Sept. 25, 1956 E. E. DORKINS 2,764,306

BACK HOE EXCAVATOR

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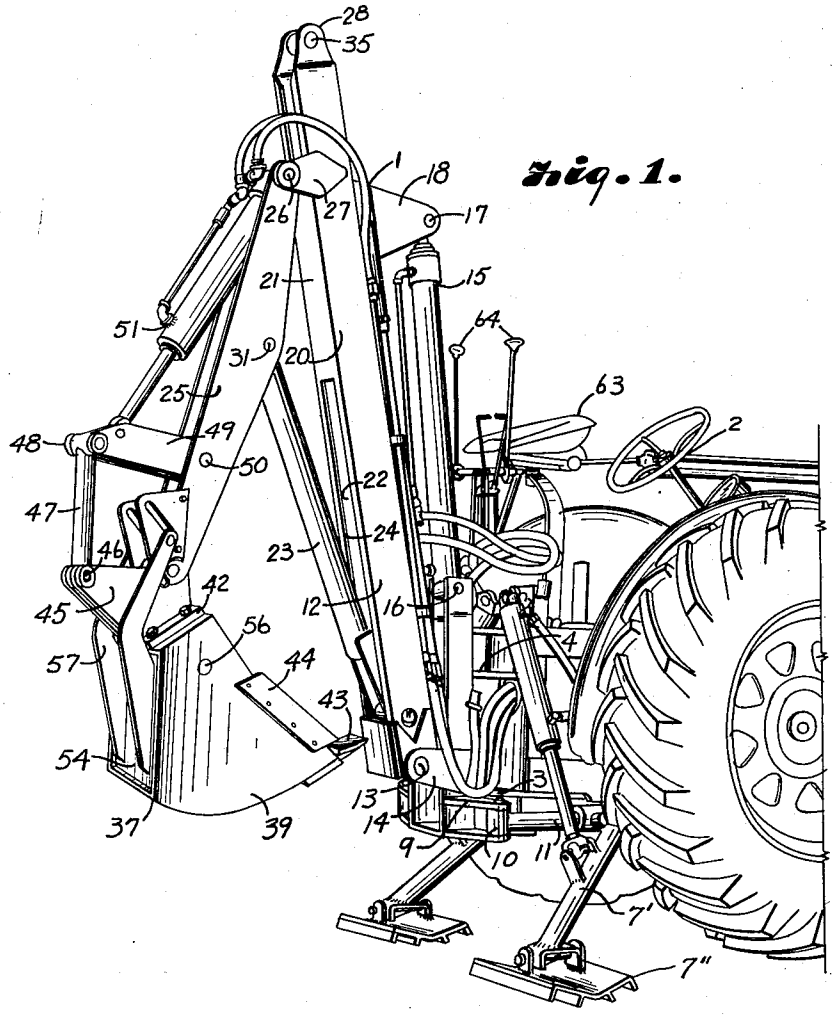

Fig. 1.

Fig. 8.

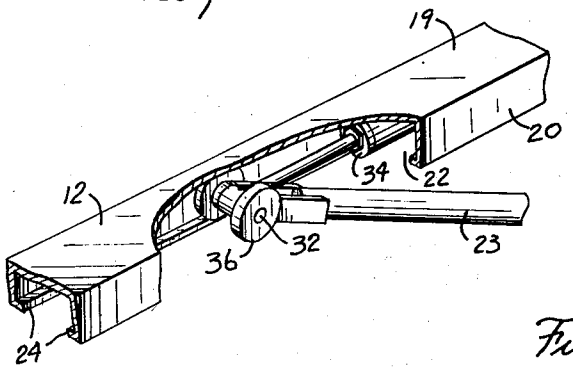

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Fig. 2.

