

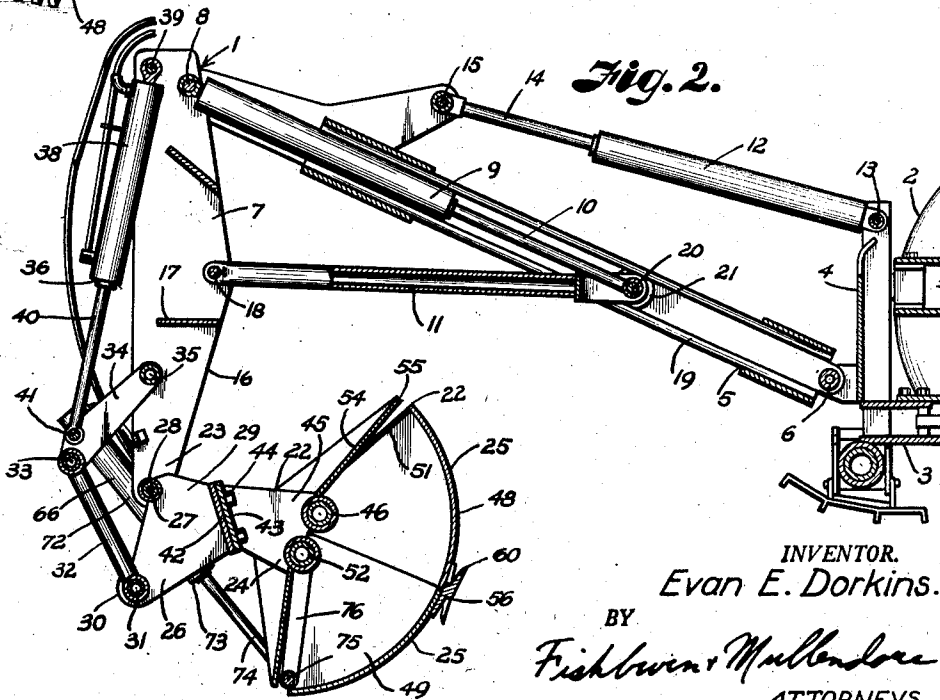
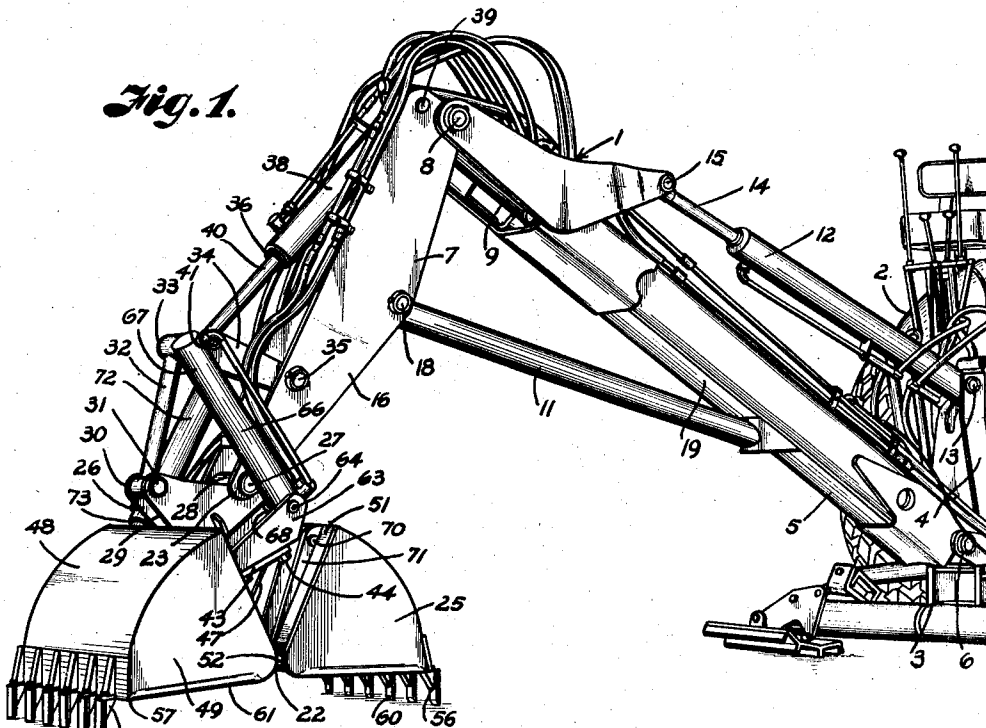
March 25, 1958

