No. 893,398. PATENTED JULY 14, 1908.

H. STROM.

EXCAVATING MACHINE.

APPLICATION FILED MAY 29, 1907.

4 SHEETS—SHEET 1.

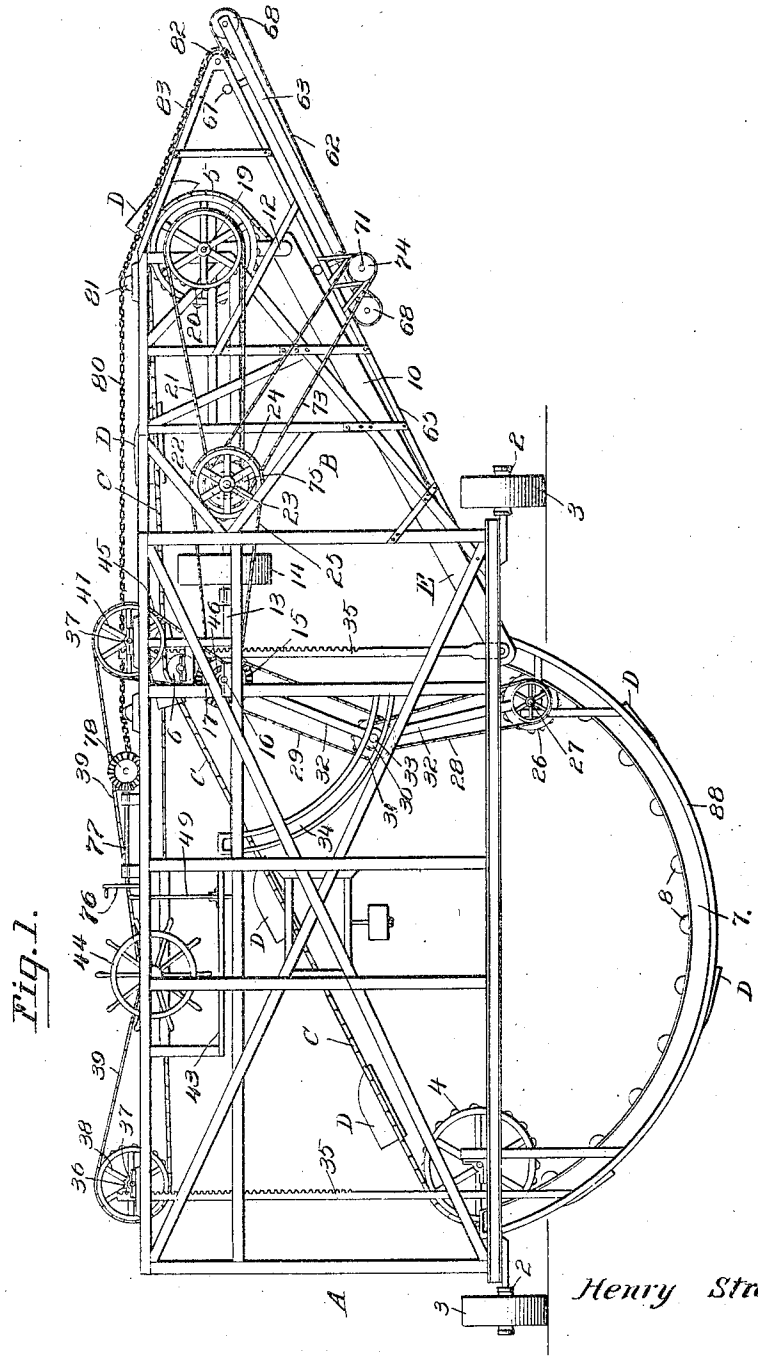

Fig. 1.

