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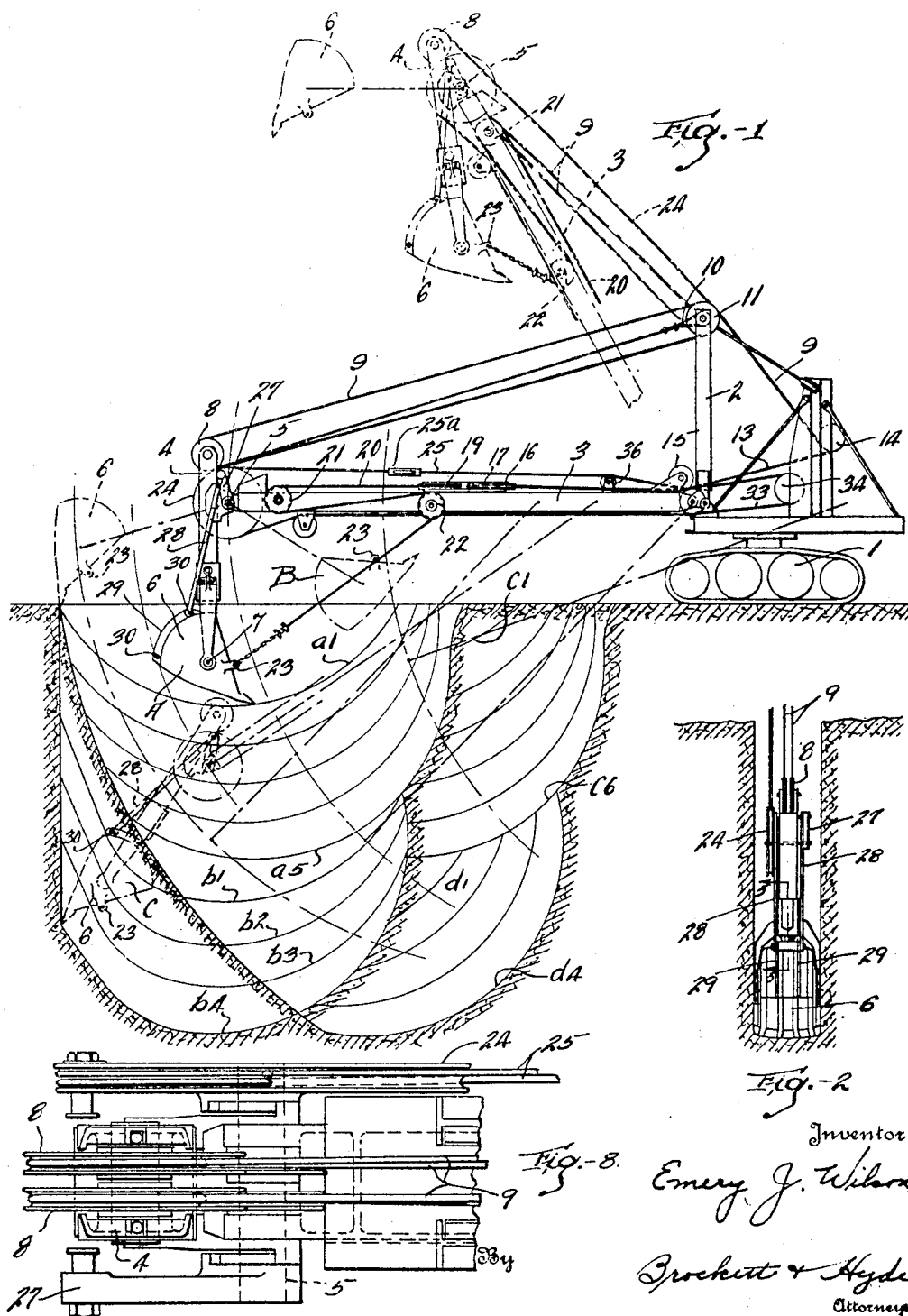
E. J. WILSON

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BACK DIGGER SWINGING DIPPER TYPE

