Oct. 10, 1961 A. R. HENRY 3,003,652

FRONT LOADING TRACTOR SHOVEL

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Fig. 1

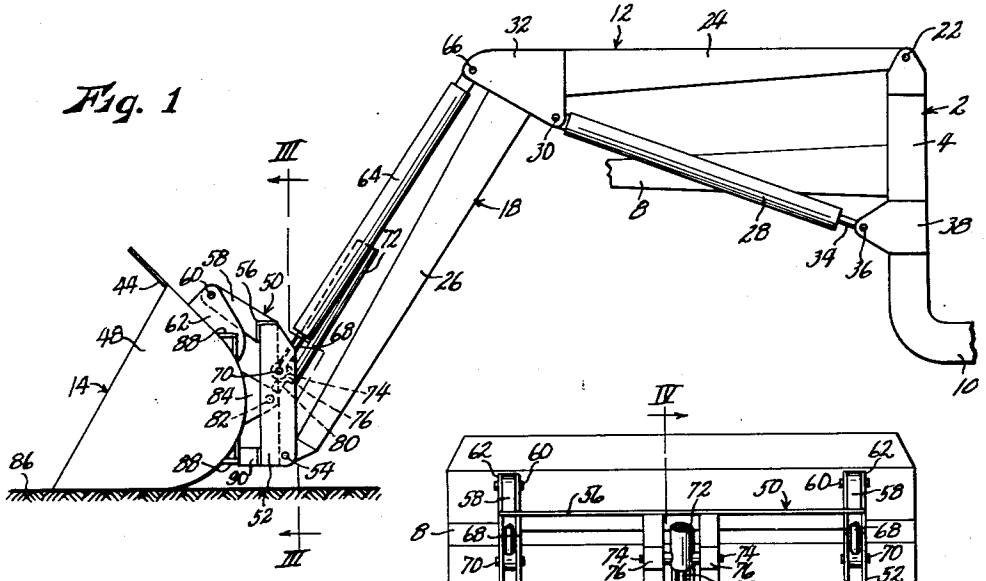


Fig. 3

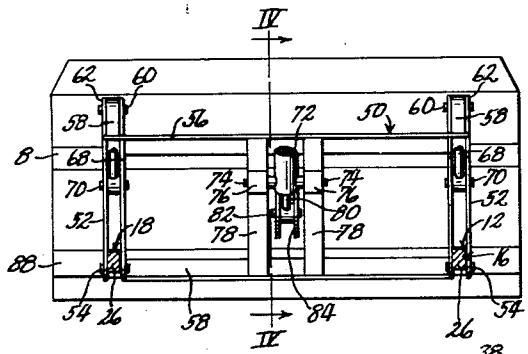
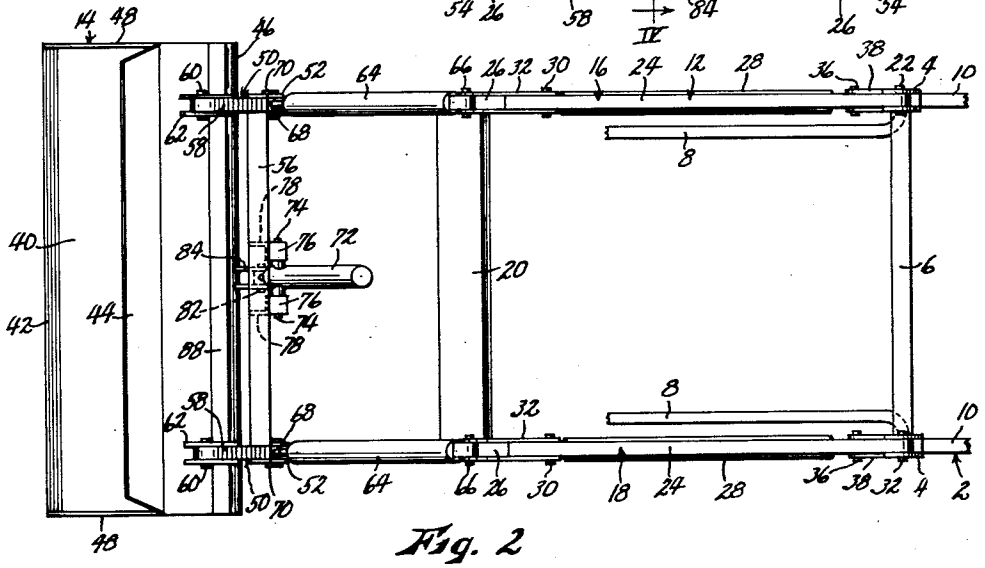


