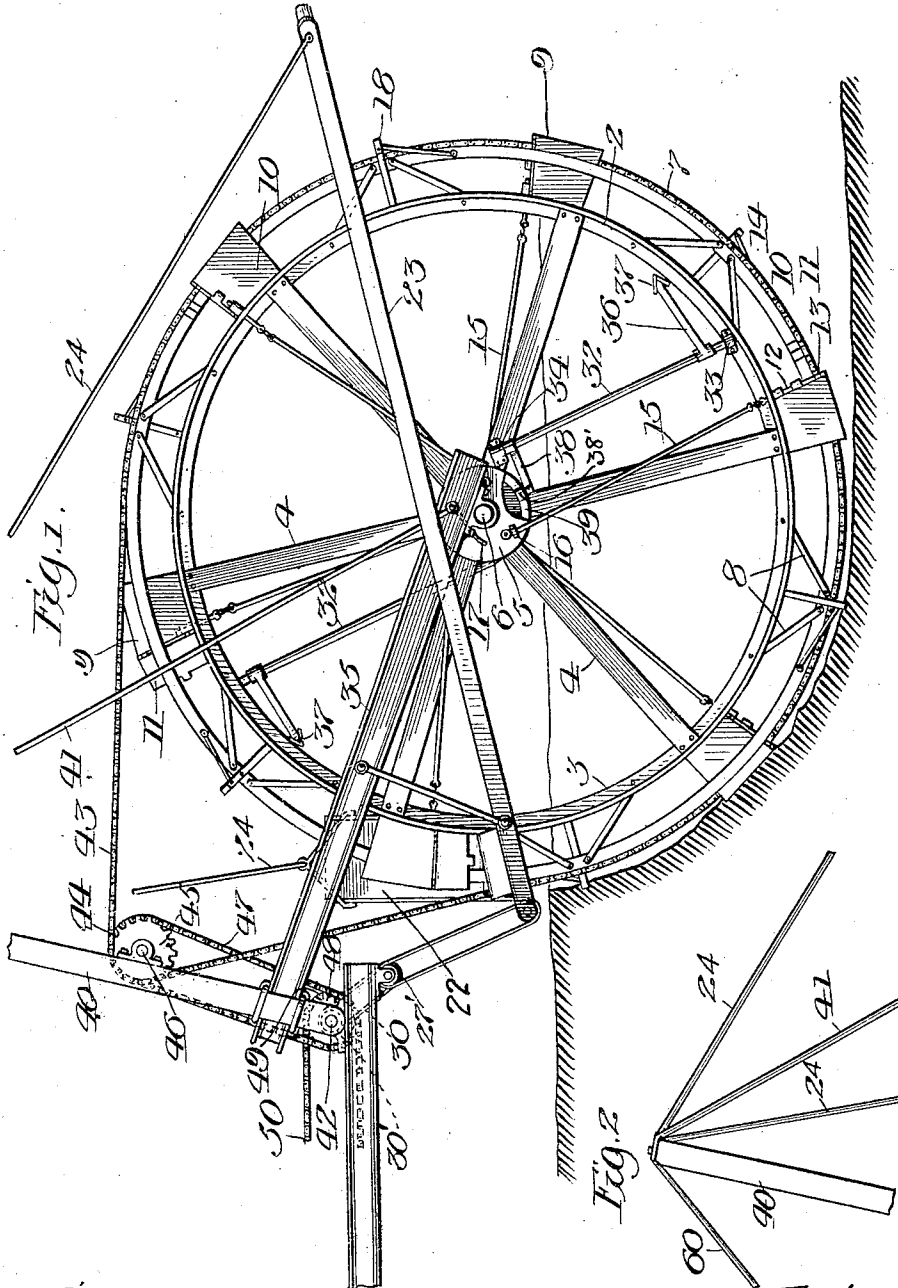


D. W. MILLER.
EXCAVATING MACHINE.
APPLICATION FILED FEB. 11. 1908.

976,590.

