

Dec. 13, 1932.

E. H. FUNDOM
EXCAVATOR CONSTRUCTION

1,890,727

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3 Sheets-Sheet 1

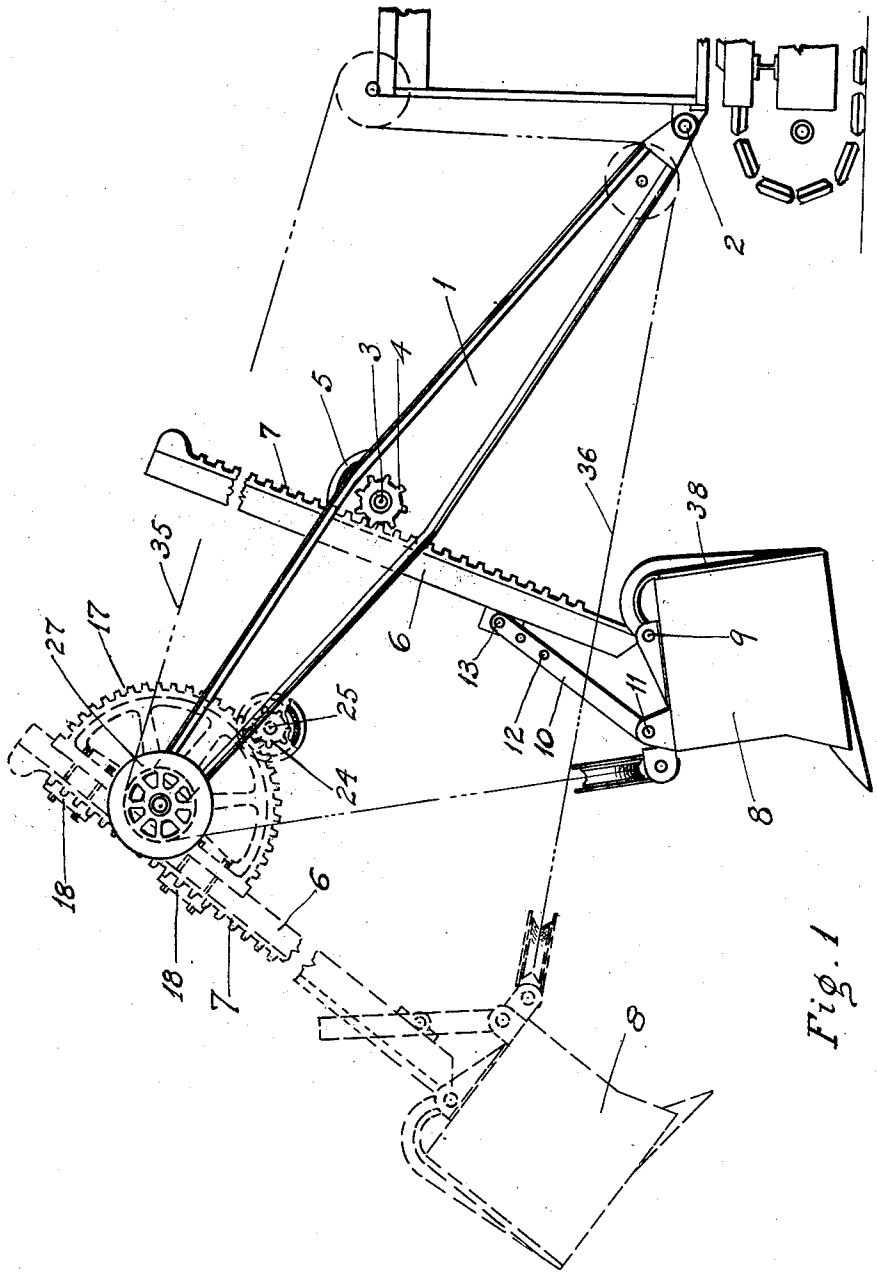


Fig. 1

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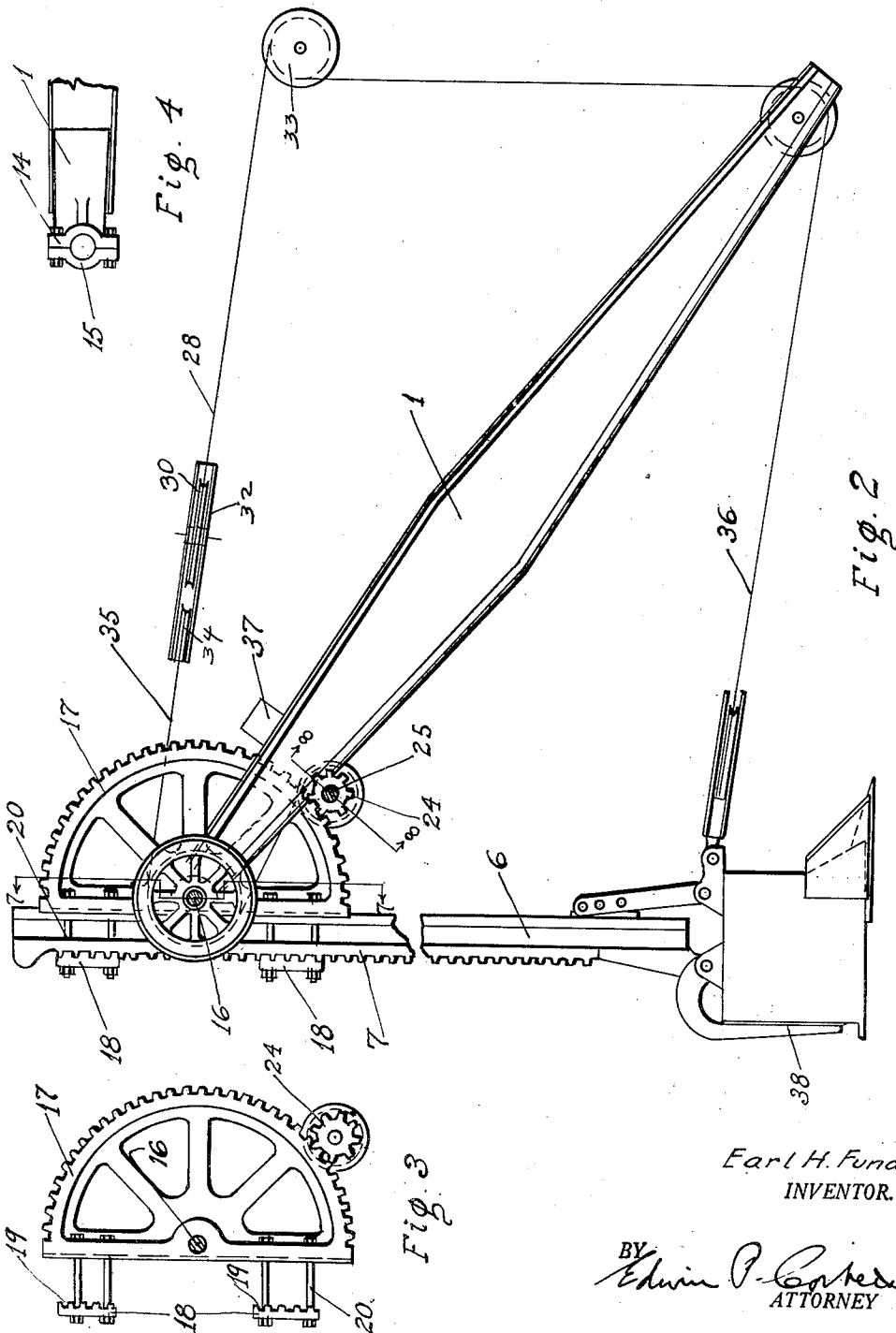
