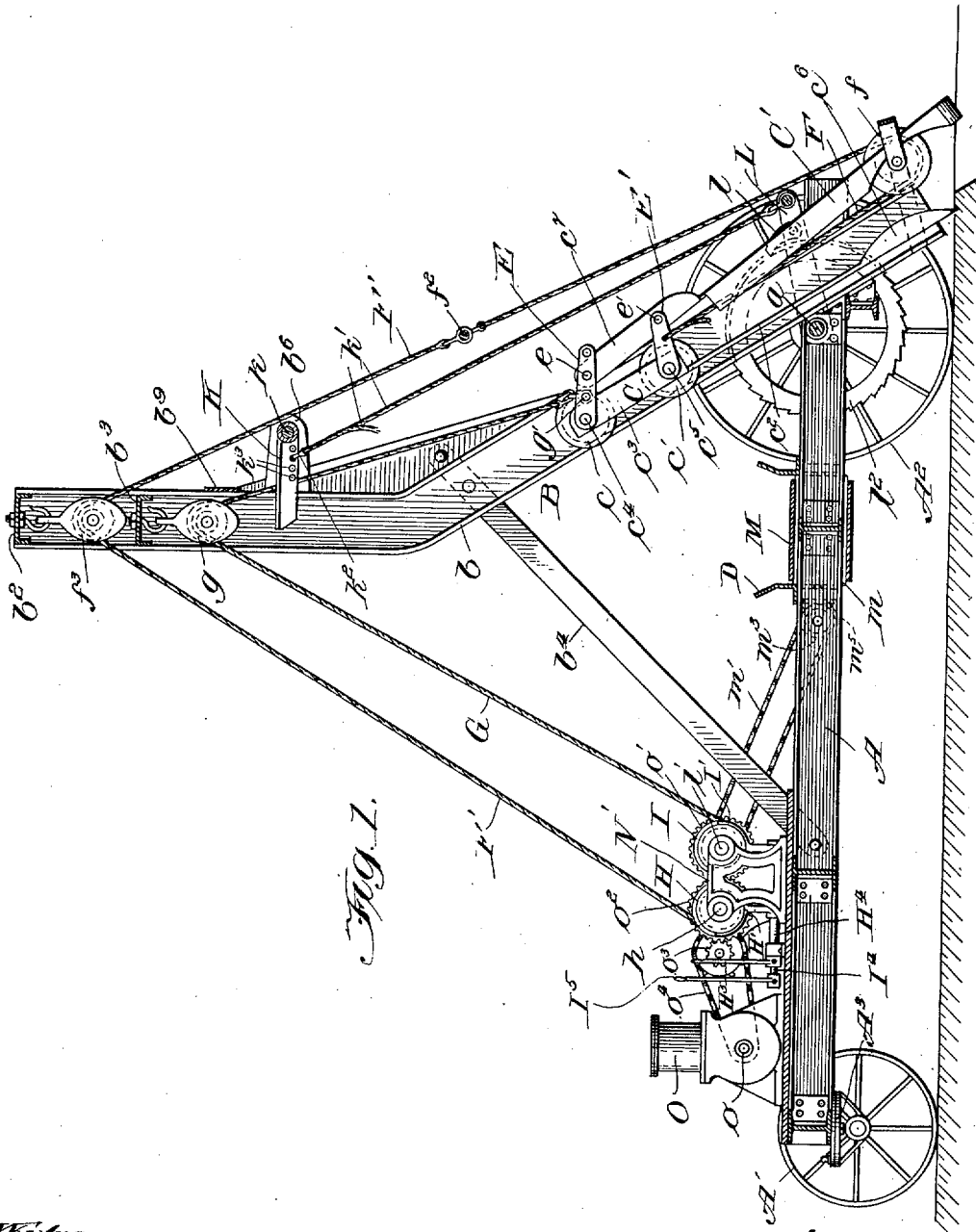


Fig. 1.

