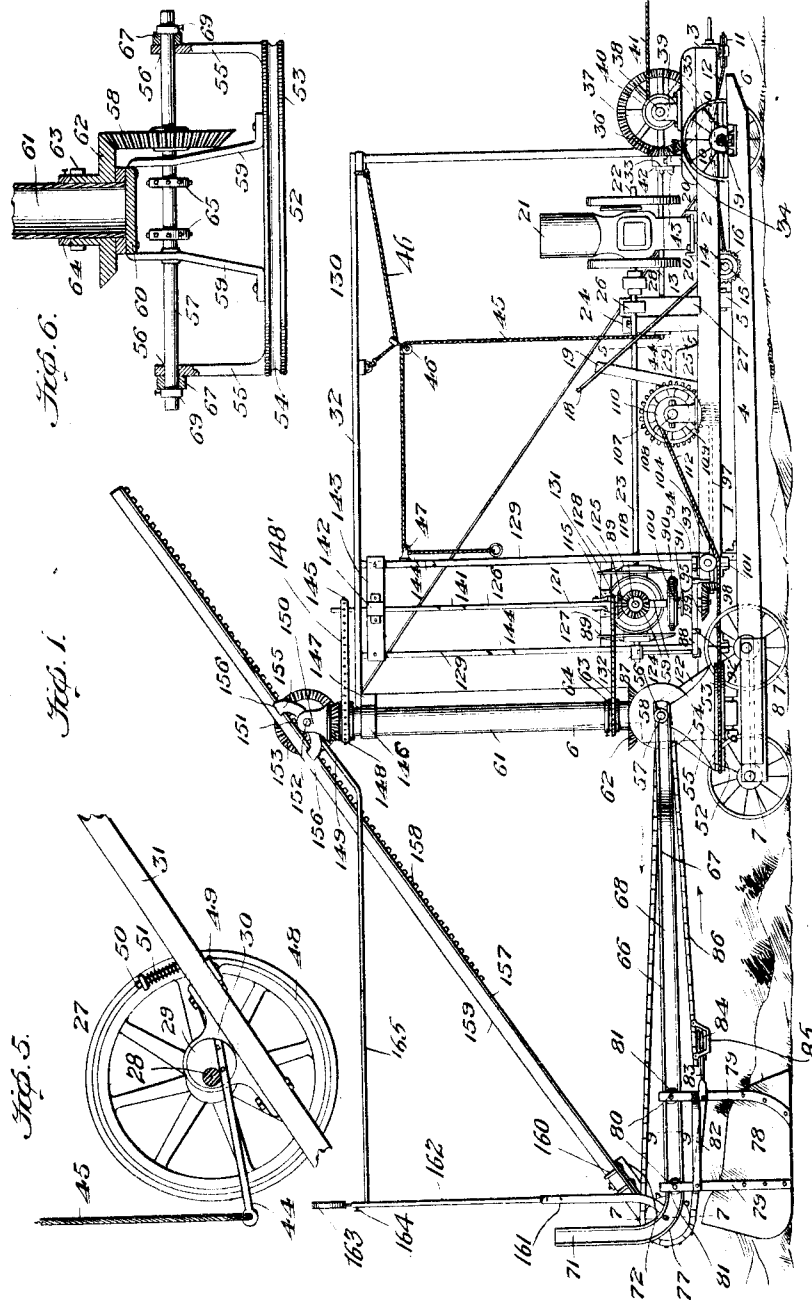


J. K. CUFF.
DITCHING MACHINE.
APPLICATION FILED DEC. 26, 1911.

1,060,538.

Patented Apr. 29, 1913.

7 SHEETS—SHEET 1.



Witnesses
L. H. Ellis.

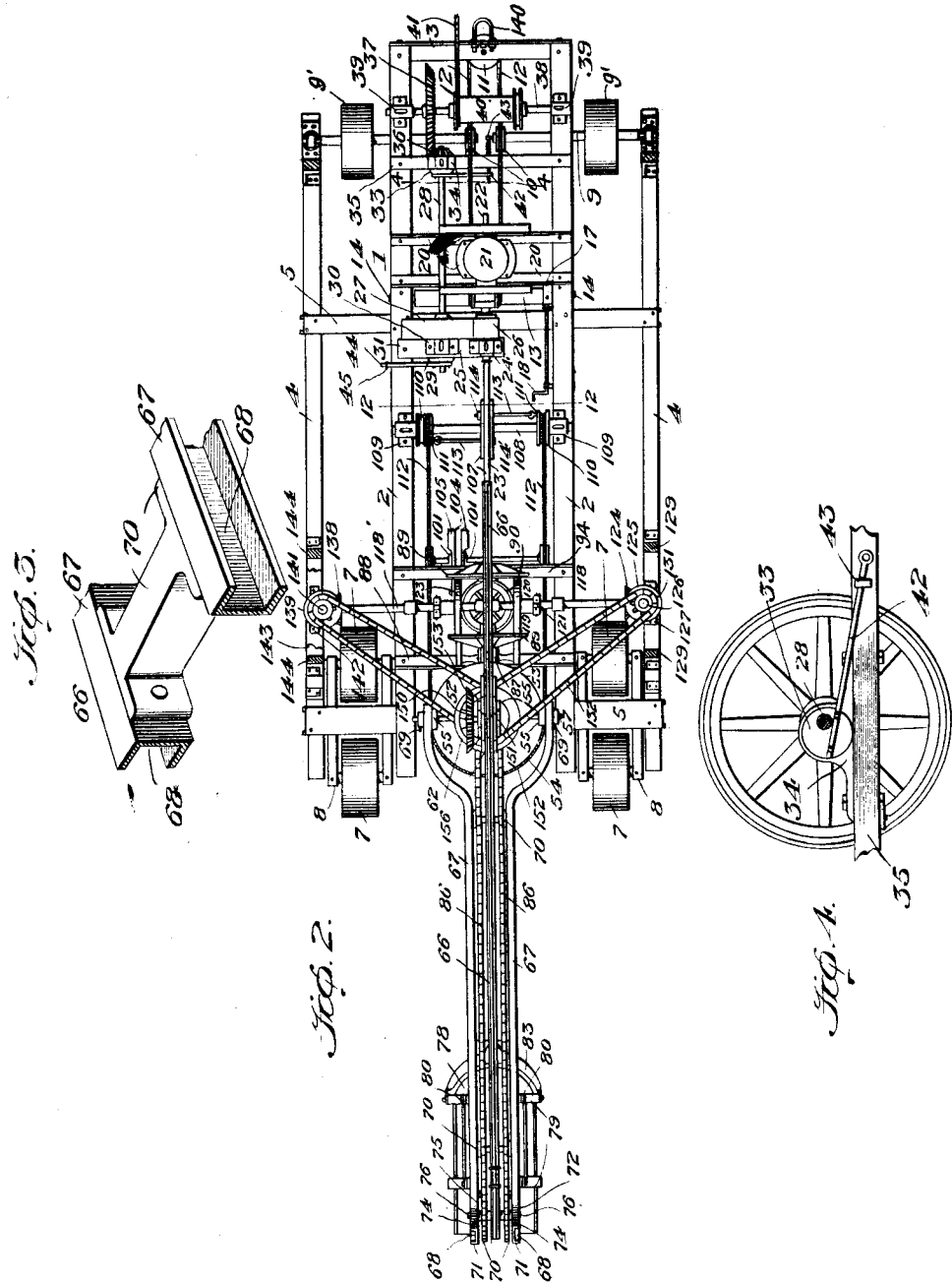
Inventor
J. K. Cuff
by *Watson E. Coleman*
Attorney

1,060,538.