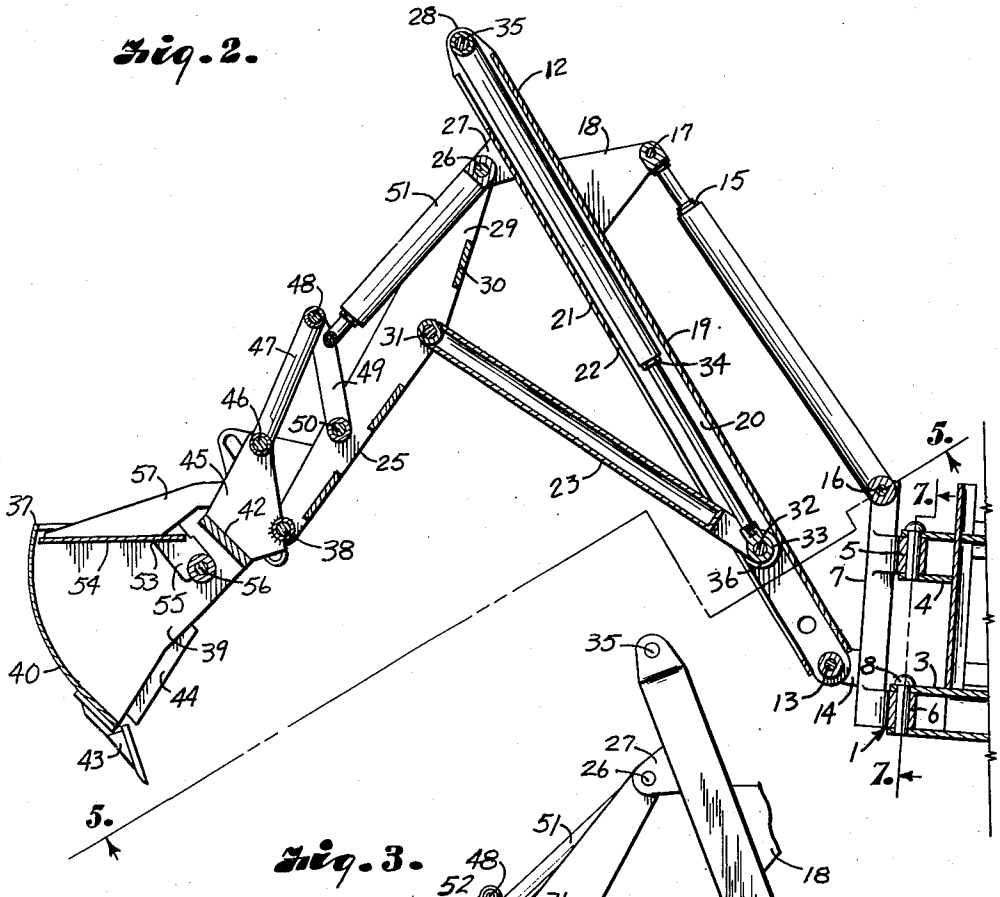

Fig. 3.

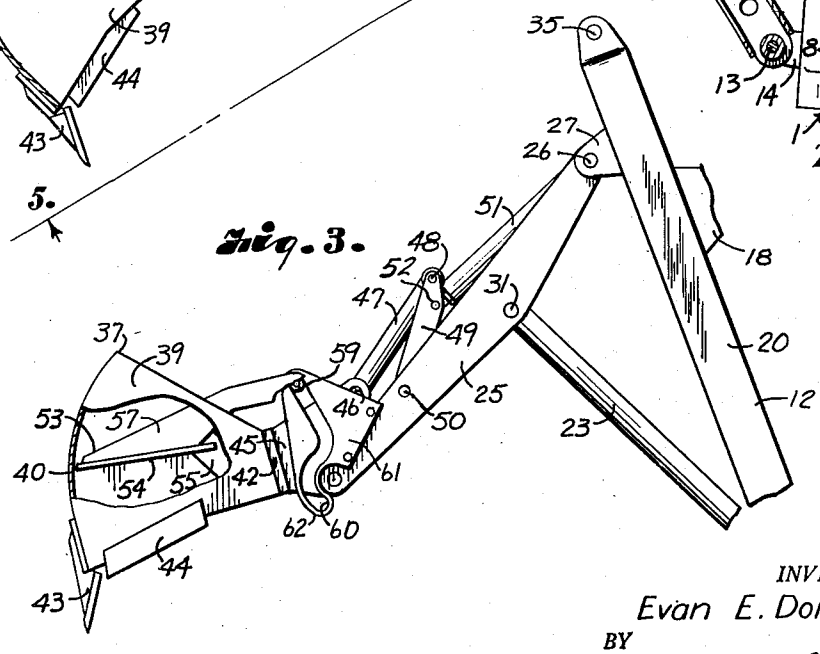

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Fig. 4.