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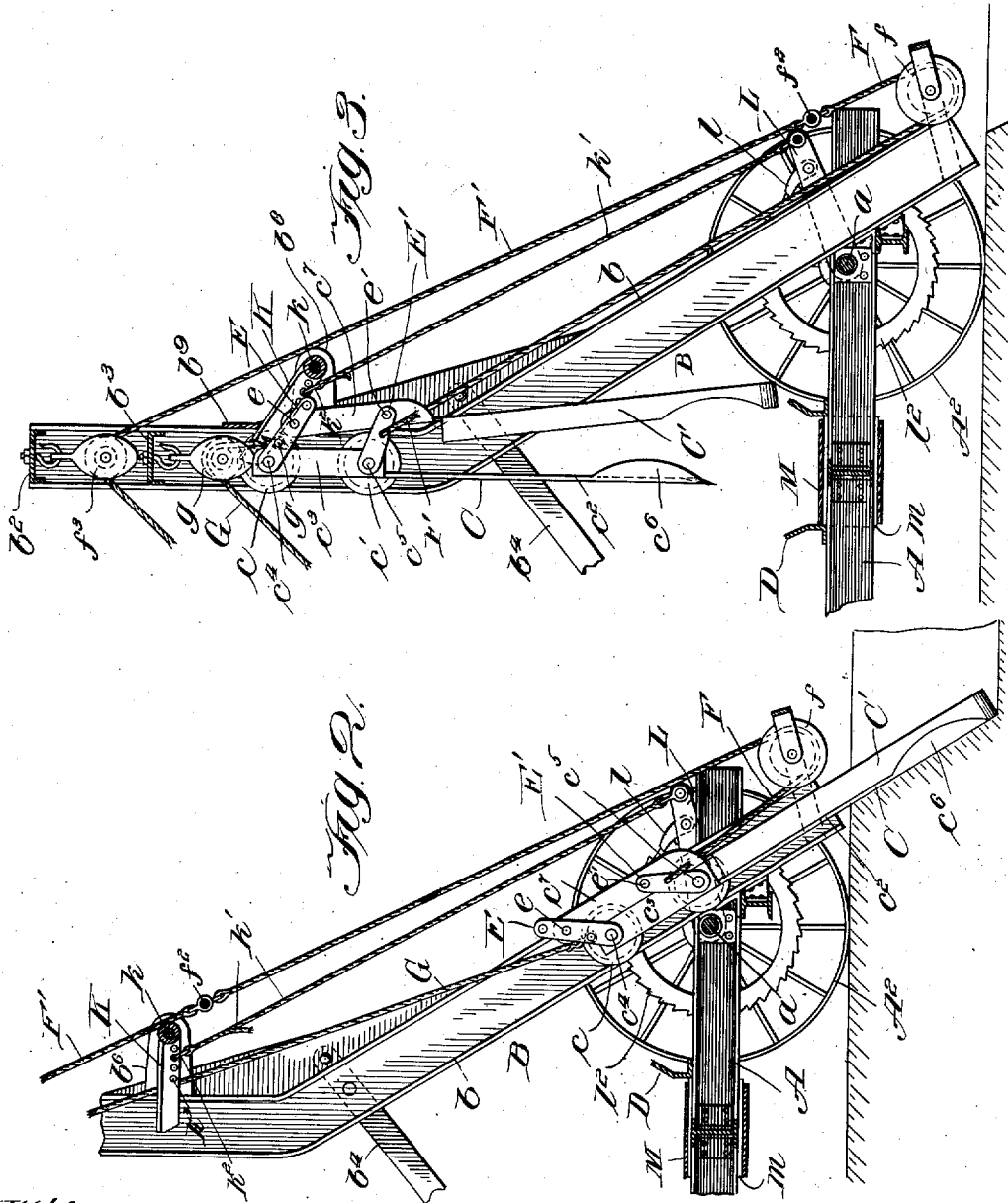
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3 SHEETS—SHEET 2.