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3 Sheets-Sheet 2



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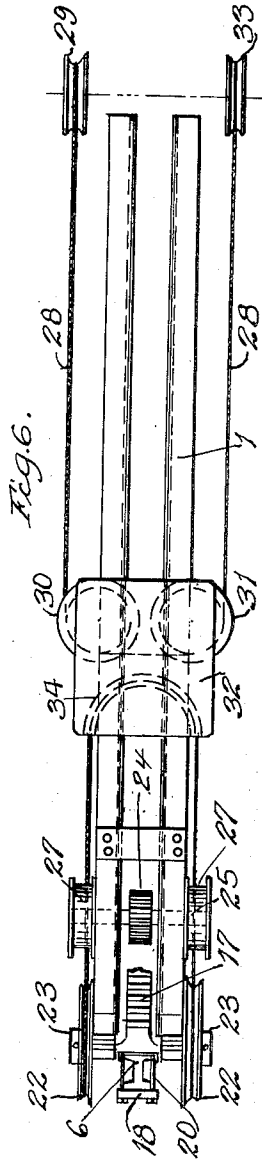
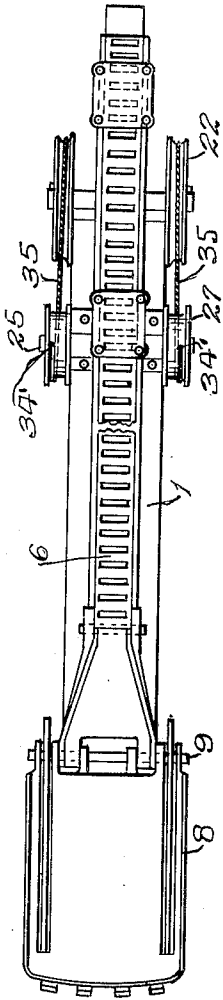
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3 Sheets-Sheet 3