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Witnesses
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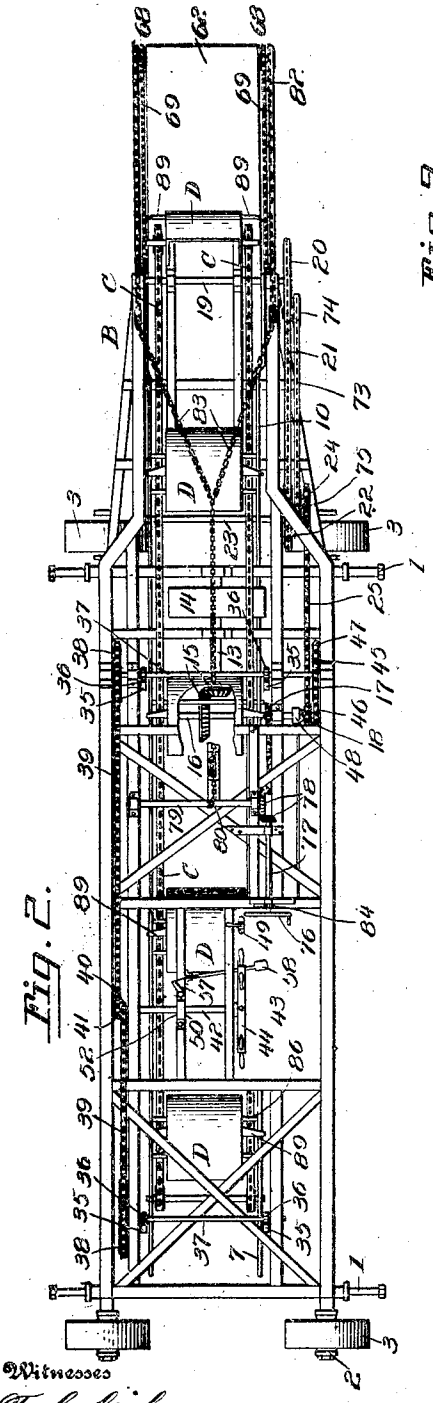

Fig. 2.

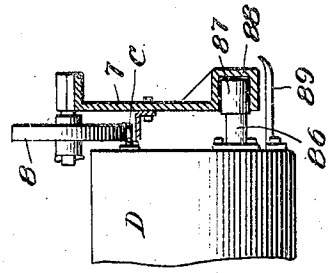

Fig. 5.

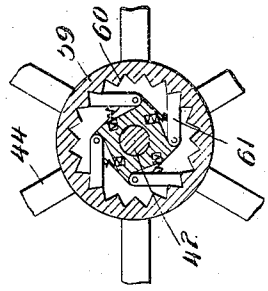

Fig. 8.

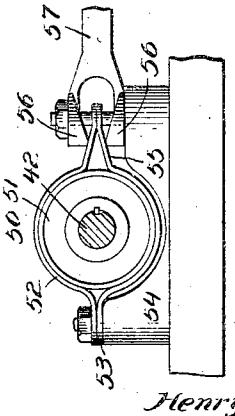

Fig. 7.

Witnesses

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4 SHEETS—SHEET 3.