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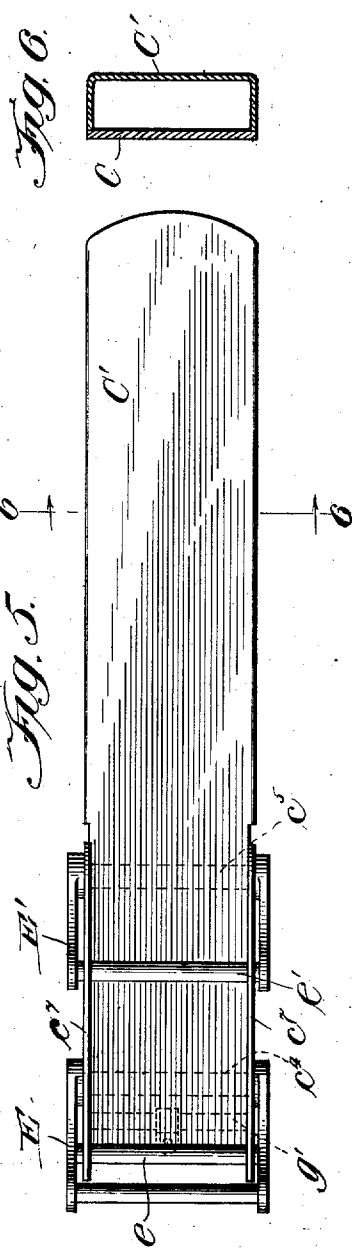
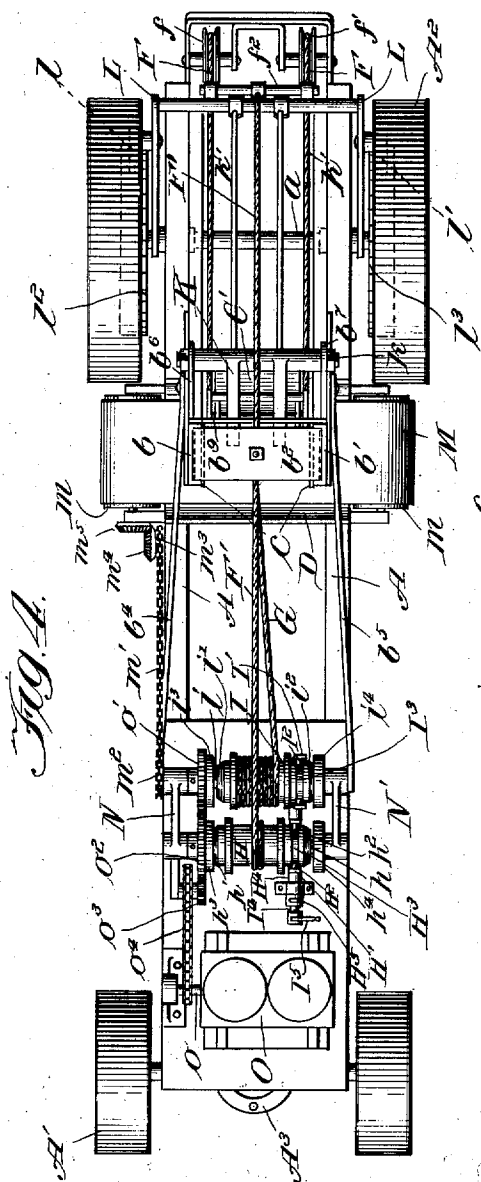
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

EDWIN O. ROOD, OF BRITT, IOWA, ASSIGNOR TO THE INTERSTATE DRAINAGE & INVESTMENT COMPANY, OF BRITT, IOWA, A CORPORATION OF IOWA.

EXCAVATING-MACHINE.

No. 884,764.

Specification of Letters Patent.

Patented April 14, 1908.

Application filed June 12, 1907. Serial No. 378,527.

To all whom it may concern:

Be it known that I, EDWIN O. ROOD, a citizen of the United States, residing at Britt, county of Hancock, State of Iowa, have invented a certain new and useful Improvement in Excavating-Machines, and declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to apparatus for excavating by power, and particularly apparatus adapted for digging trenches or ditches.

Heretofore it has been common to dig trenches by means of endless conveyers or the like provided with scoops, each of which takes up a small charge of material as it passes over the surface thereof. Not only is apparatus of this kind cumbersome, but a considerable portion thereof must lie within the excavated portion of the trench so that, in case the walls cave in, the material drops upon the top of the portion of the apparatus in the trench and makes it necessary to release the apparatus by digging around it and removing the material which has fallen thereon.

The primary object of my invention is to provide an excavating apparatus which shall be simple in construction and positive in its operation, so as to make it possible to excavate material in the most expeditious and economical manner.

A further object of my invention is to provide an excavating apparatus wherein no portion thereof remains within the excavated portion of the trench, so that all danger of inconvenience or injury to the apparatus occasioned by caving-in walls is obviated.

A further object of my invention is to provide an excavating apparatus which will automatically move itself step by step as the excavation progresses, so that no particular attention is required to maintain the excavating devices at all times in proper relation to the material to be excavated.

Further objects of my invention will hereinafter appear in the detailed description of my invention.