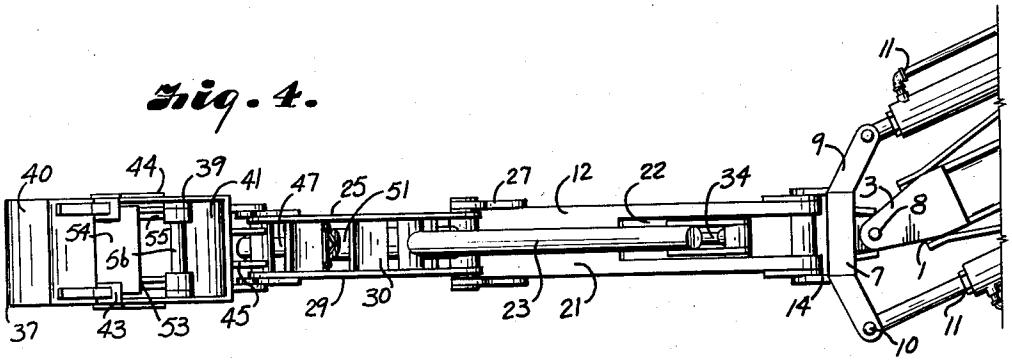


Fig. 5.

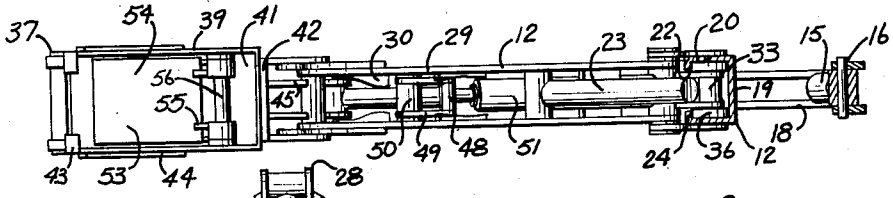


Fig. 6.

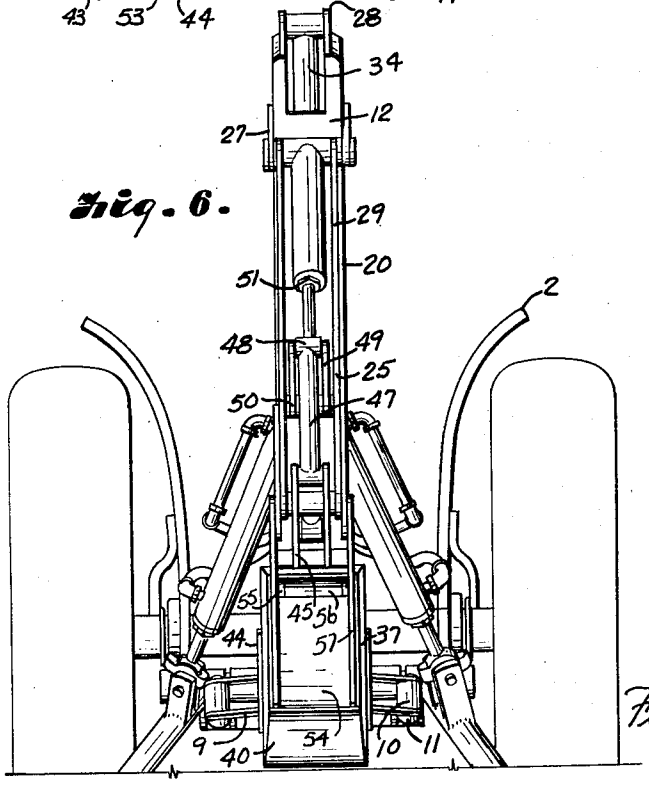
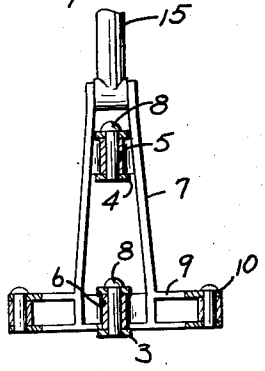


Fig. 7.



