July 6, 1948. R. L. BEYERSTEDT 2,444,692

TRACTOR SHOVEL

Filed Dec. 12, 1946

2 Sheets-Sheet 1

Fig. 1.

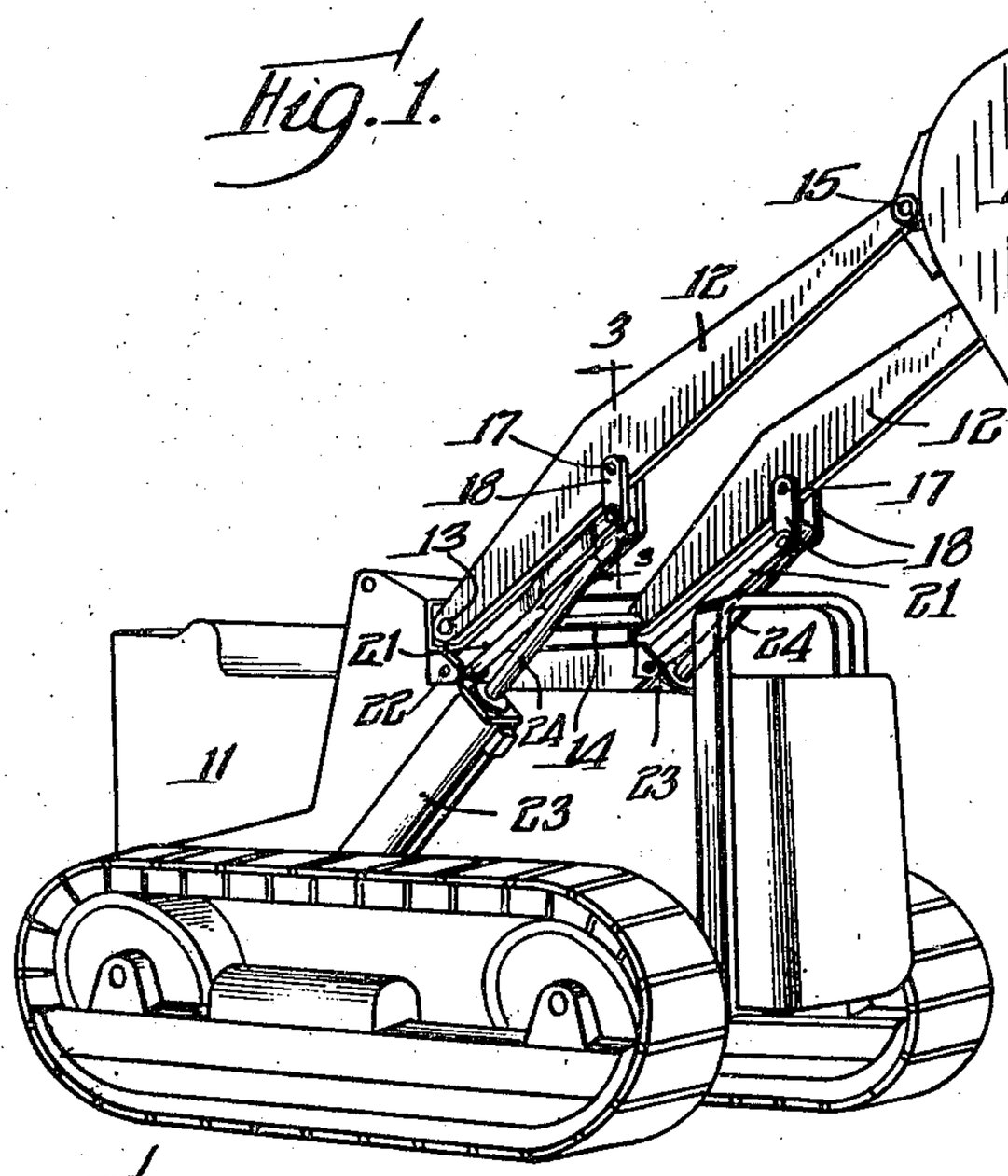

Fig. 3.