E. E. DORKINS
EXCAVATING APPARATUS

2,828,038

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2 Sheets-Sheet 1



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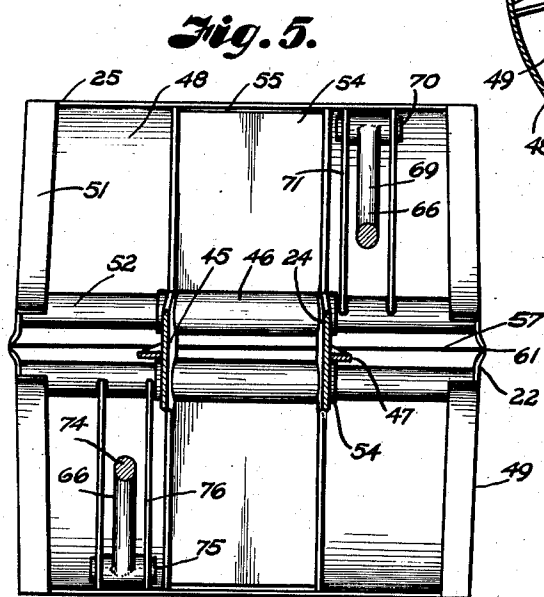
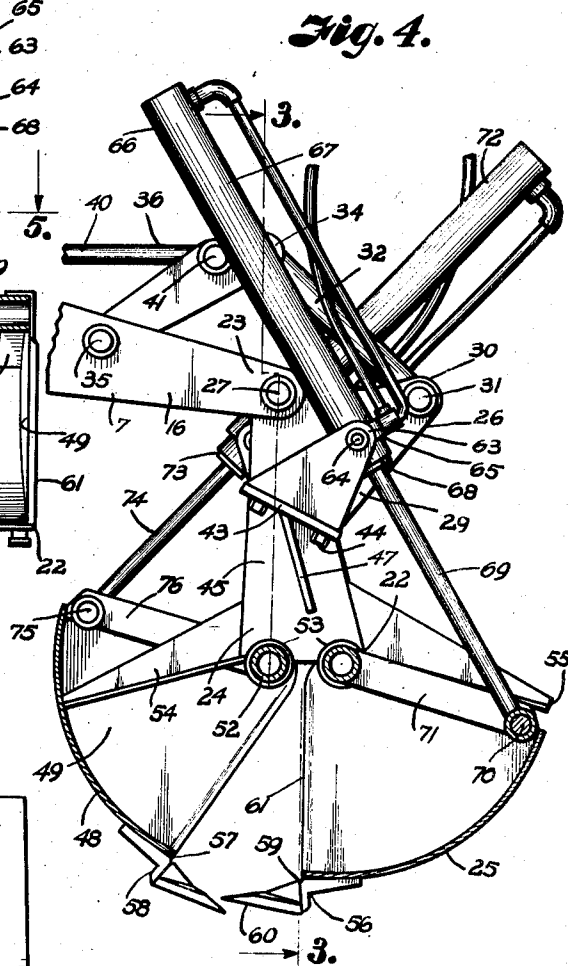
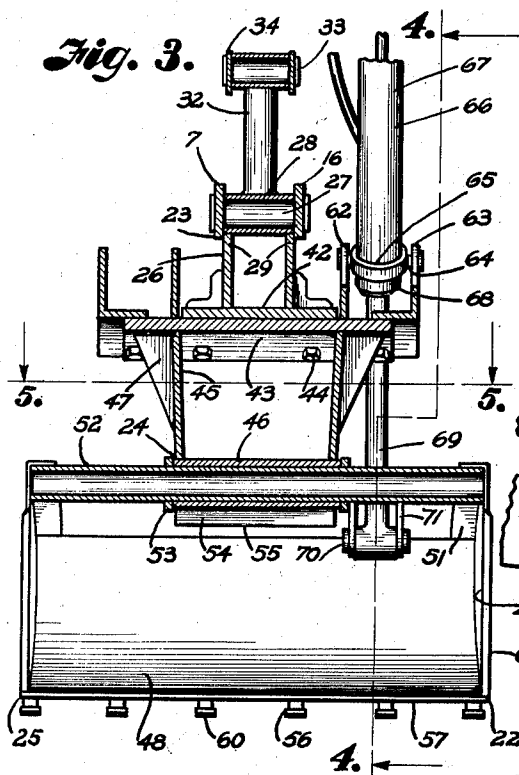
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2 Sheets-Sheet 2