Patented Nov. 22, 1910.

3 SHEETS—SHEET 1.



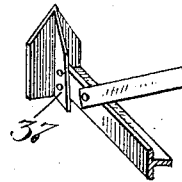
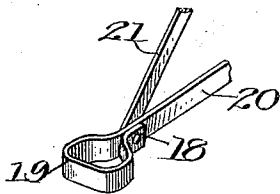
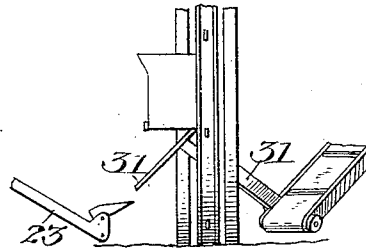
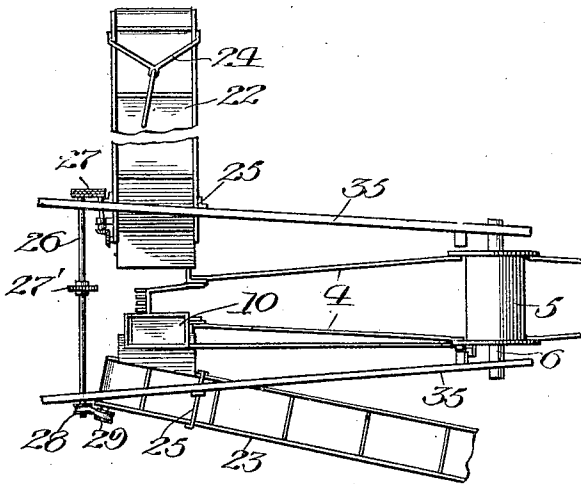
Witnesses:
O. M. Merrill
F. L. Belknap

by

Inventor,
David W. Miller,
Albert N. Graves, atty

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3 SHEETS--SHEET 2.