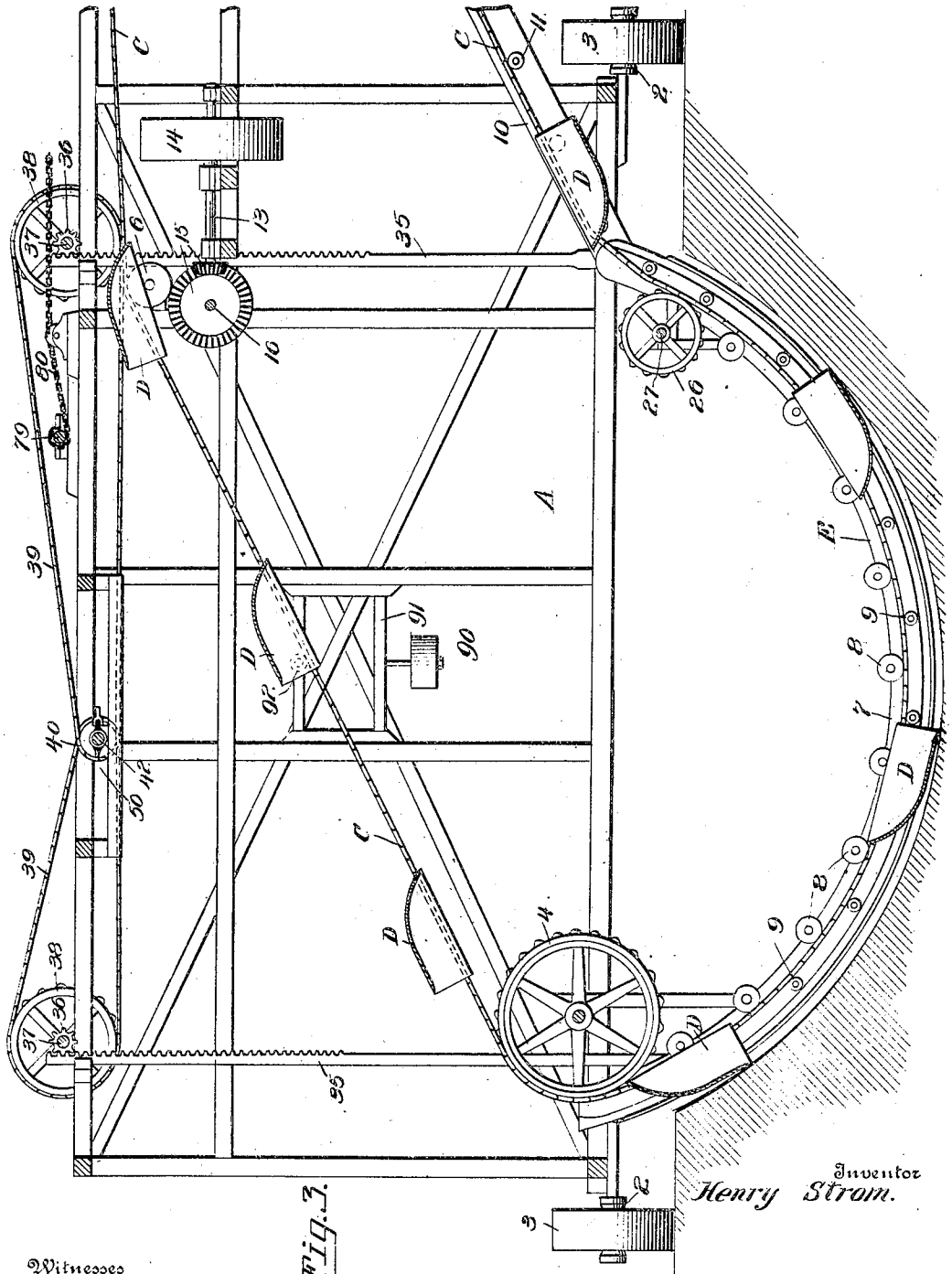

Fig. 3.

Witnesses

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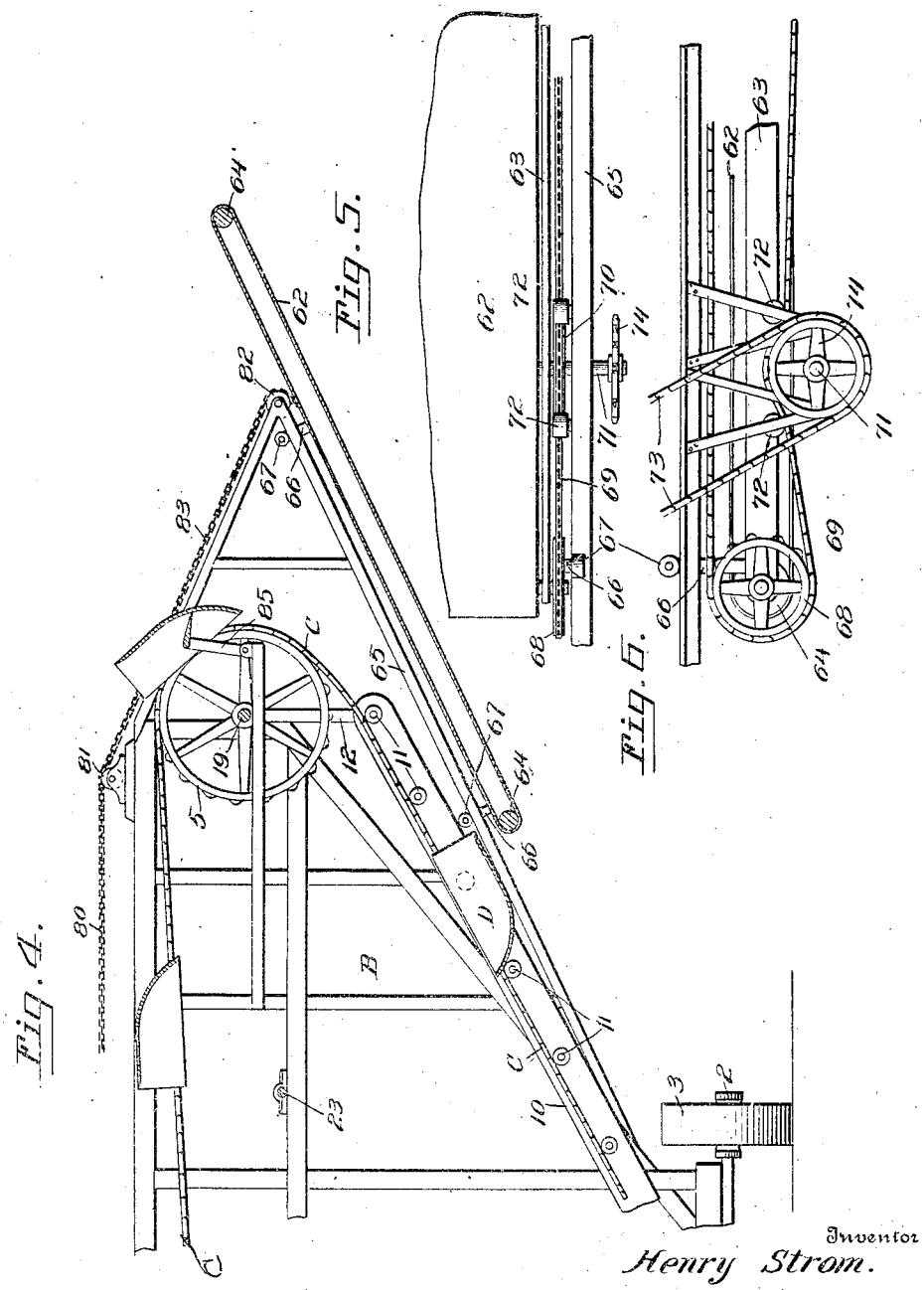