Filed Oct. 5, 1927

2 Sheets-Sheet 1



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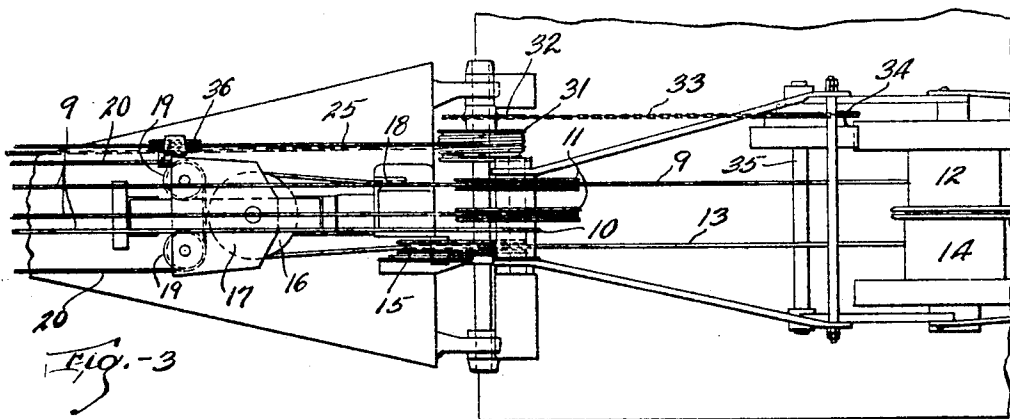
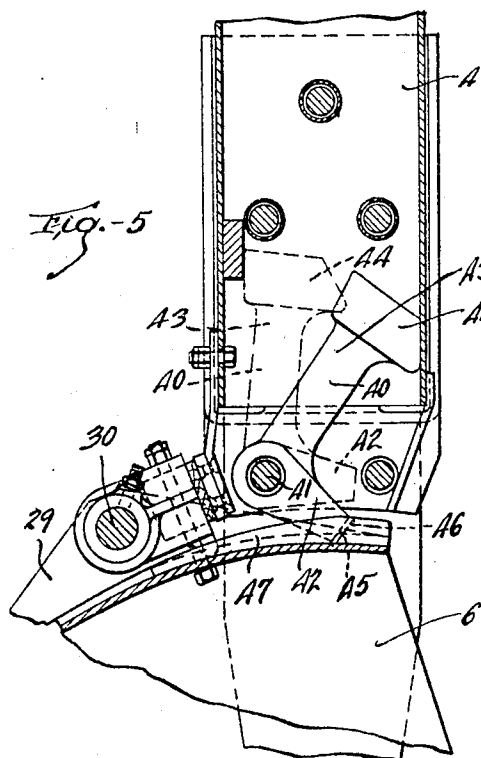
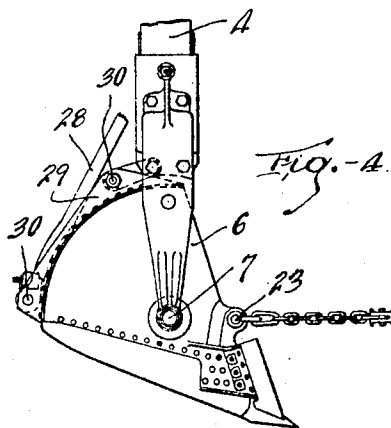
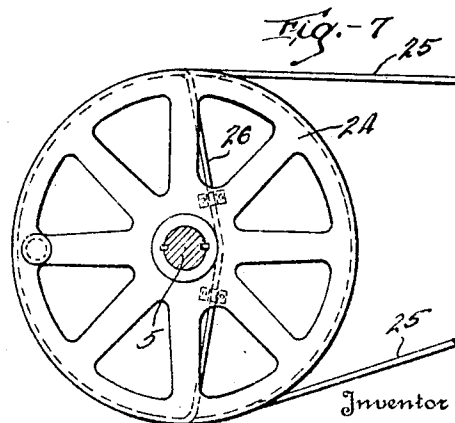
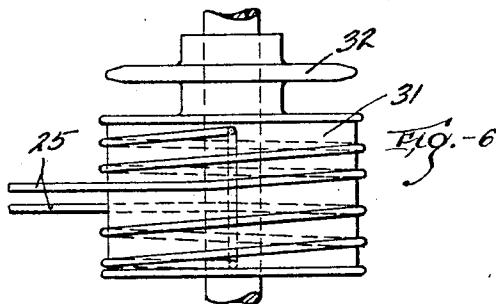
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UNITED STATES PATENT OFFICE

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BACK DIGGER SWINGING DIPPER TYPE

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This invention relates to back digging ditchers of the type in which the dipper is mounted to swing on an arm on the end of a boom, the direction of the cutting or digging stroke being toward the mast.