Wm. Merrick
F. L. Belknap

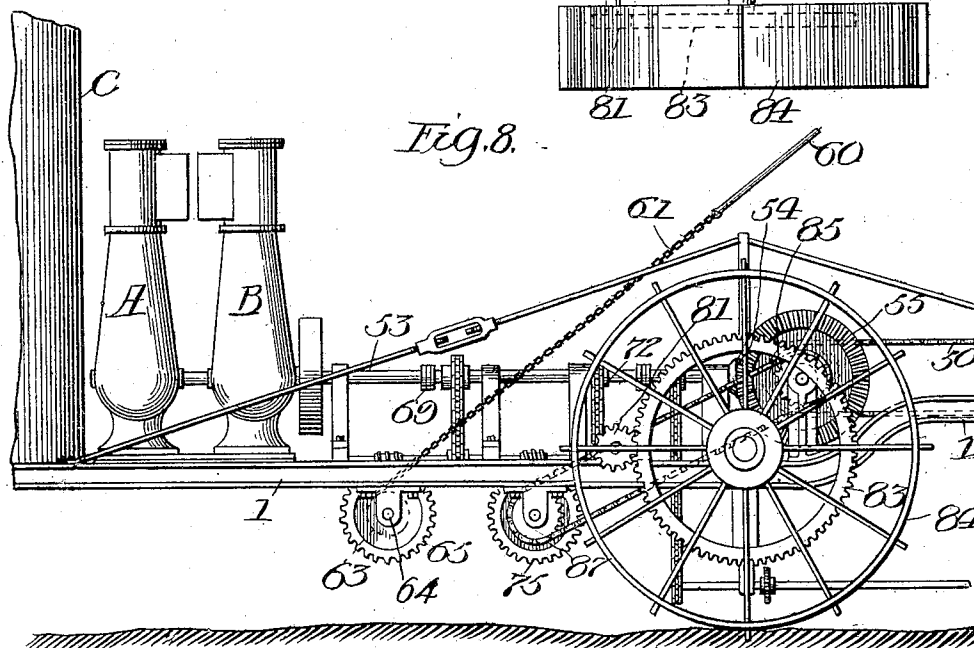
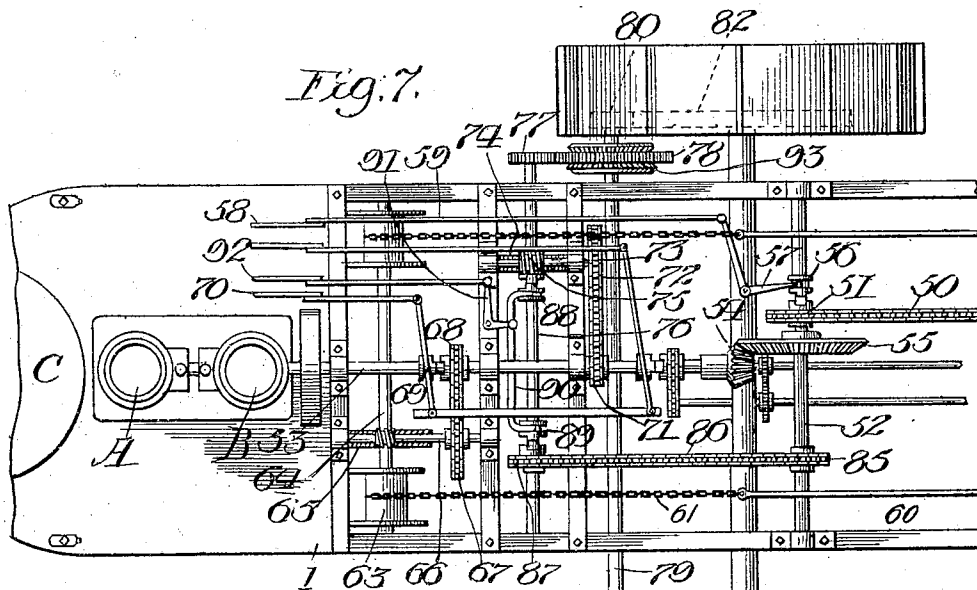
Inventor:
David W. Miller.
Albert H. Graves.
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3 SHEETS-SHEET 3.



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UNITED STATES PATENT OFFICE.

DAVID W. MILLER, OF CHICAGO, ILLINOIS.

EXCAVATING-MACHINE.

976,590.

Specification of Letters Patent.

Patented Nov. 22, 1910.

Original application filed January 8, 1907, Serial No. 351,347. Divided and this application filed February 11, 1908. Serial No. 415,313.

To all whom it may concern:

Be it known that I, DAVID W. MILLER, a citizen of the United States, residing in the city of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Excavating-Machines, of which the following is a specification.

This invention relates to improvements in excavating machines of that type in which the excavator is embodied in the form of a rotary wheel which is supported and carried along by a traveling wagon or truck, and progressively excavates the ditch in the rear of the wagon.

This specification is a divisional application of the original application filed by me January 8, 1907, Serial No. 351,347.

Among the salient objects of the invention are to provide a machine of the character referred to, the excavator wheel of which carries a series of diggers and buckets arranged on either side of the wheel and which co-operate to loosen the soil and collect and carry it upwardly out of the ditch; to provide in a construction of the character referred to automatically operating mechanism for tripping open the hinged member on the respective buckets to discharge the soil into the traveling conveyers; to provide improved means for digging the ditch wider at the top than at the bottom, said means being automatically controlled by the rotation of the excavator wheel; to provide improved means for supporting the conveyer belts at various angles relative to the excavator wheel; to provide improved means for conveying the soil from the respective buckets to the traveling conveyers; to provide a construction in which the excavator wheel and conveyer belts may be bodily raised and lowered and otherwise manipulated, the wagon and excavator propelled slowly and at a rate of speed suitable to excavate the ditch, and at a higher rate of speed when not excavating; and in general to provide an improved construction of the character referred to.