Generally speaking, my invention consists in an apparatus arranged to ply a spade-like tool so as to shear a slice from the material to be excavated and then to carry this slice

away. To this end I provide a traveling carriage or vehicle, which may be conveniently mounted on wheels, and mount thereon suitably inclined guides within which the spade-like tool is free to slide. The guides are so arranged that the tool enters the ground beneath the carriage at a suitable angle. Any desired form of power device may be employed for positively forcing the tool into the ground until the desired depth is reached.

The tool is provided with a guard which is automatically brought into place after the tool has finished its cut and holds the slice of material upon the tool. The tool is then lifted by the power device so as to clear the opening in which the cut has been made and the guard is released so that the material carried by the tool may drop therefrom. The excavated material may be deposited on any suitable conveyer so as to be carried to any desired point. If the apparatus is being used to dig a trench as wide as the tool, the material need only be carried far enough so that it may be deposited at the side of the trench. Means are also provided so that after the tool has completed a cut, and before it again descends into the material to be excavated, the entire carriage is moved forward a step sufficient to cause the tool to cut off a slice of the desired thickness at its next operation. It will be seen that by this arrangement the material is cleanly excavated and in a manner which permits the power to be applied most advantageously to the tool. Furthermore the trench which is being formed contains at no time any other apparatus than the tool and its guard, so that in case the walls of the trench should cave in back of the point at which the actual excavation is taking place, no inconvenience or damage to the machinery can result therefrom.

It will, of course, be understood that the mechanisms for carrying out my invention may be greatly varied, and I do not desire to be limited to any particular mechanisms, except to the extent hereinafter particularly pointed out in the claims.

For a full understanding of my invention, however, and of its various objects and advantages, I have illustrated in the accompanying drawings an arrangement of parts which may be used to advantage in carrying out my invention.

In said drawings, Figure 1 is a view partly

in side elevation, and partly in section, of the apparatus as a whole, the spade being about to enter the material to be excavated; Fig. 2 is a view similar to Fig. 1 of a fragment of the apparatus, showing the spade in the position which it occupies just before its withdrawal from the material; Fig. 3 is a view similar to Fig. 2, showing the spade in the act of discharging; Fig. 4 is a plan view of the apparatus; Fig. 5 is a front elevation of the spade and its guard; and Fig. 6 is a section taken on line 6—6 of Fig. 5.

Referring to the drawing, A represents a frame-like body mounted upon pairs of wheels A' and A². The wheels A' may conveniently be swiveled to the body as at A³ so as to afford steering facilities. At the rear of the carriage is a tower-like construction B which is adapted to support and guide the spade C. The part B may be formed in any suitable manner, as for example, it may consist of two channel beams b and b' suitably supported upon the body portion at opposite sides thereof and arranged with the channels facing each other. The upper ends of the beams may be connected together by suitable braces b² and b³ and struts b⁴ and b⁵ may connect the beams at points intermediate their ends with the body portion of the apparatus. The channel beams are inclined to the body portion at their lower ends, while at their upper ends they may conveniently be at right angles to the body portion. The spade is provided with wheels c and c' which ride between the flanges of the channel beams and permit the spade to travel from one end of the beams to the other. The lower ends of the channel beams preferably project beneath the body of the apparatus so as to lie near the surface on which the apparatus rests. The inclination of the channel beams is such that the spade when it is moved downward between the beams may enter the ground at the most advantageous angle. A further object of the inclination is to cause the spade, which is guided in its movements by the beams, to swing forwardly after it has been lifted with its charge, so as to deposit the charge at a point which will not interfere with its further operation. Thus the spade travels in a straight line until the wheels leave the inclined portions of the beams and enter upon the perpendicular top portions, whereupon the spade will be swung out of parallelism with the lower parts of the beams, and into parallelism with the upper parts. This permits the material to be dumped into a suitable chute D which lies in front of the inclined portions of the beams.

It is necessary to provide some means for holding the material upon the spade after a cut has been made in order that it may be removed. To accomplish this end, I provide a guard C' which is associated with the spade and controlled in such a manner that it is

held clear of the spade so as to allow it to enter the material to be excavated, and then closes down upon the spade and moves with it in the upward direction until the lower end of the spade has been brought above the chute; whereupon the guard releases the material upon the spade and permits it to drop into the chute.