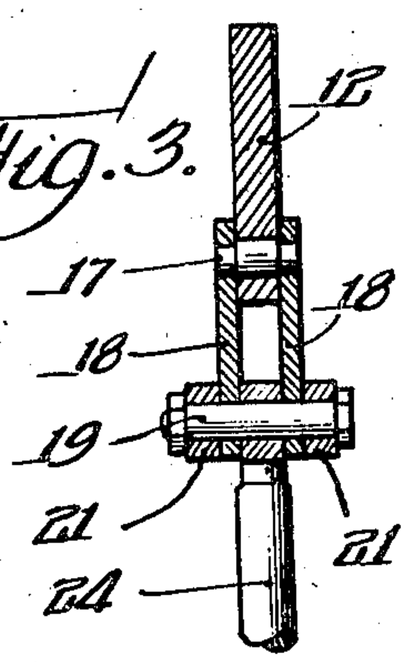

Fig. 2.

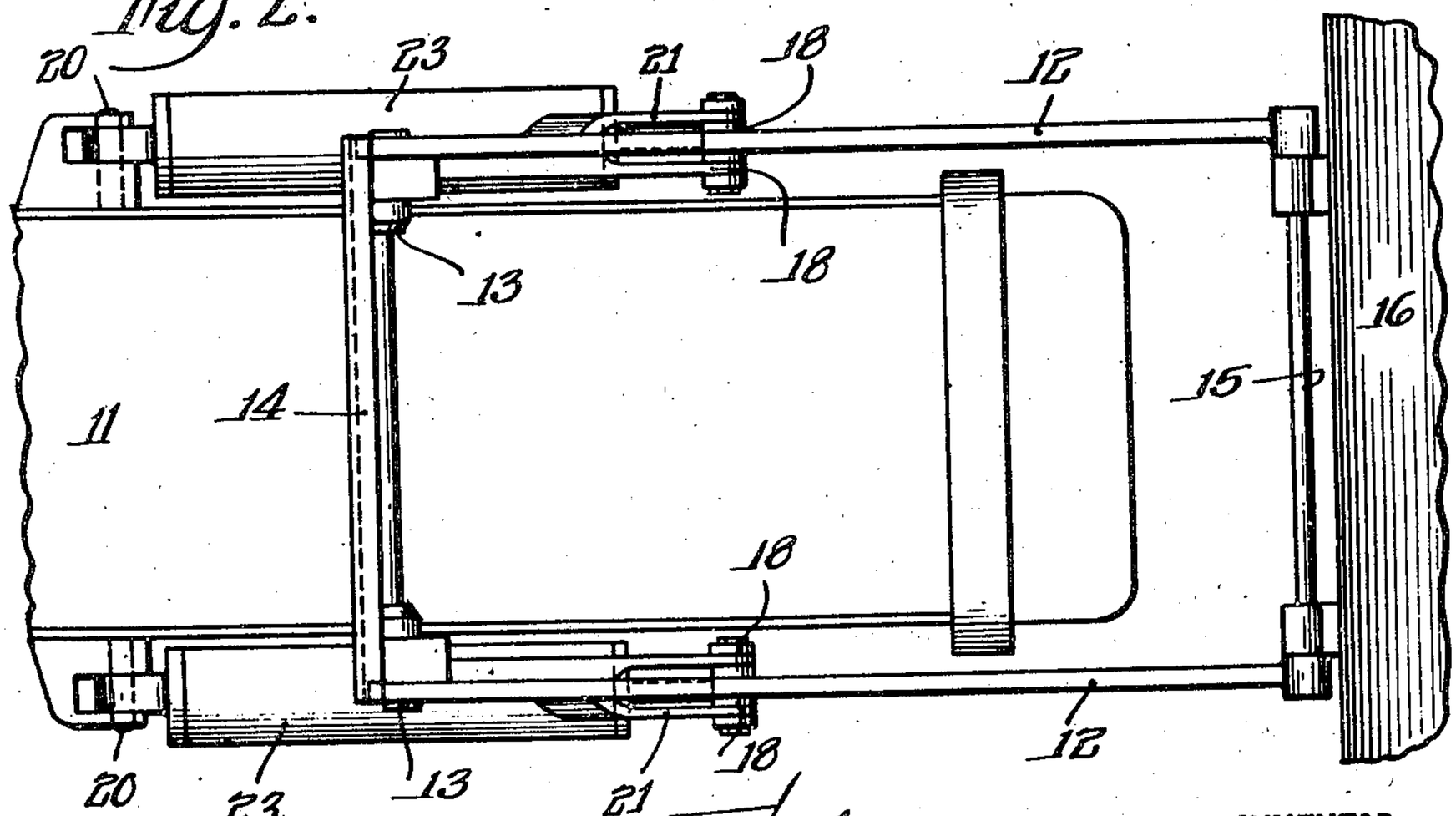

Fig. 4.

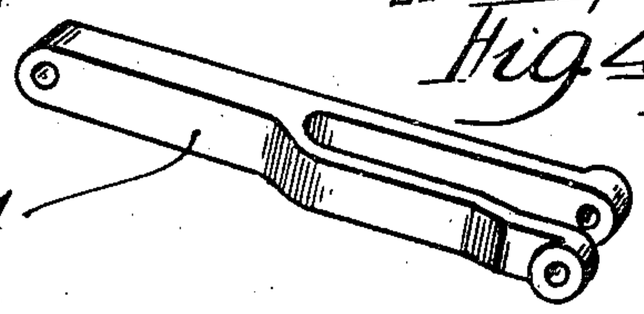