To the above ends the invention consists in the matters hereinafter described and more particularly pointed out in the appended claims.

The invention will be readily understood from the following description, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of my improved excavator wheel showing also a portion of the supporting frame. Fig. 2 is a fragmentary elevation of the upper part of the strut frame and various connecting rods. Fig. 3 is a fragmentary plan view of the excavator wheel on a reduced scale and showing particularly the connections of the traveling conveyers. Fig. 4 is a fragmentary detail view showing the manner in which the soil is emptied from the buckets onto the traveling conveyers. Fig. 5 is a fragmentary detail of one of the diggers with which the excavator wheel is provided. Fig. 6 is a perspective detail of one of the spring teeth of diggers used in widening the top of the ditch. Figs. 7 and 8 are respectively a top plan view and side elevation of the preferred driving mechanism, parts being broken away to reduce the size of the drawing.

Referring to the drawings 1 designates as a whole a suitable wagon or operating truck, to which is operatively connected an excavator wheel designated as a whole 2. Describing first the excavator wheel, it comprises a peripheral inner rim 3, a series of spokes 4, a hub and main axle 5 and 6 respectively, and an outer supporting ring 7 arranged concentrically with the main inner rim 3 and rigidly supported from the latter by means of suitable braces 8. Upon this wheel is mounted two sets of buckets 9 and 10. The supporting ring 7 is arranged between the two sets of buckets, the latter having their radially inner ends or sides secured to the inner main rim 3 and each bucket having one of its sides secured to the supporting ring 7. Each bucket is provided at its rear end with a door as 11, hinged thereto along the inner rear angle of the bucket, or that angle thereof which is next to the supporting ring, so that when the door is released and arrested in open position, it depends in a downwardly and outwardly inclined position as shown clearly in Fig. 1. In order that these doors 11 may be opened at the proper time to discharge the soil

upon the conveyers, I provide automatic tripping mechanism so arranged as to trip open the doors when they are opposite the conveyers. Describing this mechanism each door is provided upon its outer side with a latch bolt 12 mounted in suitable guides to reciprocate endwise and adapted to normally engage a latch projection 13 upon the bucket. With the inner end of each latch bolt is connected, by means of a flexible connection 14, a cam rod 15 which moves endwise in suitable guides upon the wheel frame and is provided near its inner end with a cam roller 16. Upon the stationary part of the hub which is connected to the supporting frame as hereinafter described, is mounted a cam 17 which is properly shaped and arranged to cooperate with the cam rollers 16 of the rods 15. The cam is located in front of and slightly above the axle shaft of the excavator wheel and is so shaped as to retract each cam rod and connected latch rod just as the corresponding bucket rises slightly above the position horizontally opposite the center of the wheel. At this time the bucket is in proper position to discharge out through its bottom onto the belts. As the buckets are carried over and downwardly, and reach a position where they are nearly inverted, the doors obviously swing back into closed position.

In order to loosen the soil in advance of the buckets, two sets of diggers 18 are provided, one at each side of the supporting ring 7. Each of these diggers is preferably formed of strap steel bent into suitable shape to form an outer loop or cutter 19, a main body or shank 20 formed integrally with the cutter and a brace bar 21 connected with the inner end of the cutter loop and extending thence obliquely inwardly and forwardly to and connected with the inner ring of the wheel. It is to be understood, of course, that each digger is of a width equal or approximately so to the corresponding width of the buckets.

In order to convey away the earth, I provide in this instance a pair of conveyers 22, 23 connected at opposite sides of the conveyer wheel. Conveyer 23 extends from a point adjacent to the front periphery of the wheel rearwardly and upwardly while the conveyer 22 extends from a corresponding point, laterally or transversely as shown clearly in Fig. 3. These conveyers are adjustably supported at their rear and outer ends by means of cables 24 extending therefrom upwardly to and over the strut frame to which they are connected. At their front ends the conveyers are supported by means of links 25 connected with the boom members 35 hereinafter described. The conveyer belts are driven from a cross shaft 26 journaled upon the boom members, the driving connections comprising sprockets 27 and

28, and sprocket belts 29. Shaft 26 is driven from the wagon by means of sprockets 27' and 30' and belt 30. If desired the conveyers may be driven in the same manner as that shown in my original application of which this is a division.