Fig. 5.



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UNITED STATES PATENT OFFICE

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EXCAVATOR CONSTRUCTION

Application filed November 11, 1929. Serial No. 406,397.

My invention relates to excavator construction and has to do primarily with that part of an excavator embodying the boom and attachments thereto. It pertains especially to a boom and dipper stick construction whereby, by certain adjustments and interchangeable parts, an excavator can be adapted to various uses while maintaining a maximum simplicity and rigidity of parts.

One of the objects of my invention consists in the provision of a standard boom and dipper stick construction with cooperative mechanism of such a nature that a standard dipper stick and the scoop therefor may be readily transposed and utilized as a "back-hoe" ditching machine.

Another object of my invention consists in the provision of a "back-hoe" structure with a novel and efficient means for connecting the hoisting cable of an excavator to the dipper stick in such a way as to ensure efficient operation thereof.

The preferred embodiment of my invention is shown in the accompanying drawings wherein similar characters of reference designate corresponding parts and wherein:

Figure 1 is a side elevation of a standard boom and dipper stick shown in full line and having the dipper stick and scoop transposed to the dotted line position in which it is to operate as a "back-hoe."

Figure 2 is a side elevation of my boom structure with the dipper stick applied as a "back-hoe" and showing the standard dipper stick pivotally mounted upon the outer end of the boom and the operating mechanism therefor.

Figure 3 is a side elevation of the rack member shown in Figure 2 removed from the dipper stick and showing the means for securing it to the dipper stick.

Figure 4 is a side elevation of the end of the boom, showing one of the split brackets designed to support the pivot pin upon which the dipper stick swings.

Figure 5 is a front elevation taken from the left of the structure shown in Figure 2, looking directly at the rear face of the dipper stick.

Figure 6 is a plan view of the structure

shown in Figure 2 looking down on the hauling lines and the outer end of the boom.

Figure 7 is a cross section taken on line 7-7 of Figure 2, showing the boom end and idler sheaves mounted thereon.

Figure 8 is a section taken on line 8-8 of Figure 2.

In the drawings, my invention is shown as comprising a boom 1 which may be carried pivotally as at 2 (Figure 1) upon the forward end of an excavator. This excavator may take any desired form. In the form shown in Figure 1, this excavator is intended to be of the full revolving type equipped with endless traction members.

As shown in Figure 1, the boom 1, which is preferably constructed of spaced channel beams, is provided with a shipper shaft 3 (Figure 1) journaled thereon in suitable bearing members (not shown). The shipper shaft 3 is further provided with a centrally disposed pinion 4, and a drum member 5, the drum being mounted on the exterior of the boom. Both pinion and drum are rotatable with the shipper shaft. The drum may be operated by cables, not shown, or in any other suitable manner.

A standard dipper stick 6 is mounted in juxtaposition to the shipper shaft 3 and is provided with a rack 7 for cooperation with the pinion 4, so that the dipper stick may be moved longitudinally of itself in either direction and to any desired position on the boom.

The standard dipper stick 6 is pivotally connected at its lower end to a scoop 8 by means of a transverse pin 9 on the scoop. It is also connected to the scoop 8 by means of a brace 10 pivoted to the scoop as at 11 and having a series of holes 12 which afford a means for the adjustable connection of the upper end of this link 10 to the dipper stick through the medium of a pivot pin 13. It will be understood that this adjustment makes possible the positioning of the scoop at any desired angle with relation to the dipper stick.