It will, of course, be evident that the spade and guard may be variously constructed and controlled so as to permit the various operations to be successfully effected. A convenient form of spade consists of a thin metal blade c² of sufficient thickness to permit it to be forced into the ground, the side walls at one end of the blade being turned up as at c³. The axles c⁴ and c⁵ which carry the wheels c and c' may pass through and be supported by the walls c³ so that the one end of the spade forms a carriage for the spade proper. The side walls of the spade adjacent the cutting edge are preferably turned up as at c⁶ so that, as the spade enters the ground, the wall c⁶ will cut along the sides of the trench. In this way a slice of material is cleanly cut and offers no resistance to its subsequent removal. Furthermore, by making the cut in this manner, there is less danger that the walls will cave in subsequently, due to loosening of the material at the sides which would result in case the slice upon the spade were torn away from the sides instead of being sheared.

The guard C' is preferably also made of sheet metal bent in the form of a trough which, when resting upon the spade, incloses a space sufficiently large to contain a normal slice cut by the spade. The guard is secured to the spade by means of two pairs of links or levers E and E'. These levers may conveniently be mounted at their one end upon the axles c⁴ and c⁵. The levers E are pivotally united to the upturned walls c³ on the guard by means of a rod e which passes through the levers, and through these walls. The levers E' are pivotally connected at their one end to the guard by means of a second rod e' which passes through the wall c⁷ and through these levers. The levers E and E' are so positioned and proportioned that, when they are oscillated away from the cutting edge of the spade, they cause the guard to be drawn downward into engagement with the upper side of the spade; the arrangement being such that the greater the force which is applied to the levers the more closely will the guard and spade be pressed together. On the other hand, when the levers are oscillated in the opposite direction, namely toward the cutting edge of the spade, the guard is carried away from the spade so that its lower end is displaced laterally therefrom a distance somewhat greater than the depth of cut which is made by the spade.

These two positions of the guard are indicated in Figs. 2 and 1; Fig. 2 showing the levers in their one extreme position, wherein the guard forms a housing above the spade; while in Fig. 1 the levers are shown in their other extreme positions, wherein the guard has been moved out of engagement with the spade. In the latter position of the parts the spade is free to make a cut. In the other position the material which the spade has cut away is positively held thereon.

A convenient and advantageous arrangement for operating the spade consists of ropes F attached to the levers E' intermediate their ends for pulling the spade downward and a rope G attached to the levers E intermediate their ends for elevating the spade. It will be seen that when the ropes F are drawn upon they not only force the spade into the material to be excavated, but they also positively carry the guard out of engagement therewith. On the other hand, when the rope G is drawn upon, it acts not only to lift the spade, but positively brings the guard into operative relation thereto so as to retain the load. The ropes F pass over sheaves f and f' supported adjacent the lower ends of the channel beams and then extend upwardly and are connected to a cross bar f^2 . The cross bar has attached thereto a single rope F' which passes around a sheave f^3 suspended from the cross bar b^2 of the structure, and then down to the front of the machine to a drum H. The rope G passes over a sheave g suspended from the cross-bar b^3 of the structure and then down to a drum I at the front of the machine. The rope G may conveniently be connected to the levers E by means of a rod g' to the middle point of which the rope is fastened and the ends of which are supported by the levers. This rod may also act as a stop by resting upon upper ends of the walls c^3 when the parts are in the position shown in Fig. 1 so as to limit the relative movement of the guard upon the spade.

In operation, assuming the parts to be in the position shown in Fig. 1, the drum H is rotated so as to wind up the rope F'. This causes the ends of the rope F which are connected to the spade to be drawn downward and to force the spade positively into the material to be excavated. The winding up of the rope F' continues until the spade has been forced into the material the desired extent and then the drum H is stopped. In the meantime the drum I has been operated in such a manner as to unwind the rope G or the rope G has unwound itself by pulling upon the drum. The rope F' is now slackened and the rope G is wound up upon its drum. The first effect of this is to swing the levers E about their point of connection with the spade so as to cause them to draw the guard down upon the spade as indicated in