J. K. CUFF.
DITCHING MACHINE.
APPLICATION FILED DEC. 28, 1911.

Patented Apr. 29, 1913.

7 SHEETS-SHEET 2.



Witnesses
L. V. Ellis.

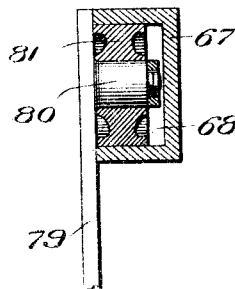
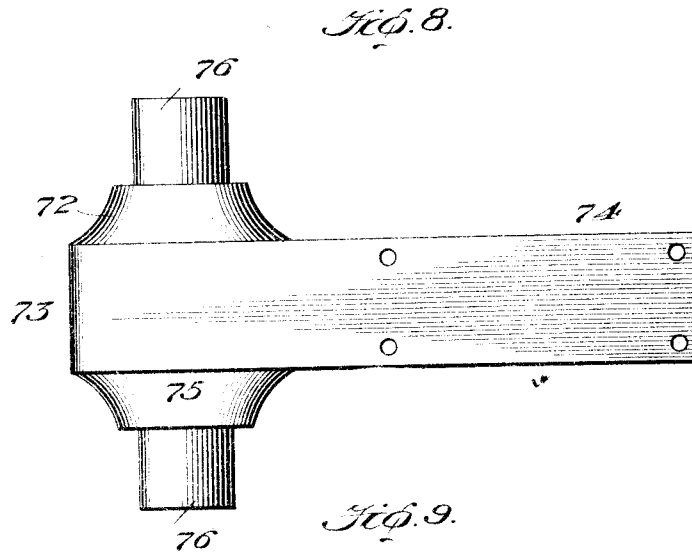
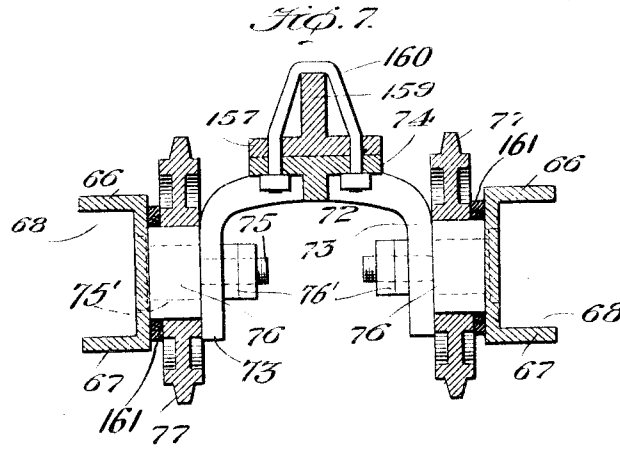
J. K. Cuff Inventor
By *Nelson E. Coleman* Attorney

1,060,538.

J. K. CUFF.
DITCHING MACHINE.
APPLICATION FILED DEC. 26, 1911.

Patented Apr. 29, 1913.

7 SHEETS—SHEET 3.



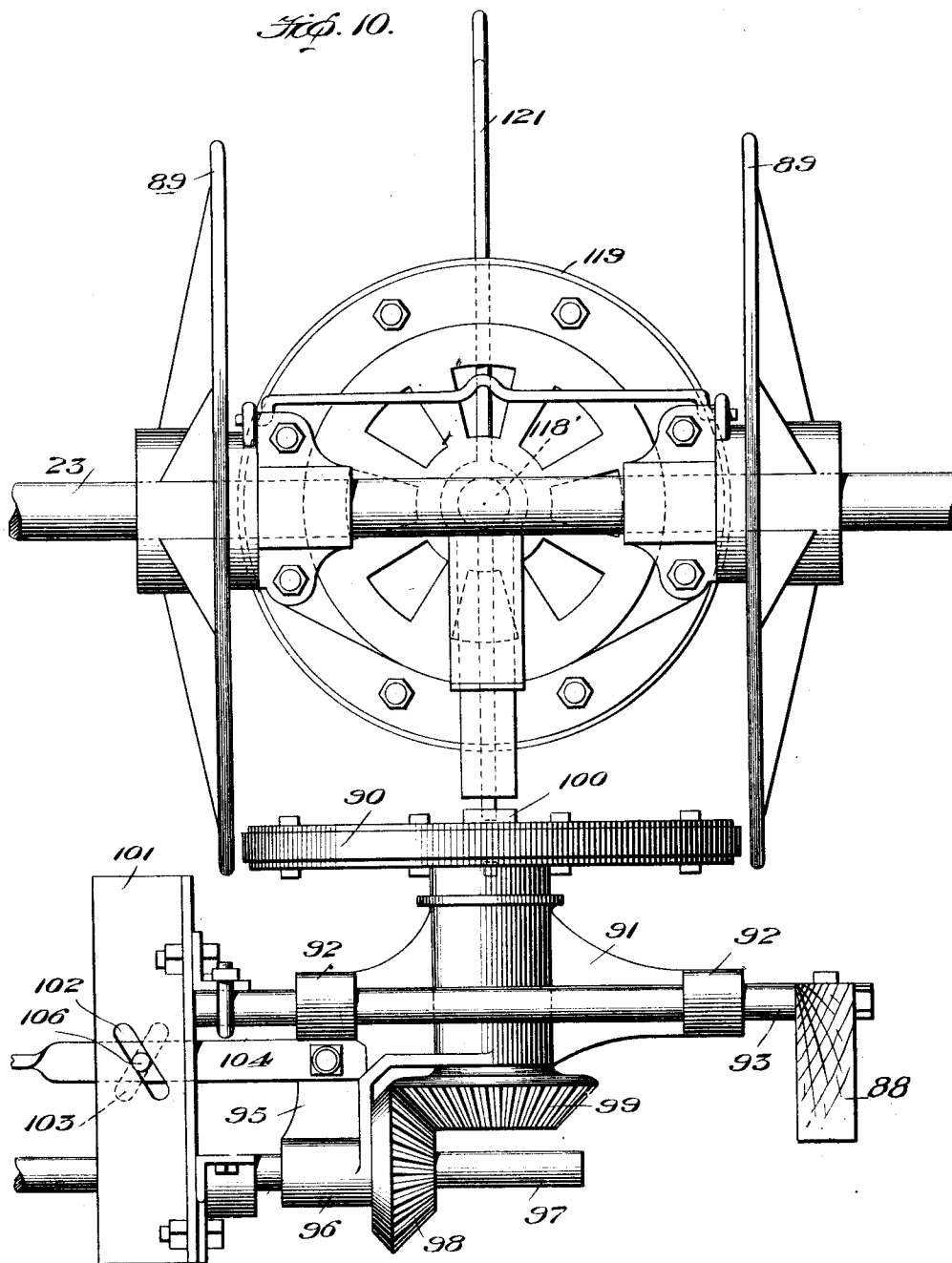
Witnesses
L. H. Ellis.