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2,828,038

EXCAVATING APPARATUS

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Application August 3, 1955, Serial No. 526,261

3 Claims. (Cl. 214—510)

This invention relates to excavating apparatus and more particularly to an hydraulic clam-shell bucket or the like and the combination thereof with a back hoe boom mounted dipper arm.

The objects of the present invention are to provide a novel excavating or material handling equipment which includes an hydraulically operated clam-shell bucket adjacent the end of a dipper arm of a back hoe structure; to provide such equipment in which the clam-shell bucket is pivotally carried on the dipper arm with operating structure for swinging the entire bucket relative to said arm; to provide an hydraulically operated clam-shell bucket wherein each bucket section is independently swingable; to provide such a clam-shell bucket in which each section has material-ejecting mechanism responsive to swinging movement of the respective bucket section; to provide such a clam-shell bucket wherein each bucket section is both opened and closed by hydraulic pressure; and to provide excavating or material handling equipment including an hydraulically operated clam-shell bucket that is strong, durable and efficient in operation.

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

Fig. 1 is a perspective view of a clam-shell bucket and back hoe structure assembled on the rear end of a tractor.

Fig. 2 is a vertical sectional view through the boom, dipper arm and clam-shell bucket.

Fig. 3 is a transverse sectional view through the clam-shell bucket and mounting taken on the line 3—3, Fig. 4.

Fig. 4 is a vertical sectional view through the clam-shell bucket and mounting taken on the line 4—4, Fig. 3.

Fig. 5 is a substantially horizontal sectional view of the clam-shell bucket taken on the line 5—5, Fig. 3.

Referring more in detail to the drawings:

1 generally designates a back hoe structure mounted on a tractor 2, the back hoe including a support structure 3 fixed to the tractor frame, a vertical post 4 carried on the support structure, a boom 5 pivotally mounted as at 6 on the vertical post, a dipper arm 7 pivotally mounted on a pin 8 adjacent the outer extremity of the boom 5 and swingable thereon in response to operation of an extensible member. The extensible member is preferably hydraulic including an hydraulic cylinder 9, having one end carried by the pin 8 and a piston rod 10 projecting from the other end of the cylinder and connected by a link 11 to the dipper arm 7. The boom 5 is raised and lowered by an extensible member such as an hydraulic cylinder 12 having one end pivotally connected as at 13 to the post 4 with a piston rod 14 extending from the other end of the cylinder and pivotally connected as at 15 to the boom 5.

The support 3, post 4, boom 5, dipper arm 7 and hydraulic actuating members for said structure are substantially in accordance with the structure shown and described in my co-pending application on Back Hoe Excavator, Serial No. 349,171, filed April 16, 1953.