Fig. 2. Thereafter the guard and the spade move together as one member, and they are drawn up the incline and then swung forwardly when the supporting wheels enter the vertical portions of the channel beams. At this point the guard engages a stop of some sort which prevents its further upward movement, and the spade continues its upward movement for a short distance and moves laterally away from the guard so that the load is free to drop into the chute. Instead of employing a fixed stop for engagement with the guard at the upper end of its travel, I prefer to make use of a swinging stop in the form of a pair of connected arms K which are pivotally supported by a shaft k upon brackets b^a and b^b projecting laterally from the channel beams. These arms are connected to a swinging frame L by means of rods or cables k' . The frame L may conveniently be pivoted on the rear axle a so that pawls l and l' carried thereby may always be in operative relation to ratchet wheels l^2 and l^3 on the rear wheels A^2 . It will be seen that when the arms K are swung upwardly, a corresponding movement is transmitted to the frame L and that, by reason of the engagement of the pawls with the ratchet wheels, the wheels A^2 will be rotated through a small angle. The parts are so adjusted that the angular movement of the arms K after they are engaged by the axle c^4 or the rod e will be sufficient to cause the entire apparatus to be moved forward a distance equal to the desired depth of cut of the spade before the arms engage with the fixed stop b^a on the frame. In order to vary the distance through which the apparatus is moved at each operation, the point of connection between the members k' and the arms K may be shifted by placing the cross bar or other attaching device k^2 into any of the holes k^3 in the arms.

After the load has been discharged, the rope F' is again wound up and the rope G is permitted to unwind until the parts assume the position shown in Fig. 1. Since there is no resistance offered to the downward movement of the spade until it strikes the ground, the rope G should be controlled in some manner, as by means of a friction brake, so that the spade will not fall too rapidly. The spade is now ready to be driven into the ground to cut another slice.

It will now be seen that I have provided means whereby a spade may be positively forced into the material to be excavated; whereby material is retained upon the spade until it is moved to the point at which dumping is to be effected; and whereby the whole apparatus is then moved forward a distance sufficient to permit the spade to make the desired cut when it again descends into the material to be excavated. Thus a trench or ditch of any desired length may be quickly

and conveniently formed and the excavated material deposited along the side of the trench so that it may readily be returned into the trench when desired. Not only may
 5 a trench be dug rapidly and conveniently, but by reason of the peculiar operation of the guard any loose material which falls to the bottom of the trench between the spade and the guard is scraped up by the guard and is
 10 held upon the spade until dumped in the manner previously described. The bottom of the trench may therefore be made quite even and clean.

The chute for conveying the material from
 15 the apparatus may take any desired form to suit the convenience of the operators or the requirements of the condition under which the excavations are to be made. Instead of
 20 employing a simple inclined trough for the chute, it will be preferable in some instance to make use of a traveling belt M so that if the excavation is being made in swampy
 25 ground, where the material is wet and sticky, it may be positively carried to the side of the apparatus and deposited upon the ground. The conveying belt may be of any ordinary
 30 endless type passing above and beneath the body portion A of the apparatus and over pulleys m secured at the sides of the body
 35 portion. Any suitable means may be employed for operating the belt.

Although any suitable mechanism may be employed for operating the several drums, without departing from the scope of the present invention, a convenient arrangement is
 35 illustrated in the drawings. The drums H and I are loosely mounted upon shafts h and i, respectively. These shafts are mounted in suitable bearings N and N' and are connected to the shaft o of an engine O which
 40 may be mounted on the front end of the apparatus. The driving connection between the engine and the shafts h and i may take any desired form: thus for example, the drum
 45 shafts may be provided with intermeshing gears o' and o'' one of which is driven by a pinion o''' which is in turn driven from the engine shaft by means of a sprocket chain o⁴.
 50 When the engine is in operation, the two drum shafts rotate continuously; so that either drum may be driven to wind up its respective rope by causing it to be clutched to its shaft. When it is desired to cause either
 55 rope to unwind, the corresponding drum is un-clutched from its shaft and the rope is allowed to un-wind therefrom, either freely, or under the control of a suitable brake. To this end each drum may conveniently be provided at its opposite ends with friction cones,
 60 as i', i'', and h', h''. These members are adapted to cooperate with complementary members i³, i⁴, and h³, h⁴, on the driving gears and one of the bearing brackets. Each drum is also free to slide axially upon its shaft so
 65 that it may be shifted in one direction or the

other so as to clutch it to the driving mechanism or cause it to be frictionally held against rotation.