The object of the invention is to provide an improved dipper of this type with a special mounting and an arrangement of operating mechanism which permits a straight, vertical downward cut, as at the end of a ditch or trench or for the purpose of facilitating starting of the ditch, as well as one in which the load may be spot-dumped either directly beneath the boom end or at the maximum distance from the mast, the latter arrangement being particularly desirable when the weight of the spoil pile might otherwise cave in the side of the trench.

A further object of the invention is to provide an arrangement of this kind in which the dipper may be variously hooked up to its operating mechanism to provide for different operating conditions and effects, all as will more fully appear hereinafter.

Further objects of the invention are in part obvious and in part will appear more in detail hereinafter.

In the drawings, Fig. 1 is an elevation, more or less diagrammatic, showing a ditching machine embodying the invention; Fig. 2 is a detail sectional elevation showing the dipper in a trench; Fig. 3 is a detail plan view, on a larger scale, of the boom parts at the bottom of the mast; Fig. 4 is a detail elevation of the dipper; Fig. 5 is a detail sectional elevation through the dipper arm, on approximately the line 5-5, Fig. 2; Fig. 6 is a plan view of a spool or drum; Fig. 7 is a detail elevation of an operating sheave or pulley; and Fig. 8 is a plan view thereof.

Much of the structure of the apparatus embodying the present invention requires no detailed description because it follows standard lines. This is true particularly of the general arrangement of the frame or truck, mast and boom. In the particular embodiment shown in the drawings for purposes of illustration, the apparatus is of portable type mounted upon a wheeled truck 1 on which are mounted the mast 2 and boom 3, the lat-

ter swinging in a vertical plane and the mast turning around a vertical axis, as is usual. At the outer end of the boom is mounted a suitable arm 4 pivoted at 5 to swing in a vertical plane, said arm having a lower or depending portion carrying a yoke to which any suitable load moving or carrying device, here denominated a bucket or dipper 6, is pivoted at 7, and an upwardly extending portion carrying the sheaves or pulleys 8 around which is run the hoisting cable 9 dead-ended at 10 on the mast and passing over sheaves or pulleys 11 thereon to the hoisting drum 12, Fig. 3. This is a four-part hoisting cable or line, operation of which raises and lowers the boom and dipper or operates the dipper arm, as will be readily understood.

The drag line 13 is wound around the drag drum 14, Fig. 3, from which it extends beneath a sheave 15 and thence around a sheave 16 on a trolley 17 travelling on suitable tracks on the boom, and then is dead-ended on the boom at 18. The trolley 17 carries a sheave or sheaves 19, around which passes a loop of the line 20 passing around sheaves 21, 22 on the boom, the two ends of the line being connected at 23 to opposite side walls of the dipper. Operation of the drag drum 14 through the two-part drag line 13 traverses the trolley 17 along the boom 3 and swings the dipper stick on its pivotal axis 5 on the boom. Cooperative operation of the drag and hoisting lines produces either or both of swinging movements of the boom and dipper stick, as is usual.

The mechanism is also provided with a third or dipper line for positively producing swinging motion of the dipper on its stick—a positive motion in either direction controlled cooperatively with the effects of the drag and hoisting lines for operation of the dipper in the manner later to be described. For this purpose the dipper is provided with link connections to an operating device centered for rotation on the axis 5 on which the dipper stick turns on the boom. The arrangement for this purpose includes a sheave or pulley 24 fast on one end of the shaft 5 and around which passes an endless line 25. Said line has a turn or bight 26 passed through

and fastened to the sheave to prevent circumferential slip, while the shaft 5 on its opposite end carries an arm 27. Like rigid links 28 extend from the sheave and from arm 27 to the dipper, which is provided with parallel flanges or walls 29 having two sets of openings 30, to either of which the ends of the links 28 may be pinned. The arrangement produces something like parallel ruler motion, rotation of sheave 24 around the axis 5 producing approximately similar rotation of the dipper around its axis 7. At its opposite end the line 25 is wound several times about a spool 31 (Fig. 6) and at one point is fastened thereto, again to prevent slip; and said line may be provided with a turn buckle 25a for taking up the slack, as is usual under such circumstances. The spool 31 is fast with sprocket 32, from which a chain 33 extends to a sprocket 34 on a shaft 35 driven at will by power mechanism (such as the usual crowding mechanism) through suitable control devices not necessary to describe in detail.