Fig. 2



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FRONT LOADING TRACTOR SHOVEL

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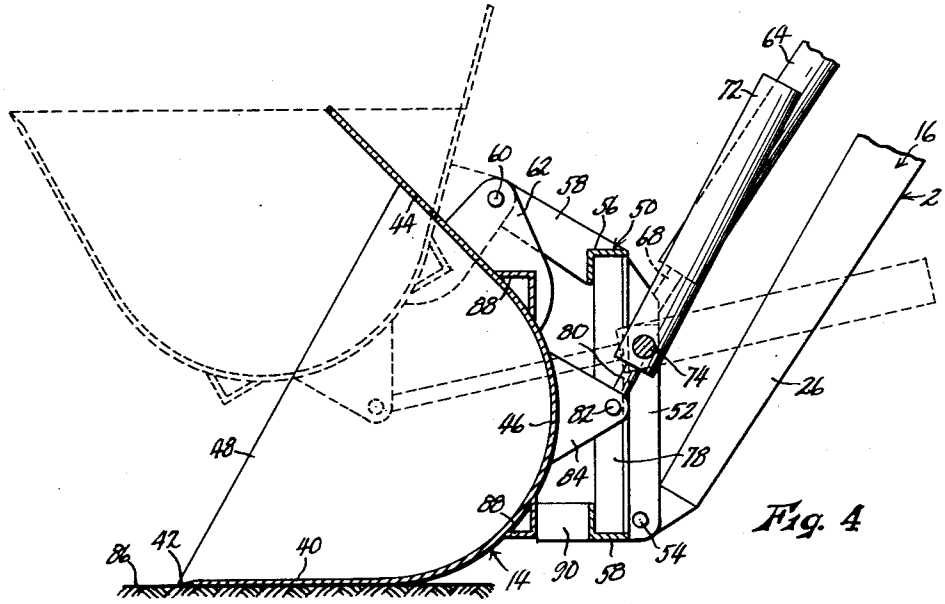