The drums may conveniently be shifted by providing forks I' and H', which are provided with pins I², and H² respectively, for
 70 engaging in annular grooves I³ and H³ in the drums. The forks I' and H' are secured respectively to the ends of an oscillating shaft I⁴ and a surrounding oscillating sleeve H⁴.
 75 The shaft and the sleeve are provided at their other ends with levers I⁵ and H⁵ respectively, these levers being arranged within easy reach of an operator on the apparatus. By oscillating the proper lever either rope
 80 may be caused to be wound up or to be paid out under any desired tension.

If desired, the conveyer belt may be driven by means of a sprocket chain m' engaging a sprocket m² on the end of one of the drum
 85 shafts, such as i. Adjacent one of the pulleys or rollers m is a second sprocket wheel m³ about which the chain m passes and this wheel is connected to a beveled pinion m⁴ which meshes with a complementary pinion
 90 m⁵ connected to the shaft of the member m. Since the drum shafts are arranged to rotate continuously during the operation of the engine, the conveyer belt will also be caused to
 95 travel continuously and, by properly proportioning the gearing, the travel of the conveyer belt may be such that the material deposited thereon is carried away with sufficient rapidity to prevent an accumulation.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In an excavating apparatus, a frame, a spade guided by said frame, means for forcing said spade into the material to be excavated, and means for retaining on the spade the material sheared off thereby.

2. In an excavating apparatus, a frame, a spade slidably supported on said frame, means for reciprocating said spade, and means for retaining on the spade the material sheared off thereby.

3. In an excavating apparatus, a frame, downwardly-inclined guides on said frame, a spade arranged to travel along said guides, means for reciprocating said spade, and means for retaining on the spade the material sheared off thereby.

4. In an excavating apparatus, a frame, a spade movably mounted on said frame, a guard, and means for moving said guard into position to hold the excavated material upon the spade.

5. In an excavating apparatus, a frame, a spade slidably mounted on said frame, means for forcing said spade into the material to be excavated, and means for retaining on the spade the material sheared off thereby during the withdrawal of the spade.

6. In an excavating apparatus, a frame, a

reciprocatory spade mounted on said frame, means for forcing said spade into the material to be excavated, means for withdrawing the spade from the material, and means for retaining upon the spade the portion of the material which has been sheared off thereby.

7. In an excavating apparatus, a frame, a spade slidably mounted on said frame, said spade having a cutting edge at one end and cutting flanges arranged at the sides thereof in planes at an angle to the cutting edge, means for forcing said spade into the material to be excavated, a guard cooperating with said flanges to form a housing for retaining the excavated material upon the spade, and means for moving the guard from and toward the spade during each cycle of operations of the spade.

8. In an excavating machine, a frame, a spade slidably mounted on said frame, a guard for said spade, said guard and spade being so arranged that when in operative relation to each other they form a chamber closed at the sides and at one end, means for forcing said spade into the material to be excavated, and means for actuating the guard so as to bring it into operative relation with the spade and thereby retain on the spade the material which has been sheared off.

9. In an excavating apparatus, a frame, a spade supported on said frame, means for forcing said spade into the material to be excavated, means for retracting the spade, and means associated with said spade and its operating means for holding the excavated material on the spade during the withdrawal of the spade and for thereafter permitting such material to be discharged from the spade.

10. In an excavating apparatus, a frame, a spade movably mounted on said frame, a guard for said spade, a device for forcing the spade into the material to be excavated, a hoisting device, and connections between said device and the spade and its guard so arranged that the guard is held out of operative relation to the spade during its passage into the material to be excavated and is brought into operative engagement with the spade to hold the excavated material thereon during the hoisting of the spade.

11. In an excavating apparatus, a spade, a guard for said spade arranged to form therewith a compartment closed at one end and at the sides, levers connected at their opposite ends to the spade and to the guard, said levers being so arranged that when they are oscillated in one direction they produce a separation between the spade and the guard, while upon oscillation thereof in the opposite direction they force the spade and guard together.

12. In an excavating apparatus, a spade, a guard for the spade arranged to form therewith a tube closed at one end, a pair of

levers pivotally connected to the guard and to the spade, the levers being so proportioned and arranged that when they are oscillated in one direction the spade and guard are brought together, while upon oscillating the levers in the opposite direction they are separated so as to permit the spade to be forced into the material to be excavated without being impeded by the guard.

13. In an excavating apparatus, a movable frame, a spade mounted so as to reciprocate on said frame, means for forcing said spade into the material to be excavated, means for hoisting the spade from the material, and means for automatically moving said frame step by step after each cycle of operations of the spade.