In order to direct the earth from the buckets upon the conveyer, inclined aprons as 31 are mounted upon the respective conveyer frames in suitable positions as shown clearly in Fig. 4. If desired additional chutes or aprons may be made rigid with the respective buckets and discharge onto the aprons 31. As an important feature of my invention this wheel, or any similar excavating wheel, may be adapted for ditching in loose or sandy soil by means of an attachment shown in Fig. 1. This attachment is adapted to cause the wheel to form a ditch with inwardly and downwardly inclined sides so that the walls will not be liable to fall during or after the excavating process. The construction of this device is as follows: At each side of the excavating wheel a pair of rock-shafts 32, extending in an approximately radial direction, are mounted in bearings 33 and 34. Fixed upon the outer end of each rock-shaft is an outwardly extending arm 36 carrying a digger 37. Each of these diggers is shaped much like spring harrow teeth in common use as shown clearly in Fig. 6. The diggers 37 are adapted to remove the soil at the sides of the excavation in such a way as to gradually increase the width from below upwardly as the wheel carries them around. To this end it is necessary that the diggers describe certain regular angular movements, which movements are imparted to the rock-shafts 32 in this case by suitable cams. The inner end of each rock-shaft is provided with a cam arm 38 carrying a roller 38. Mounted on the axle 6 but not radially, being held stationary by any suitable means, are the cams 39 which actuate the arms 38, these cams being provided with cam grooves which so guide the rollers that each digger 37 is extended somewhat beyond the side of the wheel while in any position above the wheel's axis, but in passing from the level thereof down to its lowest position, it is moved inwardly, and in ascending from its lowest position to the level of the wheel's axis, is moved outwardly in the same manner and degree, then remains stationary until it again descends at the rear of the wheel. It will be readily understood that the operation of the diggers, thus moving, while revolving, will be to incline the walls of the excavation outwardly and upwardly.

Describing now the manner of supporting the excavating wheel, I employ a pair of boom members 35 herein before referred to. These boom members are connected to a rectangular strut frame 40, and the upper por-

tions of said strut frame are connected with the respective boom members at points remote from the strut frame by means of tension bars 41. The lower end of the strut frame is formed by a transverse rock-bar 42 which is journaled in suitable bearing supports mounted upon the main side members of the wagon 1 near the rear end of the latter.

10 In order to drive the excavator wheel I provide an endless belt or chain 43 trained around sprocket teeth formed on the outer periphery of the rim 7 and also trained around a driving sprocket 44 mounted upon the strut frame. This drive sprocket is 15 sleeved to a companion sprocket 45 and the two mounted upon a suitable shaft 46 extending across the strut frame 40. The sprocket 45 is driven by a belt 47, from another pair of sprockets 48 and 49 similarly sleeved together and journaled upon the rock-shaft 42. Sprocket 49 is driven by the belt 50 which leads forwardly to and is connected with a sprocket 51 mounted upon a 25 transverse shaft 52 suitably journaled upon the wagon. Shaft 52 is driven from the main shaft 53 which is journaled to extend longitudinally of the wagon; the beveled gear 54 on said main shaft serving to transmit motion to a second beveled gear 55 on shaft 52. A clutch 56 controlled by a bell-crank-lever 57, hand lever 58 and connecting rod 59, serves to throw the sprocket 51 into and out of gear with shaft 52.