Fig. 4

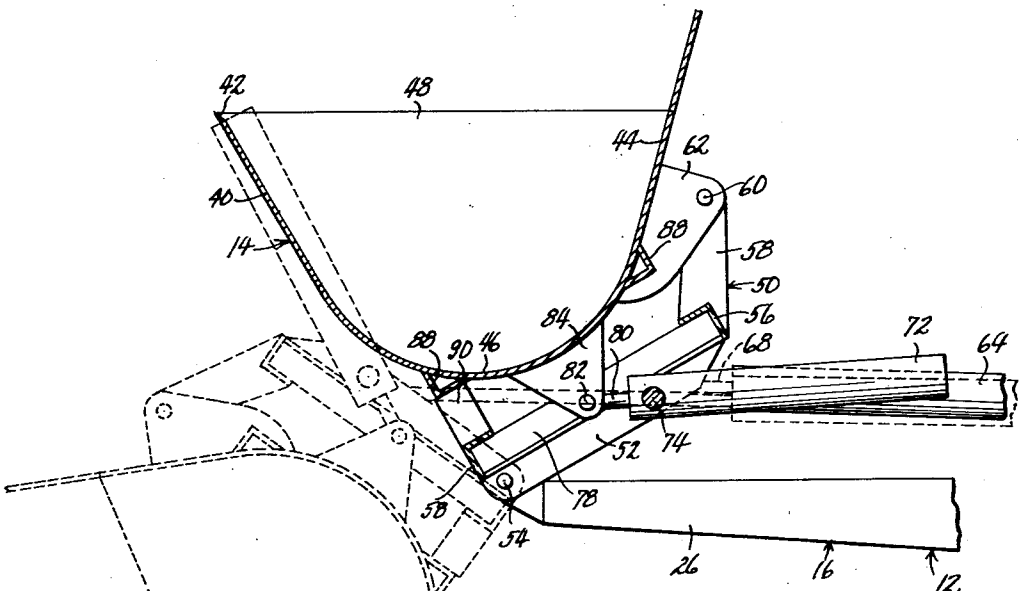

Fig. 5

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FRONT LOADING TRACTOR SHOVEL

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1 Claim. (Cl. 214—140)

This invention relates to new and useful improvements in earth moving equipment, and has particular reference to power shovels of the class adapted to be mounted on farm or industrial tractors and commonly known as "front-loaders."

In shovels of this type, a bucket is pivoted to the forward end of a boom, said boom in turn being pivoted to a frame adapted to be attached to a tractor or the like. In operation, the boom is lowered to place the shovel at ground level, the bucket pivoted relative to the boom to open forwardly, and the tractor advanced to push the bucket into a pile of earth or other material to be moved. The bucket is then tilted to open upwardly, and the boom elevated. After transportation to a desired location, the load is dumped by tilting the bucket relative to the boom.

A common fault of shovels of this type has been inability to fill the bucket completely. This results from the fact that when the bucket is tilted to place it in upright position after it has been advanced into a pile of material, the bucket mouth is retracted away from the pile, with the result that much of the earth in the mouth portion of the bucket falls away before the bucket is righted. This retraction occurs because the pivotal connection of the bucket to the boom is disposed behind the bucket and adjacent the bottom of said bucket when the bucket is in its loading position, so that when the bucket is tilted to right it, its mouth moves rearwardly. This position of the bucket pivot is necessary in order to provide a good dumping action of the bucket, and also in order that the point of application of force to the bucket by the boom during the loading operation will be positioned best to sustain the stresses involved, but also results in the disadvantage discussed above.

The principal object of the present invention is, therefore, the provision of a shovel of the class described having a novel connection between the boom and the bucket whereby when the bucket is tilted to an upright position after being moved forwardly into a pile of earth or other material, the mouth of said bucket moves forwardly and upwardly through said pile, rather than being retracted rearwardly away from said pile, whereby earth does not fall away from the bucket during said tilting, and the bucket is thoroughly filled. Many operators attempt to fill the bucket of such shovels wherein the bucket tilts away from the pile as it is turned to an upright position, by advancing the tractor simultaneously with the tilting of the bucket, so as to push the bucket still further into the pile. This maneuver is only partially effective, however, and requires considerable skill and very accurate coordination. The present object is accomplished generally by providing the bucket with a pivotal connection to the boom, the axis of said connection being adjacent the upper edge of the bucket mouth when the bucket is in its digging position, as distinguished from the usual bucket pivot which is disposed adjacent the bottom of the bucket.

Another object is the provision of a shovel of the class described wherein both the upper and lower bucket pivots are retained, and may be utilized selectively. In this manner, the bucket-filling convenience of the upper pivot may be realized without sacrificing the dumping convenience of the bottom pivot. This object is accomplished generally by interposing a link intermediate the

boom and the bucket, said link normally being disposed closely adjacent the bucket, being pivoted at its upper end to said bucket and at its lower end to said boom, and having independently controlled power means operable to control selectively the action of the two pivots.

Other objects are simplicity and economy of construction, efficiency and dependability of operation, and adaptability for use in various types of earth-moving equipment.

With these objects in view, as well as other objects which will appear in the course of the specification, reference will be had to the drawing, wherein:

FIG. 1 is a side elevational view, with parts shown fragmentarily, of a power shovel embodying the present invention, shown in its digging or loading position,

FIG. 2 is a top plan view of the shovel as shown in FIG. 1,

FIG. 3 is a sectional view taken on line III—III of FIG. 1,

FIG. 4 is an enlarged fragmentary sectional view taken on line IV—IV of FIG. 3, showing the bucket in its loading position in solid lines and showing the bucket tilted to an upright position in dotted lines, and

FIG. 5 is a view similar to FIG. 4, showing the bucket in an elevated load-transporting position in solid lines, and in a dumping position in dotted lines.