Line 25 may pass over one or more idler or guiding pulleys 36 as desired.

In the full lines in Fig. 1 the dipper is represented in what may be termed its normal hook-up, with the links 28 connected to the upper holes 30, although the word "normal" is here used only for convenience and not in any sense as implying that the other hook-up of the dipper is in any sense abnormal or unusual. With the truck in the position shown, a ditch may be started by sweeping cuts along the successive lines a^1 to a^5 inclusive. During each of these cuts the drag line preponderates over the hoist line to swing the dipper arm on its axis, and, if desired, the crowding shaft 35 may be actuated to more or less tilt the dipper upon its axis upon the dipper stick and maintain the most desirable angle of rake of the teeth. The dipper leaves the excavation inwardly of the end of the boom in about the position shown at B, in which it is filled, the dipper pivots being so located on the dipper that it will tend to hold its load by gravity to whatever position the boom or dipper stick may be swung. The boom is raised and is turned with the mast to the side of the trench, the dipper stick being swung outwardly to project to the maximum beyond the end of the boom so as to carry the load out to the utmost distance, where it may be dumped by actuation of the dipper line, or by cooperative action of dipper line, hoist line, and drag line. During this operation the dipper automatically tips to hold the load as the boom is raised or as the dipper arm is swung out. The dipper may be dumped as it moves outwardly where spot-dumping is not so essential. In any event, with this hook-up of the links 28 in the upper holes 30 the dipper may be moved to its extreme outward position before the load is dumped, so that the spoil pile may originate

at the maximum distance from the side of the trench.

If circumstances require a substantially vertical wall at the end of the trench, as where the trench extends from the wall of a building or should be cut down along a vertical bank of intersecting pipes, conduits or the like, the links 28 are unhooked from the upper holes 30 and the dipper is turned and said links are hooked into the lower holes 30, all in the position shown in dotted lines at C, Fig. 1. The truck is advanced about five feet toward the excavation and the new arrangement or second hook-up permits a series of cuts to be taken on approximately the lines b^1, b^2, b^3 , to the final line of the excavation, b^4 , with the end wall vertical. The final cuts terminate in a curve b^4 partially under-cutting the previous excavation.

With the dipper in its second position or hook-up, it cannot be spot dumped outwardly at the extreme distance from the mast, but may be dumped directly beneath the end of the boom or, in fact, at any point intermediate the ends of the boom, so that with this arrangement the load can be deposited close to the trench, where such result is desirable.

Again proceeding, the dipper is shifted back to its original hook-up, shown in full lines, Fig. 1, and the truck is moved back about sixteen feet (on a basis of eight feet for each step or cut of a series of cuts in the specific embodiment shown) and a series of cuts is taken along the lines c^1 to c^6 by swinging movement of the dipper stick on the boom, as will be readily understood. The truck is then advanced toward the excavation about eight feet, or one step, and a new series of cuts d^1 to d^4 is taken with the boom lowered to approximately 45° , completing the full depth of the trench, successive series of upper and lower cuts being taken thereafter, as will be readily understood.

With this arrangement, it is therefore possible to dig a deep trench up to say twenty-two or three feet deep and three to five feet wide and deposit the material near to or far from the sides of the trench.

The second hook-up enables the end of the trench to be sheared off substantially vertically and saves considerable hand digging, and moreover, this arrangement enables the dipper to be operated with a "pick" action even at the bottom of the trench, due to the ability to root or advance its teeth directly downwardly against the earth, which is of advantage at times in starting an excavation where the surface soil is particularly resistant and considerable effort of the "picking" character is necessary or desirable.