35 For raising and lowering the excavating wheel, so as to vary the depth of the cut or elevate the wheel for transportation, tension links 60 are connected with the upper end of the strut frame 40 and with the ends of these links are connected winding cables 61 which extend to, and are wound upon a pair of windlass drums 63 mounted upon a cross shaft 64 journaled in the main frame of the wagon. Shaft 64 carries a worm gear 65, 45 the upper periphery of which is engaged and actuated by a worm and shaft 66, which is in turn driven by a sprocket 67 mounted thereon. Sprocket 67 is connected with another sprocket 68 on the main shaft by a sprocket belt, and the sprocket 68 is controlled by a clutch 69, and hand lever 70 for operating the same.

For propelling the machine along slowly so as to excavate the ditch progressively and 55 for propelling the machine at a more rapid speed when transporting it from place to place, driving connections are provided as follows; upon the main shaft 53 is mounted a sprocket 71 which is belted to a sprocket 72 upon a worm shaft 73 carrying a worm 60 74. The worm actuates a gear 75 upon a transverse shaft 76, which latter is provided at one end with a pinion 77 which meshes with a gear 78 upon another transverse shaft 65 79. Shaft 79 carries at each end pinions as

80, 81, which engage and drive relatively large spur gears 82 and 83 respectively upon the main traction wheels 84. This is the low speed drive.

For propelling the machine along more 70 rapidly, shaft 76 is driven from the shaft 52 through the medium of a sprocket 85, belt 86, and a sprocket 87 upon the shaft 76. The driving connections between gear 75 and shaft 76 and between sprocket 87 and shaft 76 are controlled by means of a pair 75 of clutches 88 and 89 respectively; the movable members of these two clutches being linked together as indicated at 90 and actuated by the bell-crank 91 and hand lever 92. 80 The arrangement is such that the clutches are thrown into gear alternatively, and when the clutches are in the intermediate position both are out of gear. A differential gear mechanism 93 is interposed in the shaft 79, 85 the center member of this differential being engaged and driven by a spur gear 77.

The main shaft is rotated by a pair of engines A and B mounted upon the wagon frame which receives steam from the boiler 90 C also carried by the wagon.

I claim as my invention:

1. An excavating wheel adapted to form an excavation with downwardly and inwardly inclined sides, said wheel comprising 95 main excavating devices, laterally positioned auxiliary excavating devices, and means for automatically moving said auxiliary devices toward and away from the wheel in time with the rotation of the wheel, 100 the active member of each said auxiliary device being moved laterally away from the side of the wheel during the first half of its ascending motion, and being reversely moved toward it, in its revolution as it descends to 105 the ground level.

2. An excavating wheel adapted to form an excavation with downwardly and inwardly inclined sides, said wheel comprising 110 main excavating devices, laterally positioned auxiliary excavating devices, and means for automatically moving said auxiliary devices toward and away from the wheel in time with the rotation of the wheel.

3. An excavating device adapted to form 115 an excavation with inclined sides, said wheel comprising main excavating devices, and a laterally positioned auxiliary excavating device, and means for automatically moving said auxiliary device toward and away from 120 the wheel in time with the rotation of the wheel.

4. An excavating wheel adapted to form an excavation with inclined sides, said wheel being provided with a laterally positioned 125 excavating device, and means for automatically actuating said excavating device into and out of operating position in time with the rotation of the wheel.

5. An excavating wheel adapted to form 130

an excavation with an inclined side, said wheel being provided with an excavating device, and means for automatically moving said excavating device into and out of operative position.

6. An excavating wheel adapted to form an excavation with inclined sides, said wheel being provided with excavating devices, and means for automatically moving said excavating devices into and out of operative position in time with the rotation of the wheel.

7. In an excavating wheel, one or more excavating devices and means for automatically moving said excavating device into and out of operative position in time with the rotation of the wheel.

8. An excavating wheel adapted to form an excavation with downwardly and inwardly inclined sides, said wheel comprising main excavating devices, and laterally positioned auxiliary excavating devices, and means for automatically moving said auxiliary devices into and out of operative position.