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2,764,306

BACK HOE EXCAVATOR

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Application April 16, 1953, Serial No. 349,171

2 Claims. (Cl. 214—510)

This invention relates to excavating implements such as back or trench hoes and power pull shovels and more particularly to an improved boom, dipper arm and apparatus thereon for moving the dipper and dumping material therefrom.

The objects of the invention are to provide the dipper with a novel material ejecting mechanism operative in response to swinging movement of the dipper on the dipper arm; to provide an improved boom pivotally carrying the dipper arm and hydraulic mechanism and link actuated thereby for moving the dipper arm; and to provide a back hoe boom, dipper and dipper arm assembly of rigid, durable construction, having compact, easily operated and controlled apparatus for swinging, raising and lowering the dipper arm and dipper thereon.

In accomplishing these and other objects of the present invention, I have provided improved details of structure, the preferred forms of which are illustrated in the accompanying drawings, wherein:

Fig. 1 is a perspective view of a back hoe excavator structure assembled on the rear end of a tractor.

Fig. 2 is a vertical sectional view through the boom, dipper arm and dipper in partially extended position.

Fig. 3 is a fragmentary side elevation of the boom, dipper arm and dipper with portions broken away to illustrate the material ejector in the dipper.

Fig. 4 is a bottom view of the boom, dipper arm and dipper assembly.

Fig. 5 is a bottom view of said assembly taken on the line 5—5, Fig. 2.

Fig. 6 is a rear elevation of the back hoe excavator.

Fig. 7 is a vertical sectional view through the boom post mounting taken on the line 7—7, Fig. 2.

Fig. 8 is a fragmentary perspective view of the boom illustrating the roller support of the link and hydraulic mechanism connection for operating the dipper arm.

Referring more in detail to the drawings:

1 designates a support structure suitably mounted at the rear of a tractor 2, said support structure preferably being fixed to the tractor frame. The support structure includes vertically spaced pairs of rearwardly extending ears 3 and 4 which receive portions 5 and 6 of a post 7 between the ears of the respective pairs 3 and 4, the ears 3 and 4 and portions 5 and 6 having aligned apertures therethrough for mounting pins 8 for pivotally mounting the post 7 on the support structure 1. Hydraulically actuated outriggers 7' are mounted on the tractor and operatable to engage outrigger feet 7'' with the ground or other supporting surface. These outriggers are operated simultaneously or individually to level the unit and also serve to stabilize and brake the tractor.

The post 7 has laterally extending arms 9 fixed thereto, the ends of said arms being pivotally connected as at 10 to rear ends of extensible hydraulic members 11, the forward ends of which are suitably connected to the tractor or support member 1 whereby extension and contraction of the hydraulic members 11 will swing the post 7 about the axis of the pins 8. A boom 12 has its lower end pivotally mounted on the post 7 by means

of a hinge pin 13 which extends through rearwardly extending portions 14 adjacent the lower end of the post 7. The hinge pin 13 is arranged with its axis perpendicular to the axis of the pins 8 whereby the boom may be swung radially, horizontally or vertically. The vertical swinging of the boom is effected by an extensible hydraulic mechanism 15 having one end pivotally connected as at 16 adjacent the upper end of the post 7 and the other end pivotally connected as at 17 to plate 18 suitably fixed to the boom intermediate its length as illustrated in Fig. 2, whereby extension of the hydraulic mechanism 15 swings the boom downwardly and contraction of said hydraulic mechanism swings the boom upwardly.

The boom 12 is preferably of box construction, consisting of a top wall 19, side walls 20 and a bottom wall 21, the bottom wall being slotted as at 22 outwardly from adjacent the hinge pin 13 to accommodate a link 23 as later described, the slot in the bottom wall 21 being of less width than the beam to provide flange-like portions 24 extending inwardly from the side walls 20 on each side of the slotted portion.

