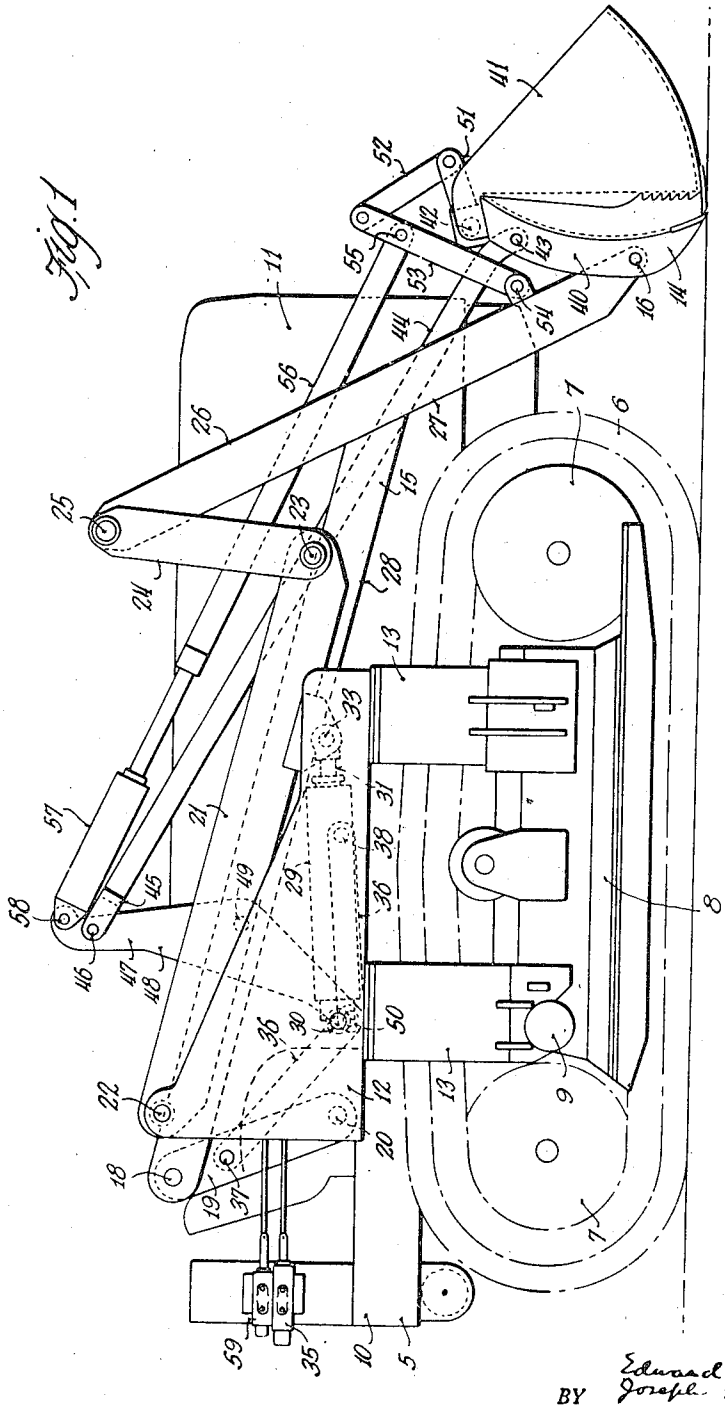
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EXCAVATOR

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Fig. 1



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EXCAVATOR

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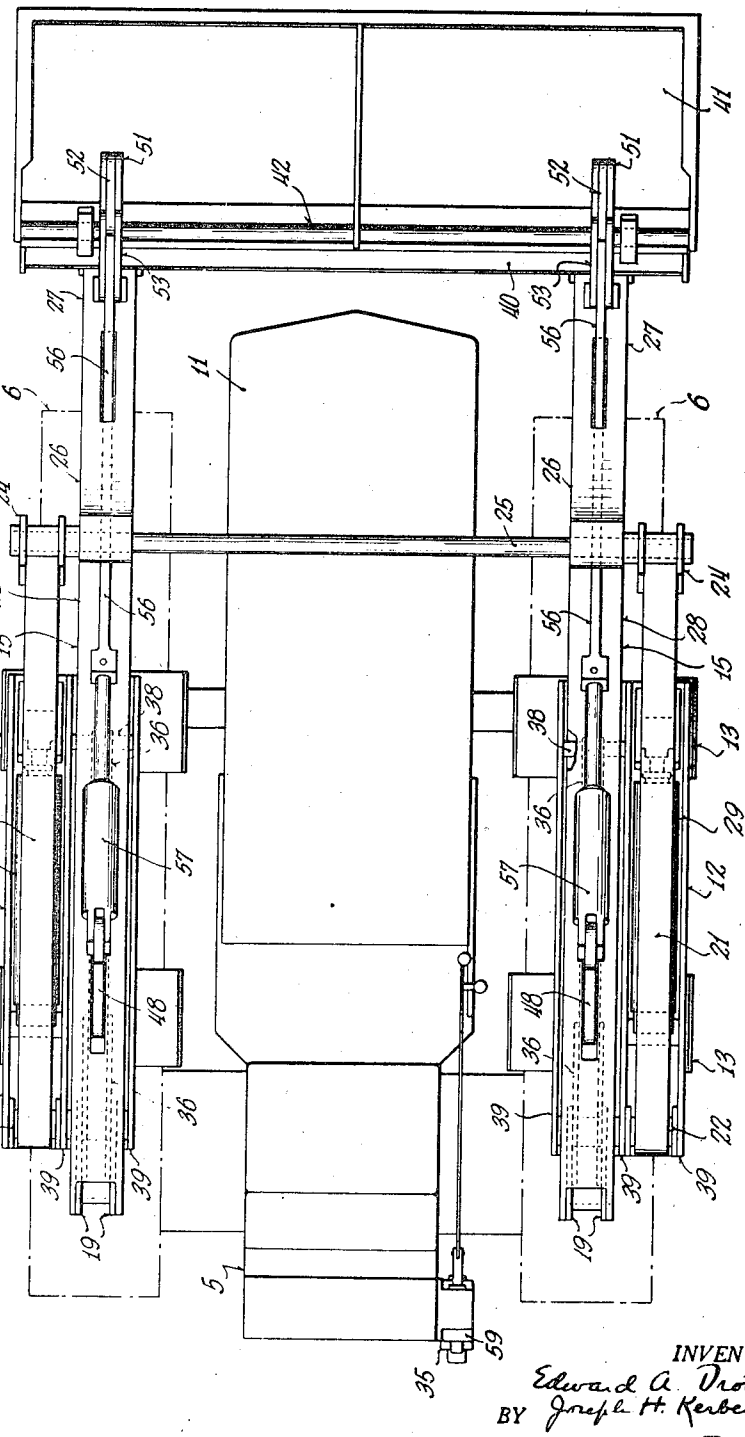