As shown in Figure 4, the outermost end of the boom is provided with two holders for supporting the shaft on which the dipper stick swings. These holders are of identical structure and are so positioned that the open-

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ings therethrough are in alignment. The holders are made in two sections. One section, as 14, is rigidly secured to the end of the boom. The other section 15 is mounted on the first section and rigidly bolted thereto. The split sections 14 and 15 are each provided with complemental semi-circular recesses and when the two sections are mounted together, the recesses are brought into cooperation to form a circular opening wherein a shaft member 16 (Figure 7) may be rigidly held against rotation. This shaft 16 forms a part of the apparatus by which the dipper stick is mounted upon the outer end of the boom when it is to be used as an inward stroke shovel.

This mechanism, in addition to the shaft 16, comprises a segmental rack member 17 which is clamped to the rear side of the dipper stick 6 in the position shown in Figures 1, 2 or 6, by means of complemental clamp members 18, Figures 1, 2 and 3. These complemental clamp members 18 are provided on their inner surfaces with teeth or corrugations 19 that interfit with the teeth of the rack 7 upon this face of the standard dipper stick. Bolts 20 are provided for drawing the segmental rack member 17 and the clamp member 18 into proper cooperative relation to cause the rack to effectively grip the dipper stick and clamp it thereto, thus holding it against all other movement, except pivotal movement about the outer end of the boom longitudinally of itself.

The segmental rack member is provided with a centrally disposed hub 21 (Figure 7), the hub being bored centrally and provided with a bushing 21'. This assembly is adapted to rotatably support the rack on the shaft 16. The rack, when mounted on the shaft 16, (Figure 6) lies intermediate the spaced channel iron beams of the boom 1. The shaft 16, as hereinbefore mentioned, is gripped against rotation by the holder members 14 and 15 and the ends of the shaft, extending beyond the holders, support the idle sheaves 22. Collars 23 mounted at the extreme ends of the shaft hold the sheaves in place, the sheaves being rotatable on the shaft. These collars may be rigidly held on the shaft by means of set screws, as shown.

A pinion 24 (Figures 1, 2 and 3), adapted to mesh with the rack teeth of the member 17, is mounted on the boom at a point somewhat in the rear of the outer end thereof and adjacent the outer edge being intermediate the spaced channel members of the boom (Figure 6). This pinion, (Figure 6) is mounted to rotate with the shaft 25, which is mounted on the boom in suitable hangers 26. The drums 27 are keyed on each end of the shaft and are rotatable therewith. The pinion 24 is preferably provided with a square bore, and the shaft is likewise cut

square, in its central portions, to ensure positive rotation of the pinion therewith.

It will be understood that the pinion 24 and the shaft 25 are in reality the pinion 4 and shaft 3 of the standard dipper stick transposed to the new position shown. It is a feature of this invention to utilize these two members for both outstroke and instroke digging. The drum 5 (Figure 1) is replaced by the smaller drums 27 (Figure 8) hereinbefore referred to. In this new position, the pinion 24 and shaft 25 are adapted, through the medium of the rack 17, to cooperate with the hauling line to operate the stick 6 for "back-hoe" digging.

The hoisting and hauling lines for operating the boom are best shown in Figures 1, 2, 5 and 6. The numeral 28 (Figure 6) indicates the line from the machine which extends over the idler sheave 29 around the idlers 30 and 31 of the sheave block 32, and back over the idler 33. The sheave block 32 is further provided with a semi-circular groove 34. The line 35 is dead-ended as at 34' (Figure 5) on one of the drums 27 on the shaft 25, and is turned around one of the idler wheels 22, around the race 34 of the sheave block (Figure 6) over the opposing idler wheel 22 and dead-ended on the opposing drum 27. Assuming the stick to be in the position shown in Figure 2; when the hoisting line 28 is drawn toward the machine, both sides of the line being drawn at once, the line 35 will exert an even pull on the remainder of the line that is wound around the drum 27 and will resultantly rotate the pinion 24, thus rotating the rack 17 to throw the scoop upwardly and outwardly.

The inward and downward movement of the scoop is effected by gravity and by the action of the hauling cable 36 (Figure 1). At this time, the drums 27 will be rotated, through the segmental rack 17 and pinion 24, to wind up the line 35 on the drums.

It will also be understood that a stop 37 (Figures 2 and 6), located upon the upper side of the boom adjacent the outer end thereof is adapted to contact with the rear surface of the dipper stick when it is extended to a position approximating alignment with the boom, as for instance, during the reaching out of the scoop for a hammer blow or preliminary to the performance of a digging stroke toward the machine or when the scoop is discharging from its mouth at a distance from the machine. This block is demountably located on the boom and may be removed when desired. It will also be apparent that the scoop is provided with a discharge closure 38 which may be equipped with suitable latch and tripping mechanism. When used as a standard dipper, the load is discharged through the discharge closure rather than at the mouth.