A dipper arm 25 has one end pivotally connected to the boom 12 by pivot bolt 26, in the illustrated structure the pivot bolt 26 being carried by plates 27 suitably secured as by welding to the boom 12 in spaced relation to the outer end 28 of said boom. The dipper arm 25 preferably consists of side portions 29 connected by spaced transverse portions 30 to form a rigid arm structure. The link 23 is a rigid non-extensible member having one end pivotally connected to the dipper arm 25 intermediate the ends thereof by a pin 31. The other end of said link extends through the slotted portion 22 of the boom 12 and is pivotally connected by a pin 32 to one end 33 of an extensible hydraulic member 34. The other end of the extensible hydraulic member 34 is pivotally connected by a pin 35 to the boom adjacent the outer end thereof. The extensible hydraulic member 34 is arranged inside of the box-like boom and the end 33 thereof is supported relative to the boom by rollers 36 mounted on the pin 32 and having rolling engagement with the inner surface of the flange-like portions 24 and inner surface of the wall 19, whereby said wall and flanges take part of the thrust from the link 23 in the movement of and support of the dipper arm 25. The arrangement of the extensible member 34, link 23 and dipper arm 25 is such that extension of the extensible member moves the end 33 thereof toward the lower end of the boom and through the connection of the link 23 with the dipper arm 25 swings said dipper arm toward said boom and contraction of the extensible member 34 moves the end 33 thereof toward the outer end of the boom whereby the link 23 causes the dipper arm to swing away from the boom.

A dipper or bucket 37 is pivotally mounted as at 38 on the end of the dipper arm 25 and preferably consists of side walls 39, an arcuate bottom wall 40 and an upper wall 42 whereby the walls 39, 40 and 42 define an open front end of the bucket, the forward end of the arcuate wall 40 being provided with teeth 43 for biting into earth or other material to be excavated. The side walls 39 diverge toward the open front end of the dipper whereby as a ditch or the like is dug there will be clearance between the sides of the ditch and the side walls 39. Also the rear of the dipper is open as later described. Cutter blades 44 are preferably arranged along and extend forwardly of the forward edge of the side walls 39. Spaced plates 45 are preferably fixed on the upper wall 42 and the pivotal mounting of the dipper arranged on said plates in spaced relation to the extension 42 as illustrated in Fig. 2.

A pin 46 is arranged in the plates 45 in spaced relation to the pivotal connection 38 and said pin 46 pivotally connected to one end of a link 47. The other end of said link is connected at at 48 to one end of a lever 49, the other end of said lever being pivotally connected as at 50 to the dipper arm intermediate the pivotal connections 31 and 38. An extensible hydraulic member 51 has one end pivotally mounted on the hinge bolt 26 and the other end of said extenseible member is pivotally connected as at 52 to the lever 49 adjacent the pivotal connection 48 whereby extension of said extensible hydraulic member swings the lever 49 and through the link 47 swings the dipper 37 on the pivot 38 to move the dipper forwardly and downwardly on the dipper arm. Contraction of the extensible hydraulic member 51 swings the dipper upwardly and rearwardly on said dipper arm.

A material ejector 53 is arranged in the dipper and includes a plate 54 which, during filling of the dipper, is at the rear of the dipper and substantially closes the open rear end thereof, said plate being provided with ears 55 pivotally mounted on a pin 56 extending transversely of and supported in the side walls 39 adjacent the wall extension 42. Spaced arms 57 are fixed on the plate 54 and extend rearwardly therefrom through the open rear end of the dipper. The ends of the spaced arms 57 are provided with cam rollers 59 adapted to ride in cam slots 60 of cam plates 61 fixed on opposite sides of the dipper arm 25. The slots 60 are a modified S-shape with the lower portion 62 thereof arranged around the axis of the pivotal connection 38 whereby when the dipper is approximately midway its swing, as illustrated in Fig. 2, the cam rollers 59 are positioned adjacent said arcuate portion of the cam slots and further forward swinging of the dipper will not alter the position of the plate 54 adjacent the rear end of the dipper wherein it serves as a rear wall for the dipper, but rearward swinging of the dipper from the position shown in Fig. 2 will cause the cam rollers 59 to move along the upper portion of the cam slots 60 whereby there is relative movement between the dipper and the plate 54 whereby the plate 54 approaches the forward open end of the dipper to force material from said dipper. The swing of the ejector plate 54 is steadily changing the relative position thereof to the open front end of the dipper as the dipper is swung in an arc with respect to the dipper arm into dumping position. Any material that may pass between the edges of the plate 54 and the walls of the dipper will pass out the open rear end and will not be trapped or build up behind the plate so there can be not interference with operation of said plate.