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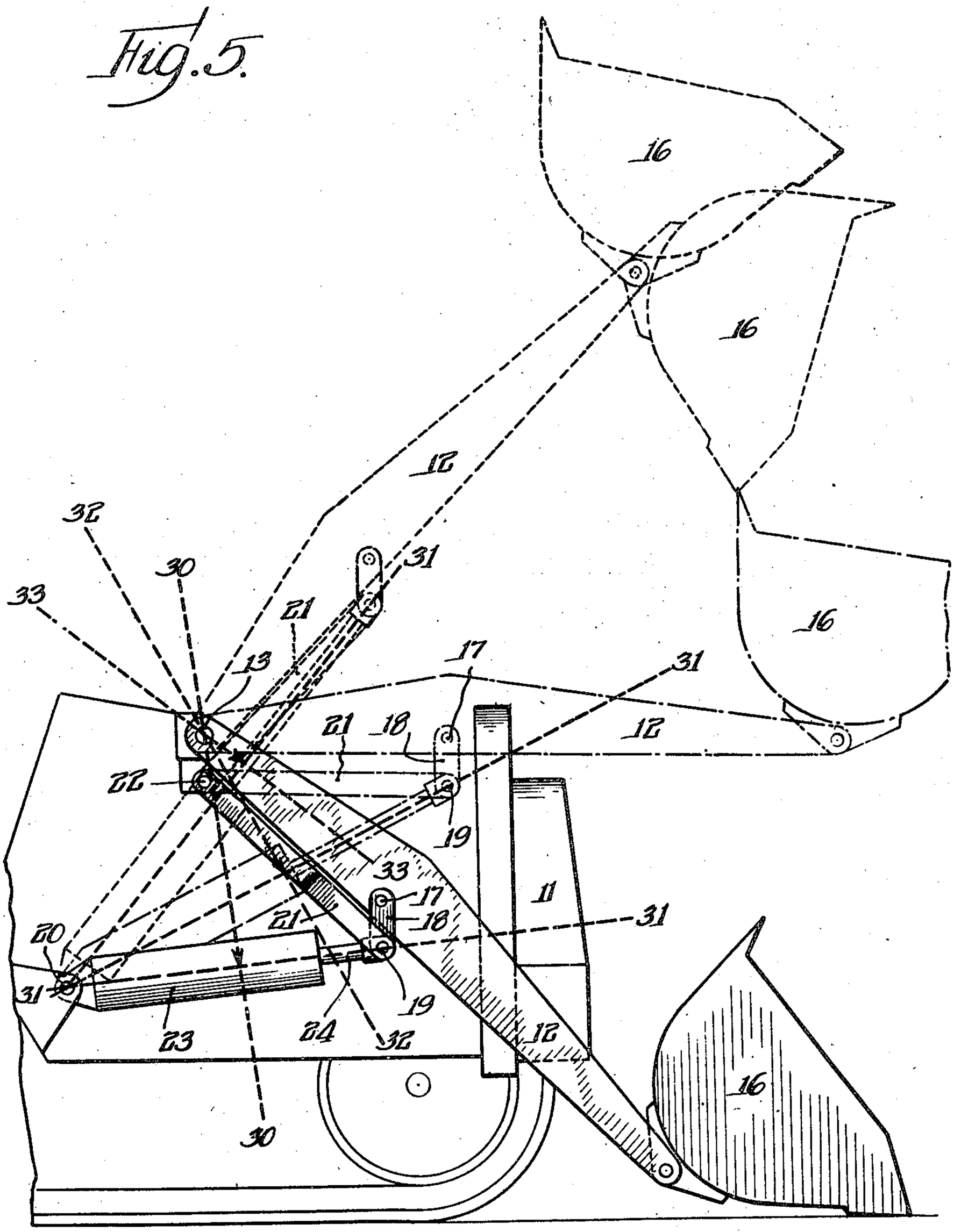
Fig. 5.