When the dipper is dropped to the bottom of the excavation with its arm 4 vertical, as at A Fig. 1, the blow at contact with the earth tends to rotate the dipper counter clockwise, Fig. 1 with heavy strains on the links, clutches

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and other parts of the crowding mechanism. Fig. 5 shows stop mechanism for avoiding the effect of such strains, but releasable so as not to interfere with the dumping operation. The dipper stick is of hollow box form, being usually formed of structural steel, and within its cavity is located an L-shaped gravity pawl 40 pivoted on a pin 41 and having a lower pawl arm 42 and an upper arm 43 provided with a counter-weight 44. The pawl arm 42 is provided at its end with a shoulder 45 adapted to cooperate with a shoulder or abutment 46 between two flanges 47 extending circumferentially along the outer wall of the dipper, one on each side of said arm. The arrangement of the parts is such that when the dipper stick extends downwardly away from the mast or depends vertically from its pivot, or is inclined downwardly toward the mast in any position short of about a 45° angle, the counter-weight 44 holds the pawl 42 in the path of movement of the abutment 46, so that the abutting shoulders 45, 46 form a positive stop to limit counterclockwise rotation, Fig. 1, of the dipper, due to impact of the dipper teeth with the earth, to the cutting operation or to receipt or distribution of the load. However, when a cut is completed by swinging movement of the dipper stick inwardly beyond the 45° angle or to the position shown at say B, Fig. 1, the counterweight 44 passes to the other side of the pivot 41 and swings the pawl 42 out of abutting relation with the shoulder 46, thereby freeing the dipper to fully swing in either direction, either by gravity or by the effect of the crowding mechanism.

This arrangement positively relieves the crowding mechanism of unnecessary shock and avoids unnecessary use of the clutch mechanism therein to restrain the torsion effect upon the dipper before referred to.

What I claim is:

1. An excavator, including a swinging boom, a dipper arm mounted to swing thereon and provided with a pivoted dipper, operating means connected to said dipper for positively rotating it in either direction, and stop means for limiting its rotation in one direction, said stop means being so arranged as to release the dipper for free movement when substantially loaded.

2. An excavator, including a swinging boom, a dipper arm mounted to swing thereon and provided with a pivoted dipper, operating means connected to said dipper for positively rotating it in either direction, and stop means for limiting its rotation in one direction, said stop means being controlled in accordance with the angular position of the dipper arm.

3. An excavator, including a swinging boom, a dipper arm mounted to swing thereon and provided with a pivoted dipper, op-

erating means connected to said dipper for positively rotating it in either direction, and including a member connected to said dipper and mounted to rotate about the axis of swinging movement of the dipper arm.

4. An excavator, including a swinging boom, a dipper arm mounted to swing thereon and provided with a pivoted dipper, and operating means connected to said dipper for positively rotating it in either direction, said operating means including a member mounted to rotate about the axis of swinging movement of the dipper arm and link means connecting said member to the dipper.

5. An excavator, including a swinging boom, a dipper arm mounted to swing thereon and provided with a pivoted dipper, operating means connected to said dipper for positively rotating it in either direction, said operating means including a member mounted to rotate about the axis of swinging movement of the dipper arm and link means arranged for various coupling to the dipper to vary the angle of rake and permit spot dumping at different distances from the boom base.

6. An excavator, comprising a swinging boom, a dipper arm pivoted intermediate its ends to the boom, a dipper pivoted thereon, hoist and drag lines effective upon the upper and lower ends of said arm, and operating means for said dipper centered about the pivotal axis of said arm and coupled to said dipper to rotate the same positively in either direction.

7. An excavator, comprising a swinging boom, a dipper arm pivoted intermediate its ends to the boom, a dipper pivoted on said arm, a hoist line effective upon the upper end of the arm, a drag line connected to the dipper on the front side of its axis, and operating means for the dipper coupled to it on the other side of its axis to rotate it positively in either direction.

8. An excavator, comprising a swinging boom, a dipper arm pivoted to the boom, a dipper pivoted thereon, a drag line connected to the dipper on the digging side of its axis, and dipper operating means effective on both sides of its axis to rotate it positively in either direction, in which said dipper operating means is centered about the pivotal axis of the arm on the boom.

9. An excavator, comprising a swinging boom, a dipper arm pivoted to the boom, a dipper pivoted thereon, a drag line connected to the dipper on the digging side of its axis, and dipper operating means effective on both sides of its axis to rotate it positively in either direction.

10. An excavator, comprising a swinging boom, a dipper arm pivoted to the boom, a dipper pivoted thereon, an actuating crank member mounted to rotate about the pivotal axis of the arm on the boom, operating means

therefor, and a rigid link connecting said crank member and dipper for rotating the latter positively in either direction.

11. An excavator of the form described in claim 10, including a drag line connected to the dipper and a hoist line effective upon the upper end of the dipper arm.

In testimony whereof I hereby affix my signature.

EMERY J. WILSON.