Inventor
J. K. Cuff
by *Watson E. Coleman*
Attorney

1,060,538.

7 SHEETS—SHEET 4.

Крѣ. 10.



Witnesses
Wm. H. Hill
L. H. Ellis.

Inventor
J. H. Cuff
by: Watson E. Coleman
Attorney

7 SHEETS—SHEET 5.

Fig. 11.

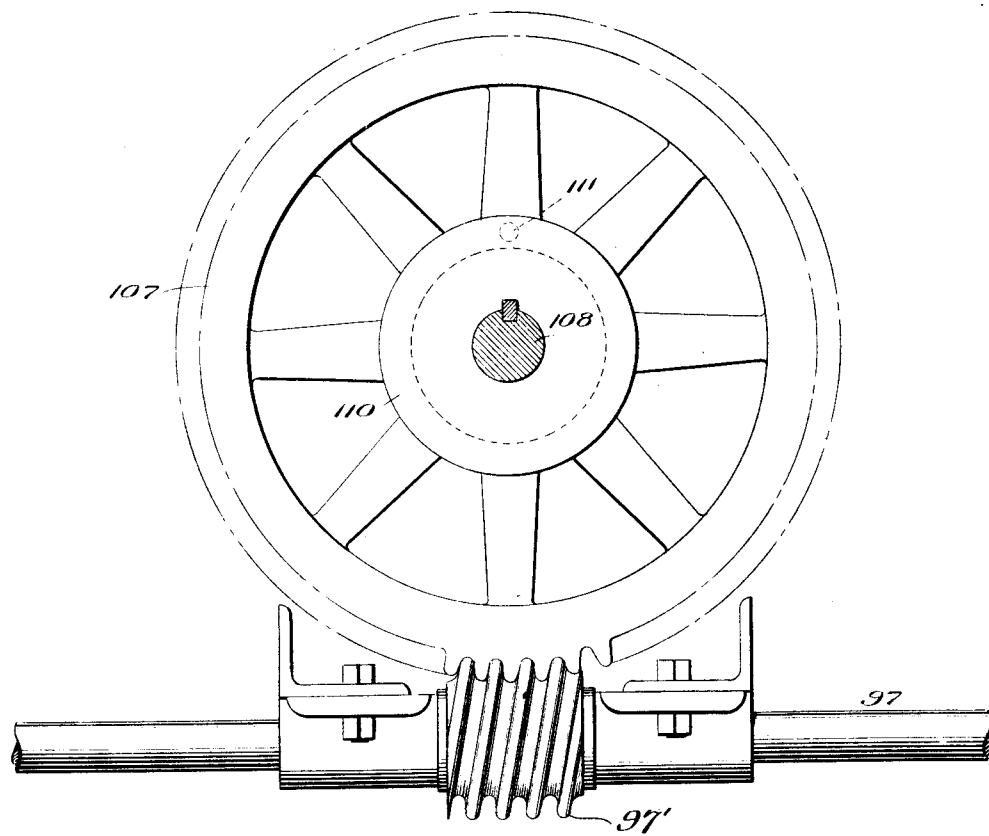
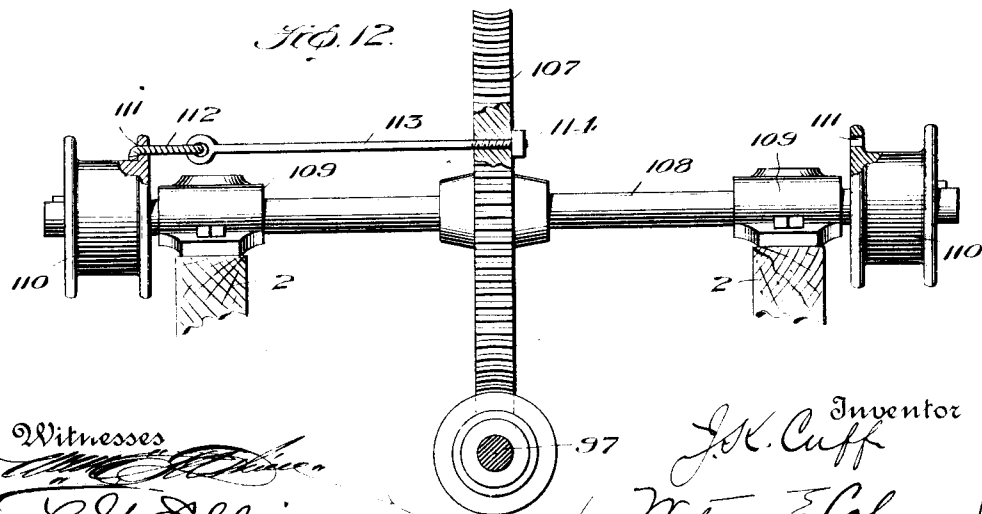


Fig. 12.



Witnesses
[Signature]
L. H. Ellis.

97 J. K. Cuff Inventor
by Watson E. Coleman Attorney

1,060,538.

J. K. CUFF.
DITCHING MACHINE.
APPLICATION FILED DEC. 26, 1911.

Patented Apr. 29, 1913.

7 SHEETS—SHEET 6.

Fig. 13.