Like reference numerals apply to similar parts throughout the several views, and the numeral **2** applies generally to a mounting frame for attaching the shovel to a tractor or the like, not shown. Said frame consists generally of a pair of vertical standards **4** adapted usually to be disposed at opposite sides of a tractor. Said standards are rigidly connected by a cross-bar **6**, and are provided with forwardly and rearwardly extending arms **8** and **10** shown only fragmentarily, by means of which the frame may be secured to a tractor body in any suitable manner.

Attached to frame **2** is a boom indicated generally by the numeral **12**, at the forward end of which is carried a bucket **14**. Said boom comprises a pair of angled arms **16** and **18** connected rigidly intermediate their ends by a cross bar **20**. Said arms are pivoted at their rearward ends respectively to the upper ends of standards **4**, the pivots being indicated at **22** and being coaxial and horizontally transverse to the direction of tractor travel. When bucket **14** is at ground level, the rearward portion **24** of each arm is substantially horizontal, and the forward portion **26** of each arm is inclined downwardly and forwardly toward the bucket. The boom is selectively raised and lowered by a pair of double-acting hydraulic cylinders **28** associated respectively with the two arms **16** and **18**. Each cylinder is pivoted at **30** in a bracket **32** affixed to the associated boom arm intermediate the ends thereof. Operable in said cylinder is a piston, not shown, to which is affixed a piston rod **34**, the outer end of which is pivoted at **36** to a bracket **38** affixed to the associated standard **4** in spaced relation below pivot **22**. It will of course be understood that pivots **30** and **36** are parallel to pivots **22**. Hydraulic fluid under pressure may be delivered selectively to either end of cylinders **28**, whereby the boom may be either raised or lowered. The pump, conduits and valving necessary for this operation are well-known in the art, and are therefore not here shown.

Bucket **14** is of ordinary form, having a bottom wall **40** adapted to lie flat on the ground and having a sharpened blade **42** along its forward edge, a top wall **44** inclined upwardly and forwardly with respect to said bottom wall and connected thereto by a curved rear wall **46**, and end walls **48**. The positions of the bracket walls described are those assumed when the bracket is in its digging or loading position opening forwardly as shown in FIGS. 1–3 and in solid lines in FIG. 4. Its load-

carrying position in which it opens upwardly is shown in solid lines in FIG. 5, and in dotted lines in FIG. 4.

The bucket is connected to the boom by means of a link designated generally by the numeral 50. Said link includes a pair of uprights 52 each pivoted at its lower end, as at 54, to the forward end of one of the boom arms. Said uprights are connected rigidly by upper and lower horizontal cross bars 56 and 58. Extending upwardly and forwardly from cross bar 56, and rigidly attached thereto, are a pair of spaced apart arms 58 each pivoted at its forward end, as at 60, to a bracket 62 welded to the outer surface of top wall 44 of the bucket. Link 50 may be pivoted relative to the boom by means of a pair of hydraulic cylinders 64 associated respectively with the boom arms 16 and 18, each of said cylinders being pivoted at 66 to bracket 32 of the associated arm. A piston, not shown, is operable in each of said cylinders, and has a piston rod 68 affixed thereto and pivoted at 70 to the associated upright 52 of link 50, at a point spaced above pivots 54. Bucket 14 may be pivoted relative to link 50 by means of a hydraulic cylinder 72 pivoted on transverse trunnions 74 which are journalled in bearing blocks 76 affixed respectively to a pair of vertical bars 78 extending between and fixed to cross bars 56 and 58 of link 50, midway between uprights 52. A piston, not shown, is operable in cylinder 72, and has affixed thereto a piston rod 80 which is pivoted at 82 to a bracket 84 which is welded to the outer surface of rear wall 46 of the bucket. It will be understood that pivots 22, 30, 36, 54, 60, 66, 70, 74 and 82 are all parallel, and are disposed generally horizontally and transverse to the line of tractor travel. It will be understood also that cylinders 64 and 72, as well as cylinders 28, are double-acting, and may be either extended or retracted by furnishing fluid under pressure selectively to either end of each of said cylinders.