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2,444,692

TRACTOR SHOVEL

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Application December 12, 1946, Serial No. 715,871

1 Claim. (Cl. 214—140)

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In the known type of tractor-shovel in which the shovel is mounted at the front of the tractor on the end of a duplex or single forwardly-extended boom hinged at its rear end on the tractor and equipped with hydraulic-means for rocking the boom and its loaded shovel upwardly to dumping-position and for allowing them to swing down to their lowermost digging-position, it has been found that a comparatively simple heretofore undiscovered modification in such construction which results in valuable, novel and advantageous functioning or operating properties may be beneficially availed of.

By the employment of this innovatory invention, relating more particularly to the means for and manner of operating the boom and its shovel, a graduated accelerated speed of lift of the shovel is obtained whereby in a specific instance the time of lift formerly of 10½ seconds was reduced or lessened to 8½ seconds, using the same oil-pump for performing the lifting operation.

A further distinct advantage resulting from the use of the present invention is the attainment of a relatively low rate of lift at the lowest part of the stroke, where it is especially needed for control in grading, whereas a fast rate of lift is secured in the upper part of the stroke, where it is distinctly beneficial in elevating the loads in the shovel over the bodies of trucks into which it is to be delivered or discharged.

A current preferred embodiment of the present invention in physical form, whereby the above-stated and other aims of the invention are attained, has been portrayed in the accompanying drawings, forming a part of this specification, and has also been described in detail below in order that those persons acquainted with or interested in this art may be informed as to the structural features incorporating the invention and advised as to the attainment of the substantial benefits and advantages resulting from the use of the invention.

In these drawings:

Figure 1 depicts, with some structural parts omitted, a tractor-shovel equipped with the new invention, the shovel being shown in its uppermost dumping or discharge position;

Figure 2 depicts in plan view the boom portion of the appliance;

Figure 3 is a transverse section on line 3—3 of Figure 2, but on a larger scale;

Figure 4 is a perspective view of one of the long links; and

Figure 5 presents a side elevation of the construction with the various parts of the mechanism

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in their several positions with the shovel at three different elevations.

By reference to the several views of these drawings, it will be observed that the internal-combustion engine equipped tractor, designated as a whole 11, has a forwardly projecting boom 12 of the dual or duplex type, although the invention is equally applicable for satisfactory employment with a single boom, fulcrumed at its rear end on the tractor at 13 and with its parallel members cross-connected together by a back-bar 14, the front ends of the two parts of the boom being also appropriately transversely joined together by a shaft 15 on which the shovel 16 is hinged in the usual manner, the locking and unlocking means coacting with and controlling the dumping of the shovel not being shown because although employed they form no part of the instant invention.

At an appropriate point 17 intermediate its length each such boom-lever 12 has a hinge-pin mounted thereon and projecting from its opposite sides, the upper portions of a pair of like links 18, 18 of equal length being rockingly supported on each such pin 17.