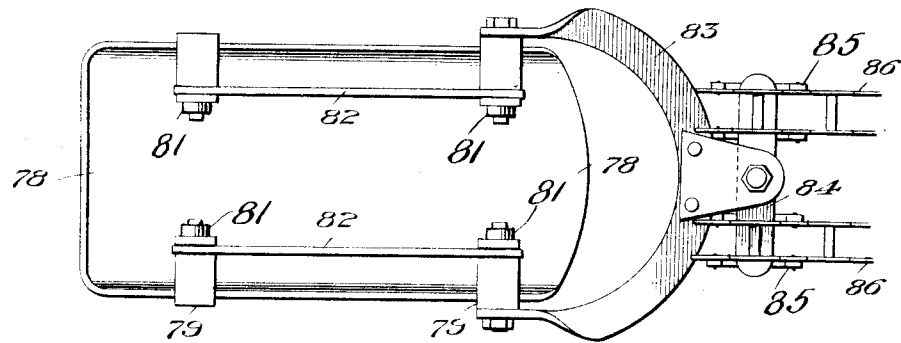
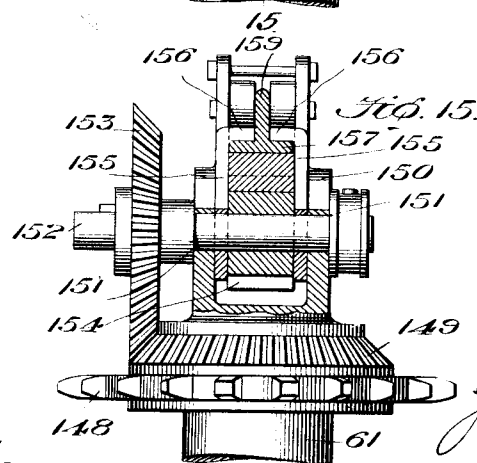
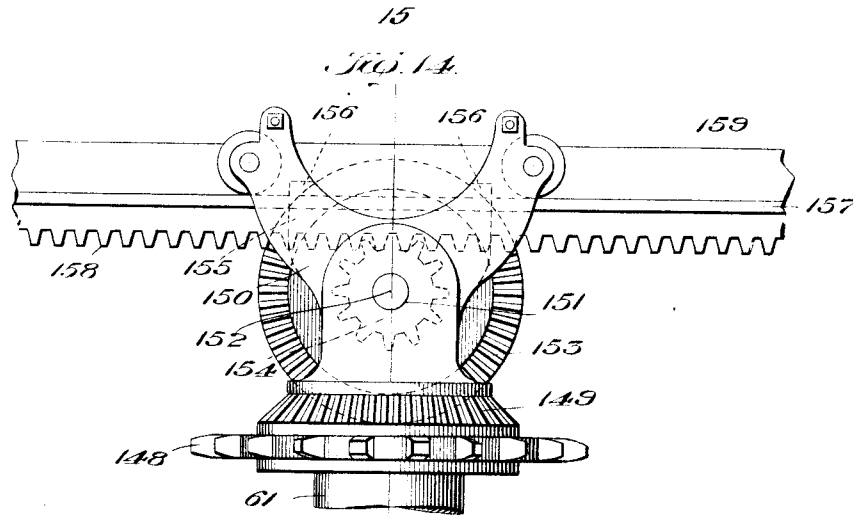


Fig. 14.



Witnesses
L. H. Ellis.

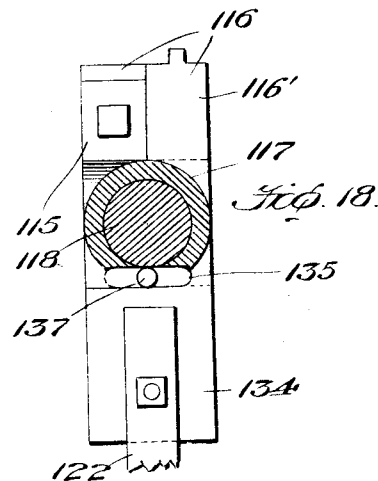
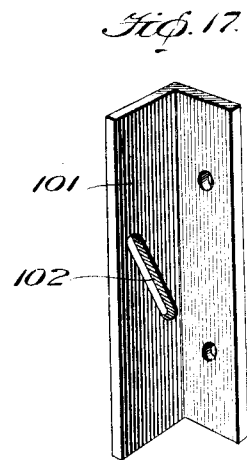
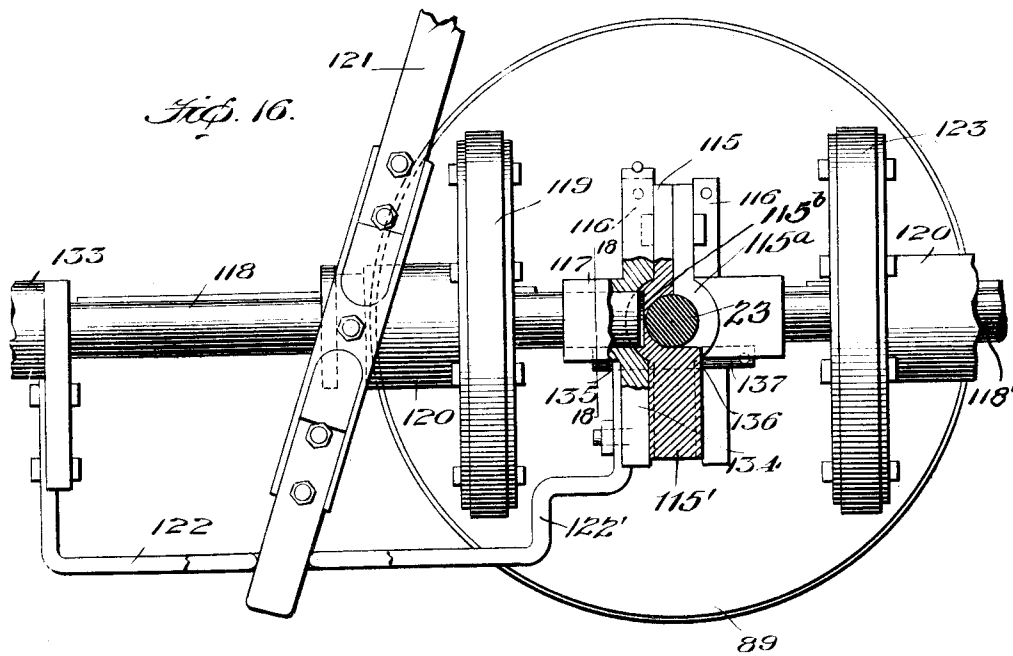
By

Inventor
J. K. Cuff
by *Watson E. Coleman*
Attorney

J. K. CUFF.
DITCHING MACHINE.
APPLICATION FILED DEC. 26, 1911.

Patented Apr. 29, 1913.
7 SHEETS—SHEET 7.

1,060,538.



Witnesses
L. H. Ellis.

J. K. Cuff Inventor
By *Watson E. Coleman* Attorney

UNITED STATES PATENT OFFICE.

JOHN KENNEDY CUFF, OF RIO, WISCONSIN.

DITCHING-MACHINE.

1,060,538

Specification of Letters Patent.

Patented Apr. 29, 1913.

Application filed December 26, 1911. Serial No. 667,636.

To all whom it may concern:

Be it known that I, JOHN KENNEDY CUFF, a citizen of the United States, residing at Rio, in the county of Columbia and State of Wisconsin, have invented certain new and useful Improvements in Ditching-Machines, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to excavating machines and has for its object to provide a machine of this character embodying a movable material gathering scoop, and means under the control of the operator for lifting and moving the scoop to the place where its contents are to be dumped.

Another object of the invention resides in the provision of means for movably supporting the scoop and positioning the scoop at one extreme of its movement to dump the load.

A further object of the invention resides in the provision of new and novel means for moving the scoop and its supporting means in vertical and lateral planes whereby said scoop may be elevated and then moved to its dumping position.

Another object of the invention is to provide a vertically and laterally movable scoop carrying boom, independent mechanisms for moving the boom, and improved power transmitting means for actuating said mechanisms at the will of the operator.