Fig. 4.

Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE.

HENRY STROM, OF HILLSBORO, NORTH DAKOTA.

EXCAVATING-MACHINE.

No. 893,398. Specification of Letters Patent. Patented July 14, 1908.

Application filed May 29, 1907. Serial No. 376,288.

To all whom it may concern:

Be it known that I, HENRY STROM, a citizen of the United States, residing at Hillsboro, in the county of Traill and State of North Dakota, have invented new and useful Improvements in Excavating-Machines, of which the following is a specification.

This invention relates to a machine for excavating, grading and other purposes, of that type in which the buckets or shovels are mounted on an endless chain so as to take up the earth, sand or other material at one point and discharge it at another point.

The invention has for one of its objects to improve and simplify the construction and operation of machines of this character so as to be comparatively easy and inexpensive to manufacture, thoroughly reliable and efficient in use, readily controlled and adapted for a large variety of uses.

A further object of the invention is the provision of an excavating, grading and earth moving machine comprising a feeding device controlling the depth of cut and including means whereby the engine can be employed for returning the feeding device to initial position to begin another cut.

A still further object is the provision of a discharge apron or endless belt which receives the material from the buckets and delivers it to the proper point, the endless belt being adjustable to deliver the material at any desired point and provided with driving means receiving power from the same source employed for operating the other parts of the machine.

Another object of the invention is the employment of an endless bucket-carrying chain, and a simple and effective means for guiding the movement of the loaded buckets and for permitting the buckets and chain to be moved to inoperative position as in transporting the machine from place to place.

A further object is to provide a machine having a manually controlled mechanism for raising and lowering the feeding device and a manually controlled means for adjusting the discharge apron, the said means being located at a convenient point so as to be under the control of a single operator.

With these objects in view and others, as will appear as the description proceeds, the invention comprises the various novel features of construction and arrangement of parts which will be more fully described hereinafter and set forth with particularity in the claims appended hereto.

In the accompanying drawings, which illustrate one of the embodiments of the invention, Figure 1 is a side elevation of a machine. Fig. 2 is a plan view thereof. Fig. 3 is an enlarged vertical section of the main body portion of the machine. Fig. 4 is a similar view of the discharge end of the machine, forming a continuation of Fig. 3. Fig. 5 is a plan view of the mechanism for driving the discharge apron or belt. Fig. 6 is a side elevation thereof. Fig. 7 is a detail view of the brake for the feeding device. Fig. 8 is a detail sectional view of the clutch of the wheel for actuating the feeding device by hand. Fig. 9 is a detail sectional view of the guide frame of the bucket guide of the feeding device.

Similar reference characters are employed to designate corresponding parts throughout the several views.

Referring to the drawing, A designates the main frame of the machine that is rectangular in form and comprises an openwork structure of iron or wooden beams, and at one end is an overhanging extension B. The main frame A is provided at its corner with transversely extending axles 1 on longitudinally extending axles 2, and on either set of these axles are wheels 3. The wheels are placed on the axles 1 when the machine is transported from place to place, and on the axles 2 when the machine is in operation, as shown. The machine is adapted to be propelled by an external source of power such for instance as a traction engine which may be attached in any suitable manner.