9. An excavating wheel adapted to form an excavation with downwardly and inwardly inclined walls, said wheel comprising main excavating devices, a laterally positioned rock-shaft mounted on each side of the wheel, and auxiliary excavating devices held by each rock-shaft and fixed cams for causing the active member of each auxiliary excavating device to be moved laterally away from the side of the wheel during the first half of its ascending motion, and to be reversely moved toward it in its revolution as it descends to the ground level.

10. An excavating wheel adapted to form an excavation with downwardly and inwardly inclined walls, said wheel comprising main excavating devices, a laterally positioned excavating device mounted on each side of the wheel, and means for rocking said excavating device into and out of operative position in time with the rotation of the wheel.

11. An excavating wheel adapted to form an excavation with downwardly and inwardly inclined walls, said wheel being provided with a laterally positioned excavating device, and means for automatically rocking said excavating device into and out of operative position in time with the rotation of the wheel.

12. An excavating wheel adapted to form an excavation with downwardly and inwardly inclined walls, said wheel being provided with excavating devices, and means for automatically moving said excavating device into operative position during its ascending motion, and for moving it back to inoperative position as it descends to the ground level.

13. In an excavating wheel, an excavator-

bucket carried thereby, a hinged bottom for said bucket, said bottom being hinged at one of the radially disposed lateral angles of the bucket so as to open toward the side of the wheel, and means for automatically unlatching and latching the bottom of the bucket as it arrives at, and passes beyond, discharging position.

14. In an excavating wheel, an excavator-bucket carried thereby, a hinged bottom for said bucket, said bottom being hinged upon one of the radial lateral angles of the bucket so as to open toward the side of the wheel, means for automatically unlatching and latching the bucket-bottom as it arrives at, and passes beyond, discharging position, and a pivotally mounted receiving apron positioned to receive material discharged from the bucket, and arranged to yield to the upward travel of the bucket.

15. In an excavating wheel, a series of excavator-buckets carried thereby, a hinged bottom upon each bucket, said bottom being hinged to one of the radial lateral angles of the bucket so as to open sidewise, automatic latching and unlatching means, a conveyer arranged to receive material from the buckets, and a hinged apron held by the frame of said conveyer, said apron receiving material directly from the buckets and directing the material upon said conveyer.

16. The combination of an excavating wheel carrying two series of excavator-buckets arranged upon opposite sides of the wheel, each bucket being provided with an automatically opening bottom, a rearwardly extending conveyer located at one side of the excavating wheel, a transversely extending conveyer located at the opposite side, said conveyer receiving material from said respective series of buckets, and two hinged aprons arranged to receive the material directly from the two series of buckets and conduct the same onto said respective conveyers.

17. In an excavator wheel, an excavator bucket carried thereby, a hinged bottom for said bucket, means for automatically unlatching and latching the bucket bottom as it arrives at, and passes beyond, discharging position, a traveling conveyer mounted adjacent to said wheel, and means for directing the soil from said bucket to said traveling conveyer.

18. In an excavator wheel, an excavator bucket carried thereby, a hinged bottom to said bucket, a traveling conveyer, and a pivotally mounted receiving apron for directing the soil from said bucket to the traveling conveyer.

19. The combination of an excavating wheel carrying two series of excavating buckets arranged upon opposite sides of the wheel, each bucket being provided with an automatically opening bottom, and a rear-

wardly extending conveyer located at one side of the excavator wheel.

20. The combination of an excavating wheel provided with an inner rim and an
5 outer ring, two series of excavating buckets upon said wheel and arranged upon opposite sides of said supporting ring and secured thereto.

21. In an excavating machine, the com-

bination with an excavator wheel, of a trav- 10
eling conveyer extending on either side of said wheel and mechanism for rotating said wheel and driving said conveyers.

DAVID W. MILLER.

Witnesses:

LOIS FORCE,

FRANK G. BELKNAP.