A still further object of the invention is to provide a ditching machine, means for progressively moving the machine as the earth is excavated, and additional means carried by the machine whereby the earth is excavated to a predetermined depth.

A further object of the invention resides in the provision of a machine of the above character consisting of comparatively few parts which are so arranged and assembled that a maximum of durability in the use of the machine is secured, and means whereby the various mechanisms may be readily controlled by the operator.

With the above and other objects in view, the invention consists of the novel features of construction, combination and arrangement of parts hereinafter fully described and claimed, and illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of an excavating or ditching machine embodying my improvements; Fig. 2 is a top plan view

thereof, certain of the parts being broken away; Fig. 3 is a fragmentary perspective view of a portion of the boom and one of the spacing members thereof; Fig. 4 is a section taken on the line 4—4 of Fig. 2; Fig. 5 is a section taken on the line 5—5 of Fig. 1; Fig. 6 is a section taken on the line 6—6 of Fig. 1; Fig. 7 is a section taken on the line 7—7 of Fig. 1; Fig. 8 is a top plan view of the casting to which the movable rack is connected; Fig. 9 is a detail section taken on the line 9—9 of Fig. 1; Fig. 10 is a detail elevation of the turn table operating mechanism; Fig. 11 is a similar view of the drum operating means; Fig. 12 is a side elevation thereof partly in section; Fig. 13 is a top plan view of the scoop; Fig. 14 is an enlarged elevation of the upper end of the mast illustrating the means for actuating the boom lifting rack bar; Fig. 15 is a section taken on the line 15—15 of Fig. 14; Fig. 16 is a detail elevation of the speed regulating and reversing mechanism for actuating the movable scoop; Fig. 17 is a detail perspective view of one of the angle plates forming part of the reversing mechanism of the turn table; and Fig. 18 is a detail section taken on the line 18—18 of Fig. 16.

Before proceeding with the detail description of my invention, it may be stated that while I have illustrated and described the machine as applied for earth excavating purposes, it will be understood that the machine may also be utilized for analogous purposes to which unloading and hoisting machinery is commonly adapted. The main purpose of the invention is, however, to provide a machine whereby a ditch may be quickly dug, and at a predetermined depth which is maintained throughout its length.

With the above end in view, I provide a frame generally designated by the numeral 1. This frame embodies the longitudinal side sills 2 which are arranged in spaced parallel relation, and the transverse sill 3 connecting the same at their rear ends. Arranged upon each side of the main frame 1 and spaced from the sills 2 thereof, are the skids 4 which are also disposed in parallel relation to the sills 2 and are held rigidly in such spaced relation to the sills by means of the transverse brace bars 5 which traverse the width of the main frame 1, said bars extending beneath the sills and beyond the same at each side of the frame. The skids 4

are rigidly bolted or otherwise secured to the ends of the frame bars 5. These skids at their rear ends are preferably beveled or upwardly inclined as indicated at 6 for a purpose which will be obvious from the following description.

The main frame 1 is supported at its forward end by the wheels 7 which are arranged in pairs upon opposite sides of the center of said frame and are mounted in the trucks 8, said trucks being suitably arranged between and connected to the sills 2 of the main frame and the skids 4 respectively. A pair of transversely disposed axles 9 are arranged at the rear end of the machine and are pivotally mounted at their outer ends upon the skids 4. The supporting wheels 9' are rotatably mounted upon these axles, the inner ends of which are provided with clamps 10 which may be of any approved form.

Upon the transverse frame bar 3 a pulley 11 is rotatably mounted and around this pulley a cable 12 passes, the ends of said cable being connected to a windlass 13 upon which they are adapted to be wound in opposite directions. This windlass is provided at its ends with trunnions 14 which are journaled in suitable bearings 15 arranged upon the side sills 2. A worm gear 16 is rigidly fixed upon one of these trunnions and is engaged by a worm 17 which is fixed upon the lower end of an inclined rod, said rod being supported at its upper end in a brace 19 and provided with a crank handle 18 whereby the rod may be rotated. The cable 12 is secured to the inner ends of the axles 9 by means of the clamps 10 which are arranged thereon, and upon the operation of the worm 17, it is obvious that the windlass 13 will be rotated to wind one end of the cable thereon, whereby the axles 9 are swung from their outer pivoted ends into transverse parallel angular positions with relation to the transverse axis of the machine, thereby disposing the supporting wheels 9' in position to direct the machine as desired by the operator.

Mounted upon the sills 2 of the main frame and rigidly fixed thereto are the parallel transverse bars 20 upon which an engine 21 of any approved form is mounted. This engine is provided with a shaft 22 which is disposed longitudinally with relation to the frame and centrally between the sills 2 and is coupled to one end of a shaft 23 disposed in alignment therewith. This shaft is supported in a suitable bearing 24 arranged upon an inwardly extending support 25 which is fixed to one of the sills 2 and suitably braced therefrom. A friction wheel 26 is fixed upon the shaft 23 and is adapted to frictionally engage with the periphery of a wheel 27 which is similarly mounted upon one end of a longitudinally

disposed shaft 28 to the end of which a disk 29 is eccentrically secured. This disk is rotatably mounted in a bearing 30 which is secured upon an inclined support 31, the lower end of which is mounted upon the transverse supporting member 25, the upper end thereof being braced from said supporting member in any desired manner. To the other end of the shaft 28 a disk 33 is eccentrically secured and is mounted in a bearing 34 secured upon the transverse intermediate sill 35 which connects the longitudinal sill bars 2 of the main frame. To the extreme end of the shaft 28 a beveled pinion 36 is secured, said pinion meshing with a beveled gear 37 which is fixed upon a transverse shaft 38 mounted at its ends in the bearings 39 arranged upon the sills 2. Upon the intermediate portion of this shaft a drum 40 is fixed and to this drum one end of a cable 41 is connected, the other end of said cable being anchored to a distant stationary object (not shown). To the eccentric 33 one end of a rod 42 is fixed, the other end of said rod being adapted for engagement by a spring held latch 43 mounted upon the transverse sill 35. To the eccentric disk 29 on the shaft 28, one end of a similar rod 44 is fixed, to the other end of which one end of a rope or wire 45 is connected, said rope passing over a sheave 46 arranged upon the rope 46' which is connected to one of the longitudinal bars 32 of a frame 130. The rope also passes around a similar sheave or pulley 47 arranged upon one of the vertical members 129 of said frame and has its end portion disposed within convenient reach of the operator.

From the foregoing arrangement of parts it will be readily seen that when it is desired to transmit rotary movement to the drum 40, the operator pulls upon the rope or wire 45, thereby moving the eccentric disks 29 and 33 in their bearings and simultaneously engaging the wheel 27 with the periphery of the friction wheel 26 and the beveled pinion 36 with the gear 37 and the cable 41 is thus wound upon the drum 40 to move the machine over the ground as the digging of the ditch progresses. When the operator releases the rope 45, the disks 29 and 33 return to their normal positions and disengage the wheel 27 and pinion 36 from the friction wheel 26 and the gear 37 respectively. When the pinion 36 and gear 37 are in mesh, the free end of the rod 42 is engaged with the catch 43 so as to retain the eccentric disks in their effective positions. It is of course understood that this rod is first released from the catch before the disks can return to their normal positions.