14. In an excavating apparatus, a frame, a spade, means for reciprocating said spade, and means for causing said spade to move rectilinearly during a portion of its stroke and for causing it to swing laterally during another portion of its stroke.

15. In an excavating apparatus, a frame, a spade, means for reciprocating said spade, means for causing said spade to move rectilinearly during a portion of its stroke and for causing it to be swung laterally during another portion of its stroke, a guard for retaining excavated material on the spade when the guard is in operative relation to the spade, and means for maintaining the guard in operative relation to the spade during its rectilinear movement in one direction, and for effecting the disengagement of the spade from the guard after the spade has been swung laterally.

16. In an excavating apparatus, a frame, guides comprising two portions arranged at an angle to each other, a spade, means on the spade for engaging said guide, means for causing said spade to travel across the guides, a guard for retaining excavated material on the spade, and means for holding said guard in operative relation to the spade while the spade is moved on one portion of the guides and for causing the guard to move out of operative relation to the spade when the spade enters upon the other portion of the guide, and a chute so situated as to be located beneath the lower end of the spade when the spade is on said latter portion of the guides.

17. In an excavating apparatus, a frame, guides on said frame consisting of upper vertical portions and lower inclined portions, a spade, means on the spade for engaging said guides, means for moving said spade back and forth along the guides, a guard for retaining excavated material upon the spade, means for controlling the guard so as to maintain it in operative relation to the spade during the upward travel of the spade along the inclined portions of the guides, and for moving the guard out of operative relation to the spade when the spade is on the vertical

portions of the guides, and a chute arranged beneath the vertical portions of the guides to receive the excavated material from the spade.

18. In an excavating apparatus, a spade, means for forcing the spade into the material to be excavated, means for hoisting the spade out of the material to be excavated, and means for automatically shifting the apparatus a distance equal to the thickness of the cut by the spade after the spade has been retracted from the material in which the excavation is being made.

19. In an excavating apparatus, a movable frame, guides on said frame consisting of an upper vertical portion and a lower inclined portion, a spade movably mounted on said guides, a guard for said spade, a movable stop on said frame adjacent the vertical portion of the guides, means associated with said stop for moving the frame when the stop is operated, means for forcing said spade into the material to be excavated, and means for hoisting it against said stop so as to operate the stop.

20. In an excavating apparatus, a movable frame, guides on said frame consisting of an upper vertical portion and a lower inclined portion, a spade movably mounted on said guides, a guard for said spade, a movable stop on said frame adjacent the vertical portion of the guides, means associated with said stop for moving the frame when the stop is operated, means for forcing said spade into the material to be excavated, means for hoisting it against said stop so as to operate the stop, a guard, and connections between the guard and the spade for causing the guard to be held in operative relation to the spade during the hoisting movement with the spade, and to be carried out of operative relation to the spade upon engagement thereof with said stop.

21. In an excavating apparatus, a frame, guides on said frame consisting of an upper

vertical portion and a lower inclined portion, a spade mounted on said guides, a guard for said spade for permitting relative longitudinal movement between the guard and the spade, said connections being so arranged that when the relative longitudinal movement between the guard and the spade is in one direction the guard and spade are moved laterally toward each other, while upon a relative longitudinal movement in the opposite direction the guard and spade are moved away from each other in the lateral direction, means for moving said spade toward and into the material to be excavated and at the same time producing a relative movement between the guard and spade away from each other, and means for hoisting the spade and at the same time forcing the guard and spade toward each other, and a stop adjacent the upper vertical portion of the guides for causing the guard and spade to be moved away from each other in the lateral direction when carried against the stop.

22. In an excavating apparatus, a frame, downwardly inclined guides on the frame, a spade slidably mounted on said guides, a guard for retaining on the spade the excavated material, means for operating the spade and the guard to force the spade into the material to be excavated and at the same time move the guard into engagement with the bottom of the excavation at a point in advance of the spade, and for withdrawing the spade from the material and at the same time drawing the guard along the bottom of the excavation into engagement with the spade so as to retain the material on the spade during the retraction of the spade.

In testimony whereof, I sign this specification in the presence of two witnesses.

EDWIN O. ROOD.

Witnesses:

JAS. E. VERRALL,
RAYMOND ROBERTS.