It will appear that I have provided an

excavator construction of novel form which permits of the ready adaptation of an excavator to various desirable purposes. For example, an excavator of standard type may be readily converted into an excavator of the "back-hoe" type with minimum difficulty and with a minimum number of additional parts. The standard dipper stick and scoop may be utilized and such parts as the shipper shaft and the pinion normally carried thereby may also be utilized. In addition, my excavator cannot only be readily adapted to use as a drag line excavator, but it may also be readily adapted for use as a crane, a clam shell excavator or a pile driver.

Having thus described my invention what I claim is:

1. In an excavating machine, a boom, a standard dipper stick, means for mounting said dipper stick intermediate the ends of said boom for movement longitudinally of itself, and other means for pivotally mounting said dipper stick on the outer end of said boom.

2. In an excavating machine, a scoop-carrying member, rack teeth disposed along one side of said scoop-carrying member, a plate for interfitting with said rack teeth, a segmental rack mounted on the opposing side of said stick, and bolts for drawing said segmental rack and said plate together.

3. In a convertible excavating machine, a boom, a dipper, a reversible dipper stick secured to said dipper and adapted to be mounted upon said boom at a point intermediate the ends of the latter with the dipper facing forwardly, means for pivotally mounting said dipper stick on said boom near the point thereof in a reverse position and with said dipper facing rearwardly, and means for imparting both longitudinal movement and pivotal movement to said dipper stick when it is in the first mentioned position and for imparting pivotal movement thereto when it is in its last mentioned position.

4. In a convertible excavating machine, a boom, a dipper, a dipper stick secured to said dipper and adapted to be mounted on said boom at a point intermediate the ends of the latter with said dipper facing forwardly, an actuating member having means for detachably securing the same to said dipper stick, means for pivotally mounting said dipper stick and said actuating member on said boom near the point thereof with said dipper facing rearwardly, and means for imparting longitudinal movement to said dipper stick when it is in the first mentioned position and for causing said actuating member to impart pivotal movement to said dipper stick when it is in the last mentioned position.

5. In a convertible excavating machine, a boom, a dipper, a dipper stick secured to said dipper and adapted to be mounted on said boom at a point intermediate the ends of the

latter and having a longitudinal rack on one side thereof, a segmental rack having means for securing the same to the other side of said dipper stick, means for pivotally mounting said segmental rack on said boom near the point thereof, a pinion, said boom having means for supporting said pinion either in a position to engage said longitudinal rack when said dipper stick is in said intermediate position, or in a position to engage said segmental rack when the latter is mounted on said boom, and means for rotating said pinion in either of said positions.

6. In an excavating machine, a boom pivoted for up and down movement, a dipper stick, a segmental rack rigidly secured to said dipper stick and pivotally mounted on said boom near the point thereof with the toothed portion thereof extending rearwardly along said boom, a dipper carried by said dipper stick and facing rearwardly, a pinion on said boom meshing with said segmental rack, means for actuating said pinion to move said dipper stick in one direction about the axis of said segmental rack, and a haul line connected with said dipper to move said dipper stick in the other direction about said axis.

7. A convertible excavator comprising a boom, a scoop carrying member designed to be connected to said boom either at its end or intermediate its length, a longitudinal rack structure on said scoop carrying member, a segmental rack mounted adjacent the end of said boom and having means for securing the same to said scoop carrying member, a pinion, and means for mounting said pinion on said boom in a position to engage said longitudinal rack when said scoop carrying member is mounted intermediate the length of said boom and for mounting the same near the point of said boom to engage said segmental rack when the said scoop carrying member is mounted at the end of said boom, whereby said pinion may be alternately used to actuate said scoop carrying member either as an out-stroke excavator or as an instroke excavator.

8. In an excavating machine, a boom pivoted for up and down movement, a segmental rack pivotally mounted near the point of said boom, a pinion for driving said rack and meshing therewith, a scoop carrying member secured to said rack, a scoop carried by said scoop carrying member and facing toward the machine, means for moving said scoop toward the machine, and other means for rotating said pinion and for raising and lowering said boom.