One end of a split band 48 is fixed to the inclined support 31 as shown at 49, see Fig. 5, and the other end of said band is angularly disposed above said support. A rod 130

50 is fixed in the support 31 and is loosely disposed through an aperture in the latter end of said split band. A coiled spring 51 is arranged upon said rod, said spring normally acting to force the end of the band outwardly thereon and engage the same with the inner surface of the peripheral wall of the power transmitting wheel 27. When the wheel 27 is rotating in the proper direction to transmit movement to the drum 40, the frictional engagement of this band with the wheel is insufficient to retard the movement of the wheel, but upon any reversal in the rotation of the wheel 27, the band 48 exerts sufficient pressure upon said wheel to lock the same against rotation. Thus unwinding of the cable 41 from the drum 40 is effectually prevented when the machine is brought to a stop.

20 A turn table 52 is mounted upon the forward end of the main frame 1 between the longitudinal sills 2 thereof and comprises a base 53 of circular form provided in its periphery with a groove 54, the purpose of which will be apparent from the following description. This circular base 53 is provided with the spaced vertical bearing plates 55 the upper ends of which have openings 56 therein to receive the opposite ends of a shaft 57. A beveled gear 58 is keyed or otherwise fixed upon this shaft and upon the base 53 a mast support is mounted, said support including the vertical arms 59 fixed to the base and a circular plate 60 connecting said arms at their upper ends. The lower end of the tubular mast 61 is secured upon the plate 60 and on said mast a beveled gear 62 is loosely mounted to mesh with the gear 58 on the shaft 57. This gear 62 is provided with a sleeve having the sprocket teeth 63 formed thereon which are traversed by a sprocket chain 132 actuated by means which will be hereinafter described in detail. A collar 64 is rigidly fixed upon the mast 61 to prevent vertical movement of the gear 62. Upon the intermediate portion of the shaft 57 between the vertical arms 59 of the mast supporting member, the spaced sprockets 65 are fixed as shown in Fig. 6. These sprockets are provided to actuate a movable scoop, the construction and mounting of which will now be described in detail.

The boom 61 consists of a pair of parallel channel bars 67, the flanges of which are outwardly disposed to form the channels or grooves 68. The inner ends of the channel bars 67 are laterally curved in relatively opposite directions and are loosely mounted upon the ends of the shaft 57. Collars 69 are fixed upon the ends of this shaft to retain the channel bars thereon. These spaced channel bars are connected by means of the castings 70 shown in Fig. 3 which are rigidly fixed to the inner opposed walls of said bars. The outer ends of the bars 67 are

upwardly curved as indicated at 71 for a purpose which will appear as the operation of the device is better understood.

A casting 72 is arranged between the channel bars 67 at their outer curved ends and comprises a body 74 and the spaced vertically disposed arms 73 which are integrally formed therewith. Bolts 75 connect the channel bars 67 and the arms 73 of the casting. The heads of these bolts are countersunk in the outer faces of the channel bars and they are provided with enlarged portions 75' which space the arms from the channel bars. Upon these enlarged portions of the bolts the sleeves 76 are arranged and the inner ends of said bolts are threaded to receive the nuts 76' whereby the arms 73 may be tightened against the ends of the sleeves 76 to rigidly hold said sleeves between the same and the channel bars 67. A sprocket wheel 77 is loosely mounted upon each of the sleeves 76 and these sprocket wheels are traversed by the chains 86 which pass around the sprockets 65 fixed upon the shaft 57.

The scoop 78 has secured to its side walls the vertically disposed hanger bars 79. The upper ends of these hanger bars carry the trunnions 80 upon which are rotatably mounted the wheels 81 which are adapted to travel in the grooves or channels 68 of the bars 67. The bars 79 are connected and braced by means of the bars 82. A yoke bar 83 is pivotally connected to one of the bars 79 on each side of the scoop and upon the central portion of said yoke bar an equalizing bar 84 is pivotally mounted. To the opposite ends of this bar 84, the ends of the chains 86 are connected by means of the clips 85. The other ends of these chains are connected to the forward hanger bars 79.

The shaft 23 is journaled at its end in a bearing 87 which is mounted upon the central portion of a transverse sill 88. Spaced friction disks 89 are rigidly fixed upon this shaft, and these disks are spaced sufficiently to accommodate a horizontally disposed friction disk 90 said latter disk being bodily movable with relation to the disks 89. The horizontally disposed disk 90 is rotatably mounted in a bearing formed upon the casting 91, said casting consisting of oppositely disposed arms having bearing sleeves 92 formed upon their ends which are mounted upon a stationary shaft 93 for sliding movement, said shaft being fixed at its ends upon the transverse sills 88 and 94 respectively. The casting 91 also includes a hanger 95 which has formed upon its lower end a bearing 96 in which a worm shaft 97 is mounted. Upon this worm shaft a beveled pinion 98 is keyed which meshes with a similar pinion or gear 99 fixed to the lower end of a shaft 100 upon the upper end of which the friction disk 90 is keyed or otherwise secured.

A pair of spaced vertically disposed angle bars 101 are secured to the transverse sill 94 and the laterally disposed webs of these bars are provided with the inclined slots 102 and 103 respectively. A pair of foot levers 104 and 105 are pivotally mounted at one of their ends upon the hanger 95 of the casting 91 and each of said levers is provided with a pin 106 disposed through and movable in the inclined slots 102 and 103 respectively of the angle plates 101. From this arrangement of parts it will be readily seen that when the operator engages either one of the levers 104 or 105 with his foot and presses downwardly upon the same, the casting 91 will be shifted upon the shaft 93 to move the friction disk 90 into engagement with the face of one of the disks 89 so that rotative movement may be transmitted from said latter disks to the worm shaft 97, the direction of such rotation depending of course, upon the disposition of the disk 90 with relation to the spaced disks 89. This mechanism is provided for the purpose of rotating the turn table 52 to swing the scoop carrying boom 66 in a lateral direction, and to this end I provide the shaft 97 with a worm 97' which meshes with the teeth of a worm gear 107 fixed upon a transversely disposed shaft 108 mounted in the bearings 109 arranged upon the sills 2 of the main frame 1. Upon this shaft and adjacent to its opposite ends the drums 110 are fixed, the inner flanges of said drums being provided with openings 111 to receive the ends of a cable 112 to which are connected the rods 113, the inner ends of said rods being disposed through openings provided in the spokes of the worm gear 107. Nuts 114 are threaded upon said rods whereby the cable 112 may be drawn tightly around the base of the turn table 52, in the peripheral groove 54 of which said cable is disposed. Thus the slipping of the cable in the grooves of the table 52 as the same becomes worn may be obviated. When the worm shaft 97 is rotated in the manner above described, such rotation is transmitted to the shaft 108 to move the cable 112, which through its frictional engagement with the turn table will swing the scoop carrying boom 66 laterally from the lower end of the mast 61.