In operating the back hoe excavating apparatus the operator is positioned on a seat 63 on the tractor 2 and by movement of suitable levers 64 controls hydraulic pressure applied from a pump (not shown) to the various extensible hydraulic means for effecting controlled movement of the boom, dipper arm and dipper. In digging operations, the tractor is arranged with the wheels thereof straddling the position of the trench or the like to be excavated, the outriggers actuated to stabilize and brake the tractor, and the hydraulic jacks 11 manipulated to align the boom with said trench. Hydraulic pressure is then applied to the extensible hydraulic means 34 to contract same and swing the dipper arm 25 rearwardly away from the boom, and hydraulic pressure is applied to the extensible hydraulic means 51 to swing the dipper on the dipper arm to the relative position shown in Fig. 2. Hydraulic pressure is then applied to the extensible hydraulic member 15 to raise or lower the boom 12 to arrange the dipper in position to engage the earth or other material to be excavated. Then by further movement of the boom and also by applying hydraulic pressure to the hydraulic extensible members 34 and 51 the dipper arm 25 and dipper 37 are moved toward the boom to dig the material as desired. When the dipper is full the hydraulic member 15 is operated to raise the boom and lift the dipper from

the trench and then the hydraulic jacks 11 operated to swing the boom to one side to position the bucket over an area where the material is to be dumped. The hydraulic members 34 and 51 are then operated to raise the dipper arm 25 and swing the dipper 37 rearwardly and upwardly thereon to the position substantially as shown in Fig. 3 wherein the ejector plate is moved relative to the dipper to aid in dumping material therefrom.

With the arrangement of the various parts as illustrated and described the structure is compact and very sturdy to withstand any normal shocks incident to the excavating, and also the apparatus is easily moved to various positions as desired to facilitate digging material and dumping same from the dipper.

What I claim and desire to secure by Letters Patent is:

1. In a power operated shovel employing a boom as an operative part thereof, in combination, a dipper arm pivotally mounted on the boom adjacent the end of the boom to swing in an arc from the boom, a dipper bucket adapted for digging and loading purposes pivoted on the end of the dipper arm, extensible means mounted on the boom longitudinally thereof, link means connecting the extensible means with the dipper arm intermediate the ends thereof for swinging the dipper arm in response to change in length of said extensible means, extensible means on the dipper arm and connected to the dipper bucket for pivoting same relative to the dipper arm, a material ejection plate in the dipper bucket and pivotally mounted relative thereto, a slotted cam member mounted on the dipper arm in fixed relation thereto, and a follower engaged in the slotted cam member and fixed to the ejection plate whereby movement of the dipper bucket on the dipper arm from loading to dumping position effects relative movement of the ejection plate and dipper bucket to force material from said dipper bucket.

2. In a power operated shovel employing a boom as an operative part thereof, in combination, a dipper arm pivotally mounted on the boom adjacent the end of the boom to swing in an arc from the boom, a dipper bucket adapted for digging and loading purposes pivoted on the end of the dipper arm, extensible means mounted on the boom longitudinally thereof, link means connecting the extensible means with the dipper arm intermediate the ends thereof for effecting swinging movement of the dipper arm on the dipper boom, a lever having one end pivoted on the dipper arm in spaced relation to the dipper bucket, a link pivotally connecting the other end of the lever and the dipper bucket, an extensible means on the dipper arm and connected to the lever in spaced relation to the said one end thereof for moving said lever and link means to swing the dipper bucket relative to the dipper arm, a material ejector plate in the dipper bucket and pivotally mounted relative thereto, a slotted cam member mounted on the dipper arm in fixed relation thereto with a portion of the slot concentric with the pivotal mounting of the dipper bucket and remainder of the slot extending substantially radially of said axis, and a follower engaged in the slotted cam member and fixed to the ejector plate whereby movement of the dipper bucket on the dipper arm from loading to dumping position effects relative movement of the ejector plate and dipper bucket to force material from said dipper bucket.

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