9. In an excavating machine, a boom pivoted for up and down movement, a segmental rack pivotally mounted near the point of said boom, a pinion for driving said rack and meshing therewith, a scoop carrying member removably secured to said rack, a scoop carried by said scoop carrying member and fac-

ing towards the machine, a haul line for moving said scoop towards the machine, and a hoisting line for rotating said pinion and for raising and lowering said boom.

5 10. A dipper supporting device for a convertible excavating apparatus comprising a dipper stick adapted to be mounted in any one of a plurality of positions on a boom, a rack on said dipper stick, a pinion adapted to
10 cooperate with said rack to effect longitudinal movement of said dipper stick when the latter is in one of said positions, and means for pivotally connecting said dipper stick to said boom in another of said positions, said
15 means including a part to rigidly secure said dipper stick thereto.

11. A dipper supporting device for a convertible excavating apparatus comprising a dipper stick adapted to be mounted in any
20 one of a plurality of positions on a boom, a rack on said dipper stick, a pinion adapted to cooperate with said rack to effect longitudinal movement of said dipper stick when the latter is in one of said positions, and
25 means for pivotally connecting said dipper stick to said boom in another of said positions, said means including a clamp to rigidly secure said dipper stick thereto, said clamp having a part to engage between the teeth
30 of said rack and hold said dipper stick against longitudinal movement.

12. An excavating apparatus comprising a boom pivoted for up and down movement, a dipper stick pivotally mounted thereon, gear
35 mechanism connected with said boom and said dipper stick for causing said dipper stick to swing about its pivot on said boom, a cable connected with said gear mechanism and being also connected to drum mechanism disposed on the body portion of said excavating
40 apparatus, said cable and drum mechanism being adapted to actuate said gear mechanism and to raise and lower said boom.

13. An excavating apparatus comprising a
45 boom pivoted for up and down movement, a dipper stick pivotally mounted thereon, gear mechanism connected with said boom and said dipper stick for causing said dipper stick to swing about its pivot on said boom, means to resist the movement of said dipper
50 stick by said gear mechanism, and a cable operatively connected with said gear mechanism and being also connected to drum mechanism disposed on the body portion of said
55 excavating apparatus, said cable and drum mechanism being adapted to actuate said gear mechanism and to raise said boom when the movement of said dipper stick is resisted by said resisting means.

60 14. An excavating apparatus comprising a boom pivoted for up and down movement, a dipper stick pivotally mounted thereon, gear mechanism for causing said dipper stick to swing about its pivot on said boom, a drum
65 for operating said gear mechanism, a cable

wound on said drum, said cable being operable to rotate said drum and being connected to hoisting mechanism disposed on the body portion of said apparatus, and means to resist the rotation of said drum by said cable and hoisting mechanism and thereby cause said cable to raise said boom.

15. In an excavating machine, a boom pivoted for up and down movement, a dipper stick mounted on said boom near the point thereof for swinging movement about a fixed axis, a dipper carried by said dipper stick and facing toward the pivoted end of said boom, a haul line connected with said dipper, a member connected with said dipper stick near its axis for imparting swinging movement thereto, an actuating device mounted on said boom and operatively connected with said swinging member, a hoisting line, and means for operatively connecting said hoisting line with said actuating device to cause the latter to be actuated by said hoisting line when said haul line is slack and to cause said boom and said dipper stick to be elevated by said hoisting line when said haul line is taut.

16. In an excavating machine, a boom pivoted for up and down movement, a dipper stick mounted on said boom near the point thereof for swinging movement about a fixed axis, a dipper carried by said dipper stick and facing toward the pivoted end of said boom, a haul line connected with said dipper, a member connected with said dipper stick near its axis for imparting swinging movement thereto, a rotatable actuating device mounted on said boom and operatively connected with said swinging member, cable drums connected with said rotatable actuating device, a cable having its end portions wound on the respective drums, and a hoisting line operatively connected with the intermediate portion of said cable to cause the latter to rotate said drums.

17. In an excavating machine, a boom mounted for up and down movement, a segmental rack mounted on the outer end of said boom, a scoop-carrying member mounted on said rack, a pinion for driving said rack to cause movement of said scoop-carrying member, means for resisting movement of said scoop-carrying member, and a hoisting line connected with said pinion and to a drum mechanism disposed on the body portion of said machine, said hoisting line and drum mechanism being adapted to rotate said pinion and to raise said boom when movement of said scoop-carrying member is resisted by said resisting means.

In testimony whereof, I hereby affix my signature.

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