Upon the longitudinal shaft 23 and between the disks 89 thereon, a split casting 115 is arranged. This casting includes a body plate 115' which is disposed below the shaft 23 and each of the split portions of the casting has a semicircular portion 115^a which surrounds the shaft 23. The plates 116 each carry a bearing 117 which engage with and are movable upon the portions 115^a of the casting. The upper ends of the plates 116 are reduced in width as shown at 116', said reduced portions of the respective

plates being disposed upon opposite sides of the longitudinal axis of the shafts 118 and 118' which are mounted in the bearings carried by the respective plates. Upon the shaft 118 a friction disk 119 is splined for longitudinal movement, and a friction disk 123 is also mounted on the other shaft 118' in a similar manner. Each of these disks is provided with a tubular hub or sleeve 120 to each of which is loosely connected a hand lever 121 in any preferred manner. The lower ends of these levers extend below the shafts 118 and 118' and are fulcrumed in a loop formed in the brace rod 122. In Fig. 16 of the drawings wherein this portion of the mechanism is illustrated in detail, I have illustrated but one of the hand levers 121 and brace rods 122, the same being simply duplicated for the operation of the other friction disk 123. The mounting of these levers, is, however, identical in both instances. Upon the shafts 118 and 118' the sleeves 133 are arranged, and the outer ends of the brace rods 122 are secured to said sleeves. Adjacent to the inner ends of the rods 122 the same are offset as at 122' and are vertically disposed and rigidly fixed to the lower portions 134 of the plates 116. The friction disk engages the offset portion 122' of the brace rod before the same strikes against the end of the bearing 117, said offset portion of the rod acting as a brake for said disk so that the boom may be held in any desired position.

To the outer end of the shaft 118 a beveled gear 124 is secured which meshes with a similar gear 125 fixed upon the lower end of a vertical shaft 126 which is mounted in a bearing 127 arranged upon a bar 128, said bar being secured at its opposite ends to the vertical supports 129 which form part of the upper frame 130, said frame being provided to receive a canopy or light protecting shield which is arranged thereon during inclement weather as a protection for the various elements of the machine. The beveled gear 125 carries a sprocket 131 around which the endless chain 132 extends, said chain traversing the sprocket 63 which is carried by the gear 62 on the lower end of the mast 61 as previously explained.

Each of the plates 116 at the point of juncture therewith of the bearings 117 is provided at the lower side of said bearing with a horizontal slot 135, said slots extending upon opposite sides of the longitudinal center of the transverse power transmitting shafts and opening at one of their ends upon one of the edges of the respective plates, the open ends of the slots being disposed upon opposite sides of the shafts. The casting 115 is provided in its body portion with an opening 136 to receive a pin 137, the end portions of which are disposed in the slots in the under sides of the bearings

117. This pin limits the sliding movements of the plates 116 and the bearings carried thereby with relation to the casting 115. The portions 115^a of the casting 115 are provided with longitudinal grooves or recesses indicated at 115^b for the reception of the inner ends of the shafts 118 and 118'. said shafts engaging loosely in the grooves or channels for longitudinal movement therein. It will be understood that the inner ends of the sleeves 117 conform to the exterior curvature of the portions 115^a of the casting 115 and move freely thereon when the shafts are shifted to engage the disks 119 and 123 with the drive disks 89 upon the shaft 23. By means of this construction, it will be readily seen that when it is desired to move the excavating scoop 78 longitudinally on the boom the operator shifts the lever 121 longitudinally of the frame of the machine, thereby moving the plate 116 longitudinally with relation to the casting 115, and throwing the edge of the friction disk 119 into frictional contact with the plates of either of the disks 89 on the shaft 23, thus transmitting rotary movement from the shaft 23 to the shaft 118. The speed of such movement is regulated by the operator moving the hand lever 121 transversely with relation to the frame of the machine to shift the disk 119 longitudinally on the shaft 118 and move the same toward or from the periphery of the disk 89. It will be obvious that as the disk 119 is moved inwardly upon said shaft, the speed of rotation of the shaft 118 will be increased proportionately, and a reverse movement of said disk decreases the speed of rotation of said shaft. This rotation of the shaft 118 moves the sprocket chain 132 which rotates the gear 62 on the lower end of the mast 61 and through the medium of the gear 58 rotates the shaft 57 to move the chains 86 which are connected to the scoop 78. The other of the shafts 118' has fixed upon its outer end a beveled gear 138 which meshes with a similar gear 139 secured upon the lower end of a vertical shaft 141. The upper end of this shaft is mounted in the bearing 142 formed upon a bar 143 which connects the upper ends of the uprights 144, the lower ends of said uprights being fixed to the skids 4 of the machine frame. Through the medium of this shaft 141 mechanism mounted upon the upper end of the mast 61 is actuated to swing the boom 66 in a vertical plane and elevate the scoop 78 to its dumping position. This mechanism I will now proceed to describe in detail.

Upon the upper end of the shaft 141 a sprocket 145 is fixed. The upper end of the mast 61 is supported by a band 146 which embraces said mast and is secured to a transverse beam 147, said beam connecting the longitudinal bars 32 of a frame 130. Upon

the upper end of the mast 61 a sprocket 148 is rotatably mounted and a sprocket chain 148' connects the sprocket 145 on the shaft 141 thereto. Upon the upper face of the sprocket 148 a beveled gear 149 is formed and upon the upper end of the mast 61 the spaced vertical arms 150 are provided. These arms have openings 151 formed therein to receive the ends of a shaft 152. Upon one end of this shaft a beveled gear 153 is fixed to mesh with the gear 149 on the sprocket wheel 148. A pinion 154 is fixed upon the shaft 152 between the arms 150 and upon said shaft on opposite sides of this pinion between the same and the arms, the guide members 155 are loosely mounted. These guide members extend upon opposite sides of the shaft 152 and have their ends bent inwardly as at 156 to engage over the base flanges of the bar 157. The base of this bar is provided with rack teeth 158 to mesh with the pinion 154 upon the shaft 152. This bar is provided with a central vertical web 159 which moves between the inwardly turned guide flanges 156 of the arms 155. The lower end of the bar 157 is mounted upon the casting 72 arranged between the members 67 of the scoop carrying boom, and is rigidly fixed thereto by means of the clip bolts 160.

When it is desired to elevate the scoop 168 in order to unload or discharge the contents thereof at the desired point, the operator shifts the friction disk 123 into engagement with the proper disk 89 upon the shaft 123, to transmit rotary movement to the shaft 152. The pinion 154 on said shaft engaging the teeth 158 of the bar 157 moves said bar upwardly between the guide members 155, thereby also elevating the outer ends of the boom members 67 to which the lower end of said rack bar is loosely connected through the casting 72. The operator then shifts the other of the friction disks 119 to cause the scoop 78 to travel outwardly upon the boom, the rollers 80 disposed in the channels of the boom members moving into the curved portions of said channels and thereby tilting the scoop 78 whereby its contents are discharged.