The operation of the shovel is substantially as follows: With all of cylinders 28, 64 and 72 fully retracted, as shown in FIGS. 1–3 and in solid lines in FIG. 4, bucket 14 will be substantially at the ground level, indicated at 86, with the bottom wall 40 of said bucket resting on the ground, and with the bucket opening forwardly as shown. The bucket is then loaded by advancing the tractor to push the bucket into a pile of earth or other material to be handled. It is of course seldom possible to fill the rearward portion of the bucket fully in this operation, since the material tends to pack into the forward portion of the bucket so tightly that even full power of the tractor cannot push the shovel forwardly enough to fill it. It will be seen also, that during this loading action, a portion of the bucket adjacent its bottom, such as one of a plurality of angle-iron reinforcements 88, bears solidly against pads or blocks 90 affixed to link uprights 52 at the lower ends thereof, directly adjacent the pivots 54 of the link to the boom. This removes much of the stress from the link 50, and from cylinders 64 and 72.

The bucket should then be tilted to an upright position, in which it opens upwardly, in order that it may be elevated and transported without appreciable spillage of material therefrom. If, as in all prior shovels of this general type within my knowledge, this were accomplished by tilting the bucket rearwardly relative to the boom about an axis adjacent the bottom of the bucket, for example in the general location of pivot 54 in the present structure, such tilting would cause the bucket mouth to move upwardly and rearwardly away from the material pile. As a result, much material would fall away from the bucket mouth before the bucket was fully righted. This, plus the fact that the rearward portion of the bucket was not initially filled for the reason already discussed, resulted in the fact that the bucket was often elevated in only a partially filled condition. In the present structure, however, the bucket is righted by delivering fluid to the upper end of cylinder 72, whereby piston rod 80 thereof is extended to pivot the bucket about pivot 60 to an upright position, as shown in dotted lines in FIG. 4. Due to the positioning of pivot 60 at or adjacent the top of the bucket, it will be seen that during this movement the bucket mouth moves upwardly and forwardly through the material pile rather than away from said pile. Therefore the pile feeds the bucket till the time the bucket is fully righted, and even thereafter until the bucket is elevated.

The bucket is elevated by raising boom 12, which is of course accomplished by delivering fluid to the upper ends of cylinders 28, whereby piston rods 34 are extended to pivot the boom about pivots 22. FIG. 5 shows the boom elevated sufficiently to bring the forward portions 26 of the boom arms into horizontal position. As the boom is raised to this position, bucket 14 may be maintained upright by feeding fluid to the lower end of cylinder 72 to cause a proportionate retraction of piston rod 80. If it is desired to elevate the boom still farther, it may be necessary to extend cylinders 64 slightly, in order to tilt link 50 forwardly about pivot 54. When the shovel has been transported by the tractor to the desired dumping zone, the bucket load is dumped by delivering fluid to the upper or rearward ends of cylinders 64, whereby the bucket and link 50 are tilted forwardly as a unit about pivots 54, as shown in dotted lines in FIG. 5.

While I have shown and described a specific embodiment of my invention, it will be apparent that many minor changes of structure and operation could be made without departing from the spirit of the invention as defined by the scope of the appended claim.

What I claim as new and desire to protect by Letters Patent is:

A power shovel comprising a frame, a forwardly extending boom pivoted to said frame for movement in a vertical plane, a bucket having a loading position in which it opens forwardly and a carrying position in which it opens upwardly, a link extending vertically behind said bucket when said bucket is in its loading position, said link being pivoted at its upper end to said bucket and at its lower end to said boom, a first hydraulic ram interconnecting said boom and said link for pivoting said link relative to said boom, and an independently operable second hydraulic ram interconnecting said link and said bucket for pivoting said bucket relative to said link.

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