The digging mechanism in the present instance, comprises a pair of parallel sprocket chains C on which are arranged scoop-shaped buckets or shovels D of any approved design and suitably spaced apart, and the chains pass over sprocket wheels 4 and 5 at the rear lower corner of the main frame and the outer portion of the extension frame B respectively, and to support the upper half of the chain between these two points are guide rollers 6 adjacent the top of the frame A. The lower half or portion of the digging element is mounted in a sutiable guide E that is adapted to support the weight of the chains and buckets and the contents of the latter. One part of this guide comprises an arcuate frame composed of side members 7 located in

the main frame and constituting a part of the feeding mechanism. As clearly shown in Fig. 3, this arcuate portion of the guide is provided with two sets of rollers 8 and 9 mounted on the side members 7, the latter rollers engaging the under side of the bucket carrying chains and the rollers 8, the upper side of the chains. By this means, the buckets are guided in an arcuate path so that a ditch or trench of a form corresponding to the members 7 is dug. The idlers or sprocket wheels 4 are located at one end of the arcuate portion of the guide E. The other portion of the guide comprises a pair of straight side members 10 hingedly connected with the front end of the members 7 and suitably spaced apart so as to permit the buckets D to pass between them, and on the inner surfaces of the side members 10 are rollers 11 for supporting the chains C and preventing sagging thereof. The upper end of the straight portion of the guide E terminates just below the sprocket wheels 5 and is supported by means of hangers 12 on the extension B.

For driving the digging mechanism or bucket carrying chains, a driving shaft 13 is arranged on the main frame and provided with a pulley 14 adapted to be belted to the traction engine, and by means of miter gearing 15 drives a countershaft 16 supported on the main frame at a point adjacent to and below the roller 6 for the chain C. On the countershaft are sprocket wheels 17 and 18 for driving main and auxiliary sprocket wheels for the bucket carrying chains C. The main driving wheels are designated by 5, and on the shaft 19 is a sprocket wheel 20 meshing with the sprocket chain 21 that passes over a sprocket wheel 22 on a countershaft 23. On the countershaft 23 is a sprocket wheel 24 meshing with a sprocket chain 25 that passes around the sprocket wheel 18 on the first-mentioned countershaft 16. By this arrangement, the speed reduction is obtained between the engine and main sprocket wheels 5 of the bucket chains. The secondary means for driving the chains C comprises sprocket wheels 26 arranged on a shaft 27 at the front end of the arcuate portion of the guide E, the shaft being driven by two sprocket and chain transmissions 28 and 29 in the latter of which is the sprocket wheel 17 on the shaft 16. In order to permit power to be transmitted through the sprocket and chain mechanisms 28 and 29 at any point in the cut, the sprockets 30 and 31 are mounted on hingedly connected links 32 at the point 33, the opposite ends of the links being hingedly connected with the shafts 16 and 27. The axle 33 of the sprockets 30 and 31 moves in a slotted quadrant 34 secured to the main frame and arranged concentric with the shaft 16. Thus, as the guide E is moved up or down during the manipulation of the machine, the links 32 will change their angular relation and maintain the sprocket and chain mechanisms 28 and 29 in constant operative condition.

The feed of the buckets is accomplished by means of the vertical rack bars 35 suitably guided on the main frame and connected at their lower ends with the member 7 and meshing with the teeth thereof are pinions 36 on horizontal transversely extending shafts 37 mounted on the top of the main frame. On the shafts 37 are sprocket wheels 38 over which pass chains 39 engaging respectively, small sprocket wheels or pinions 40 and 41 on the horizontal shaft 42 arranged above the operator's platform 43. On the shaft 42 is a capstan wheel 44, whereby the operator can transmit motion to the pinions 36 for raising or lowering the arcuate frame for guiding the buckets during the digging or cutting operation. In order to quickly raise the arcuate frame and attached parts power is taken from the shaft 16 by means of a crossed sprocket chain 45 passing over sprocket wheels 46 and 47 on the shaft 16 and adjacent shaft 37, respectively, the transmission of power through this sprocket and chain mechanism is controlled by a clutch 48, Fig. 2, that is thrown into and out of operation by a hand lever 49 at the operator's platform and suitably connected therewith. As shown in Figs. 2 and 7, the shaft 42 is provided with a brake device 50 comprising a disk 51 keyed to the shaft and brake shoes or gripping members 52 arranged to engage the periphery of the disk and having corresponding ends fixed at 53 to a stationary part 54, and their opposite ends formed into ears 55 that are engaged by cams 56 for operating on the ears to set the brake members. The cams 56 are formed on a lever 57 suitably fulcrumed and connected with a foot lever 58. When the brake 50 is set, the parts of the feeding device can be held in raised position so as to be out of the way of obstructions during the transportation of the machine. The hub 59 of the hand wheel 44, as shown in Fig. 8, is chambered and provided with internal teeth 60 with which coöperate spring actuated pawls 61 that are connected to rotate with the shaft 42, and by this means the said shaft can rotate independently of the wheel, as when the parts of the feeding device are elevated by power received from the engine.