In order to insure the excavation of the earth throughout the length of the ditch to a desired grade, I provide a grade finder which includes an elongated U-shaped member 161 the ends of which are loosely mounted upon the sleeves 76 between the inner faces of the boom members 67 and the sprockets 77. To the intermediate transversely disposed portion of the member 161 a rod 162 is secured. The upper end of this rod is of tubular form to receive a rod formed upon the sight member 163. The tubular rod 162 carries a set screw 164 for binding engagement against the telescoping rod of the member 163 to rigidly secure said

sight member in its adjusted position. To the upper end of the rod 162 a pair of longitudinally disposed rods 165 are pivotally connected. The inner ends of these rods are loosely connected to the vertical arms 150 upon the upper end of the mast 61 so that said rods may move in a vertical plane as the boom 66 is raised and lowered. In the use of this grade finder a stationary mast or pole is set up at a distant point and is provided at the proper point with a suitable sight member. As the digging of the ditch progresses, when the excavation has been deepened to such an extent that the member 163 of the grade finder is disposed in line with the stationary sight member upon the mast, the digging operation is temporarily suspended and the entire machine moved over the ground to a new position and the excavation of the earth continued at a new point. In this manner the ditch may be accurately dug to a uniform depth throughout its entire length.

From the foregoing the operation of the machine will be readily understood. Upon the sprocket chains 86 being moved in the direction indicated by the arrow, the scoop will be filled with material during its inward movement upon the boom. The travel of this scoop is now reversed by means of the mechanism hereinbefore described and moves outwardly upon the boom. When the scoop reaches the outer end of the boom, said boom is elevated through the movement of the rack bar 157. The friction disk 90 is then shifted to effect the rotation of the turn table 52 whereupon the boom is swung laterally. The continuation of the outward movement of the scoop 78 upon the curved portion of the boom members tilts the scoop and discharges the contents thereof.

From the above it will be observed that I have devised a machine for quickly transporting large quantities of material from one point to another, and which is admirably adapted for excavation work or other analogous purposes. The speed of operation of the different mechanisms may be readily regulated by means of the shiftable friction disks 119 and 123 in the manner previously described. If desired, the cable 41 may be passed around a sheave or pulley and connected at its end to the U-shaped bolt 140 which is fixed to the transverse sill 3 of the frame of the machine.

A machine constructed in the manner above set forth is highly efficient and positive in its operation, strong and durable in construction and provides means whereby a large amount of work may be accomplished with a minimum expense incident to the employment of manual labor.

While I have shown and described the preferred construction and arrangement of the various elements, it will be understood

that the invention is susceptible of considerable modification in the construction and arrangement of the various parts without departing from the essential features or sacrificing any of the advantages thereof.

Having thus described the invention what is claimed is:—

1. In a ditching machine, the combination with a frame, a boom pivotally mounted at one end upon said frame, a perpendicular mast arranged at the pivoted end of said boom, said boom consisting of spaced channel bars, a scoop arranged to travel longitudinally on said bars, a shaft arranged at the pivoted end of the boom, a bevel gear fixed on said shaft, a gear loosely mounted upon the lower end of the mast and meshing with said bevel gear, spaced sprocket wheels fixed upon the shaft, sprocket wheels mounted between the outer ends of said boom members, chains traversing said sprockets and fixed at their ends to the scoop, and operating means for the scoop mounted upon the frame and including a chain traversing the sprocket carried by the gear on the lower end of the mast.

2. In a ditching machine, the combination with a boom, consisting of spaced members having one of their ends upwardly curved, each of the boom members being provided with a trackway, of a scoop mounted to travel upon the trackways, spaced sprocket wheels arranged at opposite ends of the boom, and chains traversing said sprocket wheels and connected at their ends to the scoop at a point adjacent the discharge end of the scoop, whereby said scoop is permitted to travel upon the curved ends of the boom members and to assume an inclined dumping position.

3. In a ditching machine, the combination with a boom, consisting of spaced members curved upwardly at one of their ends and each provided with a trackway, of a scoop, hangers fixed to the scoop, rollers on said hangers to travel in the trackways, a U-shaped horizontally disposed bar fixed to the hangers above the discharge end of the scoop, a transversely disposed bar pivoted upon said U-shaped bar, and operating chains connected at one of their ends to opposite ends of said pivoted bar and at their other ends to the hangers to permit of the movement of the scoop upon the curved ends of the boom members, whereby the scoop may assume an inclined dumping position.

4. In a ditching machine, the combination of a pivoted boom, means for raising and lowering the outer free end of the boom, a grade finder mounted upon the free end of the boom, and means for maintaining the grade finder in a perpendicular position in the vertical swinging movement of the boom.

5. In a ditching machine, the combination of a pivoted boom, means for swinging said

boom in a vertical plane, a grade finder pivotally mounted upon the free end of the boom, and supporting rods connected to said grade finder to maintain the same in a perpendicular position in the vertical swinging movement of the boom.

6. In a ditching machine, the combination of a pivotally mounted boom, means to move the boom in a vertical plane, a grade finder pivotally mounted on the free end of the boom, and supporting means pivotally connected to the grade finder and to the upper end of the mast to maintain the grade finder in a perpendicular position during the vertical swinging movement of the boom.

7. In a ditching machine, the combination with a boom consisting of spaced members each provided with a track way, of a scoop, hangers fixed to the scoop, rollers on the said hangers to travel in the track ways, a horizontally disposed pivoted bar mounted upon the hangers, and operating chains connected at one of their ends to the opposite ends of said bar and at their other ends to the hangers to move said scoop back and forth upon the boom.

8. In a ditching machine, the combination with a boom comprising spaced members each provided with a track way, of a scoop, a pair of hanger bars secured to each side of the scoop, rollers mounted upon the bars

to travel in said track ways, a horizontal bar connecting one of the hanger bars on each side of the scoop, a transversely disposed bar pivotally mounted upon said connecting bar, and a pair of operating chains each connected at one of its ends to one end of said pivoted bar, the other ends of said chains being connected respectively to one of the hanger bars on each side of the scoop to move said scoop back and forth upon the boom.

9. In a ditching machine, the combination of a support, a boom pivotally mounted at its inner end upon said support and normally disposed in a horizontal plane, a scoop suspended from said boom and longitudinally movable thereon, means for moving the scoop back and forth upon the boom, means for swinging the boom laterally, means for elevating the outer end of the boom to dump the scoop, a grade finder mounted upon the outer end of the boom, and means for maintaining the grade finder in a perpendicular position in the swinging movement of the boom.

In testimony whereof I hereunto set my signature in the presence of two witnesses.

JOHN KENNEDY CUFF.

Witnesses:

B. P. BERGUM,

ANDREW AMONDSON.