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The dipper arm 7 preferably consists of spaced side portions 16 connected by spaced transverse members 17 to form a rigid arm structure. The link 11 is a rigid, non-extensible member having one end pivotally connected to the dipper arm 7 intermediate the ends thereof by a pin 18. The other end of said link extends through a slotted portion 19 of the boom 5 and is pivotally connected by a pin 20 to one end of the extensible hydraulic member consisting of the cylinder 9 and piston rod 10, the extensible hydraulic member being arranged inside of a box-like boom 5 with rollers 21 mounted on the pin 20 and having rolling engagement with the inner surface of the boom. The arrangement of the extensible member consisting of the cylinder 9 and piston rod 10, link 11 and dipper arm 7 is such that extension of the extensible member moves the pin 20 thereof toward the lower end of the boom and through the connection of the link 11 with the dipper arm 7 swings said dipper arm towards said boom and contraction of the extensible member moves the pin 20 toward the outer end of the boom whereby the link 11 causes the dipper arm to swing away from the boom.

The arrangement of the cylinder 12 and rod 14 is such that it forms an extensible hydraulic member whereupon the extension thereof lowers the outer end of the boom and contraction thereof swings the boom upwardly on the pin 6. Also the post 4 is so arranged that it may be rotated to swing the boom laterally as desired. Each of the hydraulic cylinders or rams is connected to an hydraulic pressure circuit under control of operator actuated valves whereby when fluid pressure is applied to one end of a cylinder fluid is discharged from the other end and fluid pressure may be applied to hold the piston in related position in the respective cylinder.

A clam-shell bucket 22 is swingably mounted adjacent the end 23 of the dipper arm 7 remote from the boom 5. In the illustrated structure, the clam-shell bucket assembly 22 includes a supporting head 24 which carries substantially identical bucket sections 25 and is fixed on a bucket arm 26 which is swingably mounted on a pin 27 adjacent the end of the dipper arm 7. The bucket arm 26 preferably consists of a sleeve 28 rotatably mounted on the pin 27 with spaced plates 29 fixed to the sleeve 28 and extending therefrom, said plates being substantially perpendicular to the axis of the pin 27. The plates 29 are arranged whereby they form ears 30 which are pivotally connected by a pin 31 to one end of a link 32 the other end of the link being pivotally connected by a pin 33 to one end of a lever 34 which has its other end pivotally mounted on a pin 35 carried by the dipper arm 7 intermediate the pins 18 and 27.

The lever 34 is connected by an extensible member 36 to the upper end or boom end of the dipper arm 7. In the illustrated structure, the extensible member consists of a cylinder 38 having one end pivotally connected to the dipper arm by a pin 39 and a piston rod 40 extending from the other end of the cylinder and pivotally connected to the lever 34 by a pin 41 adjacent the pin 33 whereby extension of the extensible member swings the lever 34 toward the outer end of the dipper arm, and swings the bucket arm toward the boom, and contraction of the extensible member reverses the action to swing the bucket arm away from the boom. The extensible member 36 is preferably hydraulic apparatus connected in an hydraulic circuit and operable in response to operator control valves mounted on the tractor.

The bucket arm 26 includes a plate 42 fixed to the spaced plates 29 in spaced relation to the ears 30 and pin 27. The supporting head includes a plate 43 which is secured by suitable fastening devices 44 in face to face relation with the bucket arm plate 42. Spaced plates 45 are fixed to the plate 43 and extend therefrom and carry

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spaced sleeves 46 at the ends thereof remote from the plate 43, the sleeves 46 being parallel and also substantially parallel to the axis of the pin 27 whereby said sleeves 46 serve as bearings to pivotally mount the bucket sections 25 as later described. Suitable gusset plates 47 or ribs are arranged relative to the plate 43 and plates 45 to form a rigid structure.

The bucket sections 25 may be constructed in any preferred manner and of any size to suit the character of the work being done, and in the illustrated structure each bucket section includes an arcuate bottom 48 connected to sides 49 having edges converging from the bottom with the edges of each remote from the other bucket section provided with an inturned flange 51 to strengthen the sides of the bucket sections. The ends of the sides 49 of each bucket section remote from the respective bottom 48 are suitably secured as by welding to a shaft 52 which is preferably tubular and extends through and is rotatably mounted in the respective sleeve 46 to rotatably mount the bucket section thereon. Collars 53 are fixed to the shafts 52 at each end of the respective sleeves 46 to limit lateral movement of the bucket sections relative to the supporting head.