On the outer end of the extension frame B is a discharging device upon which the buckets deposit their contents, the said device comprising an endless belt or apron 62 mounted on a carriage 63 and passing around rollers 64 on the carriage. The apron 62 is arranged under the extension frame B in inclined position and is movably suspended on the bottom rails 65 of the extension frame by hangers 66 which are fitted

with rollers 67 engaging the top surface of the rails 65. By this means, the apron carriage can be projected outwardly and elevated so as to change the point of discharge of the material therefrom. As shown in Figs. 1, 5 and 6, the rollers 64 are provided with sprocket wheels 68 around which pass a sprocket chain 69, whereby both rollers are driven simultaneously. The discharging apron 62 is actuated by means of a sprocket wheel 70 on a shaft 71 disposed under the apron and meshing with the sprocket 69, there being rollers 72 on the carriage 63 for holding the sprocket 69 in engagement with the sprocket wheel 70. The shaft 71 is driven from the countershaft 23 by a sprocket and chain mechanism comprising a chain 73, sprocket wheel 74 on the shaft 71, and sprocket wheel 75 on the shaft 23, so that as long as the digging mechanism is operating, the discharging apron will be maintained in action. To shift the position of the dischar ing apron, a hand wheel 76 is arranged at the operator's platform to rotate a horizontal shaft 77 on the top of the main frame which, through a miter gearing 78, rotates a transversely extending shaft 79. On this shaft is adapted to wind a flexible element or chain 80 that extends longitudinally over the top of the frame and is guided on a pulley, as shown in Figs. 1 and 2 and is guided by a pulley 81 and which branches to pass over pulleys 82, the extremities of the branches 83 being connected with the apron carriage 63 for projecting it outwardly and upwardly. Since the carriage is mounted to move on an incline, it will automatically return to its lower position when the chain 80 is permitted to unwind. The parts may be held in locked position by a pawl and ratchet mechanism 84 arranged adjacent the hand wheel 76, as shown in Fig. 2. Located on the frame extension B at a point directly above the discharge apron, is a bucket scraping device 85, as shown in Fig. 4, which is adapted to dislodge any material tending to adhere to the bottom of the bucket.

By reference to Fig. 9, it will be seen that the buckets D are provided with outwardly extending journals 86 on which are rollers 87 that engage in guideways 88 in the members 7 so as to firmly hold the buckets in position during the digging. Since the buckets are located between the side members 7, it is necessary to cut away the earth under the side members 7 as the digging proceeds, and for this purpose each end wall of the bucket is provided with a horizontally extending knife 89 disposed directly below the side members, adjacent the side members 7, whereby the earth is cut away and taken up by succeeding buckets. The chains C are provided with devices for taking up the sag as the parts of the feeding device are operated, and such device comprises a weight 90 for each chain which is attached to a vertically movable structure 91 guided on the main frame and provided with a roller 92 engaging on the top side of the chains C, so that as the latter sags between the sprocket wheels 4 and guide rollers 6, the weights 90 will drop and carry the chains with them and thus maintain the chains in operative relation with the sprocket wheels.