The lower portions of each pair of the links 18, 18 are equipped with a hinge-pin 19 rockingly connecting them to the forward bifurcated end of a longer link 21 hinged or fulcrumed at its rear end to the tractor by a pin 22 whose axis is directly below the axis of fulcrum 13, and at a vertical distance therefrom equal to that between the axes of the elements 17 and 19, the distance between the axes 13 and 17 and that between the axes 22 and 19 being equal in the present case whereby the stated structure constitutes a parallel-motion mechanism.

To operate each boom-member 12, the usual hydraulic-cylinder 23 and its piston and piston-rod 24 are employed, but, instead of being directly connected to its boom, or to a member fixedly mounted on the boom, the piston-rod 24 is hinged at its forward end on the same pin 19 to the combined links 18 and 21 by which means the stated objects and aims of the invention are attained and satisfactorily taken advantage of.

When the boom and shovel are in their bottom or ground position as presented in the lower part of Figure 5, the leverage which the combined cylinder, piston and piston-rod exert, by the oil under suitable pressure entering the cylinder in the usual way, on the boom carrying the load in its shovel is the distance between the axis of fulcrum 13 of the boom and the axis of the cylinder and piston-rod on the line 30—30 at a right-

angle from such fulcrum to the axis 31—31 of the cylinder and piston-rod at the then position of such axis.

By the time the boom has ascended or rocked upwardly by the hydraulic means to its horizontal position depicted in the middle portion of Figure 5 such leverage has decreased, as shown on line 32, 32 with a corresponding increase of speed of boom and load lift due to substantially uniform continued feed of oil into the cylinder 23 and corresponding speed of travel of the piston-rod 24.

With the continued acceleration of speed of boom elevation due to the sustained decrease of leverage, when the boom approaches its highest or shovel-discharge position, the corresponding elements have the relative positions clearly indicated in the upper portion of Figure 5, the corresponding leverage being indicated by the arrowhead on line 33—33.

This initial low-speed of load-lift and its subsequent rapid increase of speed is a valuable time factor with respect to loading trucks, etc., and the greatest power is, of course, availed of when it is most needed by the longer leverage during the period the shovel is digging its load at low level.

It will be noted that in the particular instance under consideration links 18 are always vertical and the axes of links 21 are invariably parallel to the axis of the boom, but it is to be borne in mind that these conditions are not always vital and under certain circumstances modifications may be advantageously employed without departure from the heart and essence of the invention, and without loss or sacrifice of any of its material benefits and advantages.

For example, the distances or lengths between the axes of the parts 17 and 19 and between the axes of the elements 13 and 22 need not always be equal, neither must the axis of part 19 be invariably directly below the axis of element 17, or the axis of part 22 directly vertically in line with that of fulcrum 13, nor must the lengths between the axes of elements 22 and 19 equal the distance between the axes of parts 13 and 17 in all instances, or stated somewhat otherwise, the parallel-motion feature is not an indispensable factor in all cases provided the attainment of the main objects of the invention are secured in all instances.

I claim:

In the known type of tractor-shovel having a shovel mounted on an end portion of a boom horizontally fulcrumed at its other end portion on the tractor for swinging movement of the boom and shovel in a vertical plane, an hydraulic-cylinder, piston and piston-rod horizontally hinged at a fixed point on said tractor for rocking movement in a vertical plane, means to admit fluid under pressure into said cylinder and to discharge it therefrom to operate said piston, and means operatively connecting the piston-rod to said boom, the novel improvement in said piston-rod connecting means including the combination of a first vertical link, means hinging said link at its upper portion on said boom at a point intermediate the length of the latter, a second link, means hinging said second link horizontally at an end portion thereof on said tractor directly below the fulcrum of said boom, means hinging said second link to said first link directly below the hinge of the latter on said boom and at a distance therefrom the same as that between the boom fulcrum and said second link hinge on the tractor, thereby forming a parallel-motion mechanism, and means hinging said piston-rod to said two links coaxially with the means hinging them together, said first link remaining always vertical during its entire movement with the boom to obtain the desired functional advantages of such verticality.

RALPH L. BEYERSTEDT.

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