Ejector plates 54 are fixed to the respective sleeves 46 and plates 45 of the supporting head and extend therefrom in substantially parallel relation to the edges 51 of the bucket sections when the bucket sections are slightly open, the plates 54 being of suitable length whereby the outer edges 55 thereof clear the bottom 48 when the respective bucket sections are swung on the axis of the respective sleeve 46. The plates 54 are substantially less in width than the width of the bucket sections which are open at the top edges between the flanges 51. In the illustrated structure, the plates are approximately one-third the width of the bucket sections and it has been found that such width is effective in aiding in cleaning of the bucket sections; however, the plates may be wider if desired.

Teeth 56 are secured in spaced relation along the forward or adjacent edges 57 of the bottom members 48 of each of the bottom sections 25, particularly when the bucket sections are to be used for digging purposes. The teeth 56 on one bucket section are arranged to extend between the teeth of the other bucket section, the teeth preferably each including a flange member 58 secured to the bottom member 48 and having a depending portion 59 terminating in forwardly extending tooth portions 60 whereby said teeth project beyond the forward edge 57 of the respective bucket section. The forward edges 61 of the sides 49 of the respective bucket sections are sharpened and the side walls 49 are inclined whereby they converge slightly inwardly to provide cutting clearance at the side of each bucket section.

Each side of the supporting head 24 is provided with spaced upstanding ears 62 and 63 which rotatably mount trunnions 64 of collar 65 fixed to extensible hydraulic members 66. In the illustrated structure, one of the hydraulic extensible means includes a cylinder 67 with an end 68 fixed to the respective collar 65 and a piston rod 69 extending from said end and pivotally connected by the respective bucket section by a pin 70 arranged between spaced arms 71 having ends connected to the bucket bottom 48 and shaft 52 respectively, the spaced arms 71 being adjacent to one side of the respective ejector plate 54 and whereby the axes of the shaft 52 and pin 70 are substantially on a plane defined by the flanges 51. The other bucket section is operated by the other extensible means 66 which includes a cylinder 72 having an end 73 fixed to the collar 65 with a piston rod 74 extending from the end 73 and pivotally connected to the respective bucket section by a pin 75 to spaced arms 76 having its ends connected to the bucket bottom and the shaft 52 respectively, the arms 76 being arranged on the opposite end of the sleeves 46 to the arms 71. Each of the cylinders 67 and 72 are individ-

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ually connected to hydraulic control valves arranged for operation by an operator whereby fluid pressure can be selectively introduced in one end of the cylinder and exhausted from the other for movement of the respective bucket section in one direction and the fluid pressure introduced to said other end of the cylinder and exhausted from said one end or the fluid pressure retained in the cylinder for holding the bucket section in selected position whereby each of the bucket sections are individually operated or may be operated selectively as desired.

In using a structure constructed and assembled as described the boom 5 is moved through the hydraulic apparatus 12 to raise and lower said boom and hydraulic pressure is applied to the cylinder 9 to move the dipper arm 7 to position same over a portion to be excavated. Hydraulic fluid is then applied to the cylinder 38 to swing the lever 34 and bucket assembly to a desired position. Then fluid pressure is applied to the cylinders 67 and 72 to open the buckets and then the boom 5 is lowered to engage the bucket with material to be dug or moved and selected hydraulic apparatus is operated by selectively applying fluid pressure to the cylinders 9, 12 and 38 to move the bucket assembly to effect proper digging and filling of the bucket sections. Then fluid pressure is applied to one or both of the cylinders 67 and 72 to move the bucket sections 25 to close same and retain the material therein. The boom 5 is then raised and swung over an area in which the material is to be deposited and again hydraulic fluid is applied to the cylinders 67 and 72 selectively to move the bucket sections and effect opening of the bucket for dropping material therefrom.

Various changes and modifications may be made without departing from the spirit of the invention and all of such changes are contemplated as may come within the scope of the claims.