In practice, the machine is transported by means of a traction engine to the place where the ditching, trenching or excavating is to be done, the wheels 3 being arranged on the axles 1. The traction engine can be coupled to the machine in any suitable manner for transportation and for moving the latter step by step during the digging operation. When the machine is to be used for digging an irrigating ditch or canal or the like, the machine is jacked up and the wheels 3 transferred to the axles 2. The traction engine is then coupled to the side of the machine so as to move it bodily in a lateral direction as the successive cuts are to be made. The fly wheel of the traction engine is belted to the wheel 14 of the machine so as to deliver power for operating the various parts. Normally the buckets or shovels of the endless chain are in raised position and are so held by means of the brake device 50 so that the machine can be transported from place to place without the shovels meeting obstructions. As soon as power is thrown on the machine, the operator on the platform 43 disengages the brake so that the feeding device, including the endless conveyer guide E will drop by gravity so that as the endless conveyer travels, the shovels will take up the earth and the earth will be gradually cut away by the automatic lowering of the guide E, together with the buckets until the cut is completed. As the buckets reach the sprocket wheels 5 at the discharge end of the machine, the earth is dropped on the endless apron 62 and thereby deposited. As the pile under the apron increases in height, the apron can be projected upwardly and outwardly by turning the hand wheel 76 at the operator's platform. After one cut is made, the power at the traction wheel is thrown off and the traction wheels are clutched in so that the engine can be moved forwardly a distance equal to the width of the buckets, it being necessary, of course, to raise the endless conveyer guide E to its uppermost position. To raise the said guide, the operator throws in the clutch 48 before the power is taken off the machine, so that the guide can be raised by the engine. The machine clutch 48 causes the shaft 16 to rotate the right hand shaft 37, so that the pinion 36 will move the right-hand rack 35 upwardly, and by means of the sprocket chains 39, the sprockets 40 and 41, and left hand sprocket wheel 38, the pinion 36 at the left will cause its rack 35 to be raised.

If desired, however, the endless conveyer guide E can be raised by the operator turning the hand wheel 44. After the machine has been moved forwardly one step, the digging operation is repeated to make another cut and this process is carried on continuously until the work is finished. The machine, while useful in making ditches, trenches and other excavations, can, of course, be used for removing banks, piles of earth and grading.

From the foregoing description, taken in connection with the accompanying drawings, the advantages of the construction and of the method of operation will be readily apparent to those skilled in the art to which the invention appertains, and while I have described the principle of operation of the invention, together with the apparatus which I now consider to be the best embodiment thereof, I desire to have it understood that the apparatus shown is merely illustrative and that such changes may be made when desired, as are within the scope of the claims.

Having thus described the invention, what I claim is:—

1. In a machine of the class described, the combination of a frame, an endless conveyer thereon, shovels on the conveyer, means for feeding the conveyer, an endless discharge apron on the frame and arranged in the same vertical plane with the conveyer for receiving the material from the shovels, and means for bodily moving the apron back and forth in a path in line with the length of the conveyer.

2. In a machine of the class described, the combination of a supporting frame, an endless conveyer mounted thereon, shovels carried by the conveyer, a vertically movable guide through which the conveyer passes at the point where the shovels take up material, an inclined guide hingedly connected with one end of the other guide, means for raising the guides by power, an apron supported under the inclined guide, and means for shifting the apron back and forth in the direction of its length.

3. In a machine of the class described, the combination of a framework, an endless conveyer mounted thereon, shovels on the conveyer, means for driving the conveyer, a guide through which the conveyer passes at the points where the shovels are brought into operation, a clutch for holding the guide in fixed position, and a cam means for locking or releasing the clutch device and a mechanism deriving power from said means for moving the guide.

4. In a machine of the class described, the combination of a frame, an endless conveyer mounted thereon, shovels carried by the conveyer, a guide on the frame through which the conveyer passes, a mechanism for moving the guide by hand or by power, an endless apron at one end of the conveyer, a flexible element for shifting the apron, and a winding device for the element.

5. In a machine of the class described, the combination of a supporting frame, endless chains thereon, sprocket wheels for the chains, shovels attached to the chains, means for driving the chains, a weighted device mounted for vertical movement on the frame and disposed to yieldingly hold the chains taut a guide through which the chains pass as the shovels take up material, and a means for vertically moving the guide, said latter means including a clutch device.

6. In a machine of the class described, the combination of a frame, bucket carrying means thereon, a guide for said means, racks connected with the guide, simultaneously actuated pinions meshing with the racks for moving the guide, a driving shaft, mechanism between the shaft and pinions for actuating the latter, and a clutch on the shaft for holding the latter stationary and sustaining the weight of the guide and attached parts.

7. In a machine of the class described, the combination of a supporting structure, endless shovel carrying elements, a weighted device guided on the structure and sustained by the elements for holding the latter taut, a guide for the elements arranged to lower by gravity during the operation of the shovels, a device for holding the guide normally in raised position, and means for moving the guide upwardly.