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

1. In a material handling machine, having a boom and a dipper arm pivotally mounted thereon for swinging movement of the arm in an arc from the boom, a bucket arm pivotally mounted on the end of the dipper arm remote from the boom for swinging movement in an arc from the dipper arm, a lever pivotally mounted on the dipper arm for swinging movement relative thereto, means operatively connecting the lever and bucket arm for swinging said bucket arm in response to swinging movement of said lever, means on the dipper arm and operatively connected with the lever for effecting swinging movement of the lever and bucket arm, a pair of clam-shell bucket sections, means pivotally mounting each clam-shell bucket section separately on the bucket arm for individual swinging movement of each bucket section about axes substantially parallel to the axis of swinging movement of the bucket arm, an extensible means for each bucket section, means pivotally mounting one end portion of the respective extensible means on the bucket arm, and means pivotally connecting the other end portion of the respective extensible means to the respective bucket section whereby opening and closing movement is selectively imparted to the respective bucket sections in response to extension and contraction of the respective extensible means.

2. In a material handling machine, a support, an elongated boom swingably mounted on the support for raising and lowering movement of said boom, a dipper arm pivotally mounted on the boom adjacent the end thereof remote from the support for swinging movement of the arm in an arc from the boom, extensible means operatively connected with the boom and dipper arm for selectively effecting swinging movement of the boom and dipper arm, a bucket arm pivotally mounted on the end of the dipper arm remote from the boom for swinging movement in an arc from the dipper arm, a lever having one end pivotally mounted on the dipper arm adjacent the bucket arm for swinging movement in an arc from

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said dipper arm, means operatively connecting the lever and bucket arm, means on the dipper arm and operatively connected with the lever for effecting swinging movement of the lever and bucket arm, a pair of clam-shell bucket sections, means pivotally mounting each clam-shell bucket section separately on the bucket arm for individual swinging movement of each bucket section about axes substantially parallel to the axis of swinging movement of the bucket arm, an extensible means for each bucket section, means pivotally mounting one end portion of the respective extensible means on the bucket arm, and means pivotally connecting the other end portion of the respective extensible means to the respective bucket section whereby opening and closing movement is selectively imparted to the respective bucket sections in response to extension and contraction of the respective extensible means.

3. In a material handling machine, a support, an elongated boom carried on the support, an hydraulic ram having ends pivotally connected to the boom and support for raising and lowering the boom in response to extension and contraction of the hydraulic ram, a dipper arm pivotally mounted on the boom adjacent the end thereof remote from the support for swinging movement of the arm in an arc from the boom, an extensible means carried by the boom, means connecting the extensible means with the dipper arm for effecting swinging movement of said arm in response to extension and contraction of said extensible means, a bucket arm pivotally mounted on the end of the dipper arm remote from the boom for swinging movement in an arc from the dipper arm, a lever having one end pivotally mounted on the dipper arm adjacent the bucket arm for swinging movement of said lever, a stiff link having ends pivotally connected with the lever and bucket arm for swinging movement of the bucket arm in response to swinging movement of the lever, an hydraulic extensible means having one end

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pivotally connected with the dipper arm remotely of the bucket arm and the other end pivotally connected with the lever in spaced relation to the pivotal mounting thereof for effecting swinging movement of the lever and bucket arm in response to extension and contraction of said hydraulic extensible means, a clam-shell carried by said bucket arm, said clam-shell bucket including, a supporting head fixed to the bucket arm, a pair of bucket sections, means pivotally mounting each bucket section separately on the supporting head for individual swinging movement about axes substantially parallel to the pivotal mounting of the bucket arm, an hydraulic ram for each bucket section, means pivotally mounting one portion of each of the rams on the supporting head, means pivotally connecting the other portion of the hydraulic ram to the respective bucket section whereby opening and closing movement is selectively imparted to the respective bucket sections in response to extension of the hydraulic rams, and ejector plates fixed on the supporting head adjacent the rearward portion of the bucket sections when said bucket sections are in closed position whereby swinging movement of the bucket sections to open position causes the ejector plates to force material from the respective bucket sections.

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