8. In a machine of the class described, the combination of a framework, a bucket carrying means guided thereon, buckets on the means, and horizontally extending fixed knives projecting laterally from the ends of the buckets, an arcuate guide mounted on the framework for holding the buckets on the means in active position, and means for vertically moving the guide.

9. In a machine of the class described, the combination of a framework, endless bucket-carrying elements thereon, an endless apron disposed to receive the material from the bucket, a movable frame supporting the apron, means for shifting the frame back and forth, a sprocket and chain mechanism for driving the apron, and a toothed wheel meshing with the sprocket chain for driving the latter irrespective of the position of the frame.

10. In a machine of the class described, the combination of a framework, endless bucket-carrying elements thereon, an endless apron disposed to receive the material from the bucket, a movable frame supporting the apron, means for shifting the frame back and forth, a sprocket and chain mechanism for driving the apron, a toothed wheel meshing with the sprocket chain for driving the latter irrespective of the position of the frame, and

a common mechanism for driving the said toothed wheel and the bucket-carrying elements.

11. In a machine of the class described, the combination of a supporting structure, an endless conveyer mounted thereon consisting of spaced chains, shovels on the conveyer and located between the chains thereof, a guide for the lower length of the conveyer composed of differently shaped parts, knives projecting laterally from the ends of the buckets and disposed under the chains, and means for raising and lowering the guide.

12. In a machine of the class described, the combination of a supporting structure, an endless conveyer, buckets thereon, a guide consisting of two parts, one part being shaped to correspond to the ditch to be dug, means for vertically moving the guide, and a guiding mechanism for the conveyer, said mechanism consisting of a driving shaft, a driven shaft mounted on and movable with the guide, means on the driven shaft for engaging the conveyer to propel the same, a plurality of links pivoted to the shafts and hingedly connected together, and sprocket and chain devices supported by the links for transmitting power from the driving to the driven shaft.

13. In a machine of the class described, the combination of a supporting frame, an endless conveyer mounted thereon, shovels attached to the conveyer, a guide for supporting the lower lengths of the conveyer, a driving shaft arranged in fixed position, and a driving mechanism between the shaft and lower length of the conveyer, said mechanism comprising a pair of links connected respectively with the shaft and guide to have swinging movement, means for hingedly connecting the links, an arcuate guide disposed concentric with the driving shaft for guiding the movement of the links, and devices carried by the links for transmitting power from the driving shaft to the conveyer.

14. In a machine of the class described, the combination of a supporting frame, an endless conveyer thereon, a vertically movable guide for the lower length of the conveyer, shovels on the conveyer, a driving shaft, means on the guide for actuating the conveyer, flexible driving connections between the shaft and said means, and automatic means for holding the conveyer taut as the guide is raised or lowered.

15. In a machine of the class described, the combination of a framework, an endless conveyer thereon, shovels on the conveyer, a two-part guide for the lower length of the conveyer, rack members connected with the guide for vertically moving the same, pinions meshing with the racks, manually for simultaneously actuating the pinions, a mechanism for driving the conveyer, a clutch device for actuating the pinions from said guiding means, gravity-actuated means sustained by the conveyer for holding the latter taut as the guide is raised or lowered.

16. In a machine of the class described, the combination of a framework, an endless conveyer thereon, shovels on the conveyer, a longitudinally movable discharge apron for receiving the material from the shovels, mechanism for driving the apron irrespective of the position of the latter and means for changing the position of the apron at a relatively remote point.

17. In a machine of the class described, the combination of a supporting structure, an endless conveyer thereon, shovels on the conveyer, an endless apron mounted on the structure to receive the material from the shovels, a mechanism for driving the conveyer, means for driving the apron from the said mechanism, a device for manually adjusting the position of the apron, and means supporting the apron to permit the latter to return to initial position by gravity.

18. In a machine of the class described, the combination of a supporting frame, an endless conveyer thereon, shovels on the conveyer, a guide for the lower length of the conveyer, an operator's platform on the frame, means for raising and lowering the guide from the platform, an endless discharge apron for receiving material from the shovels, a mechanism for simultaneously driving the conveyer and apron, and means controlled from the operator's platform for changing the position of the apron.

In testimony whereof, I affix my signature in presence of two witnesses.

HENRY STROM.

Witnesses:
JOHN T. STROM,
P. G. SWENSON.