Fig. 2

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EXCAVATOR

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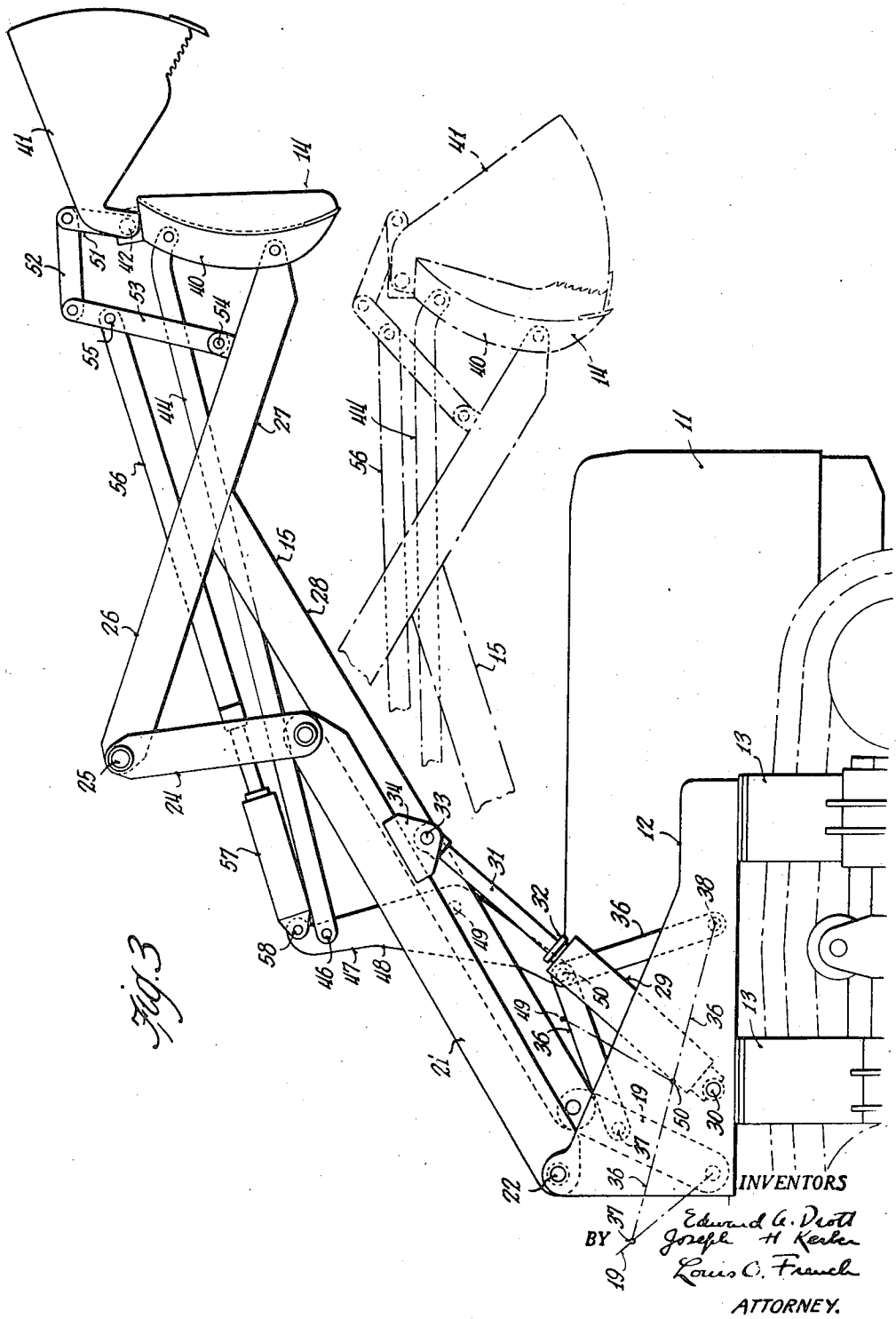


Fig. 3

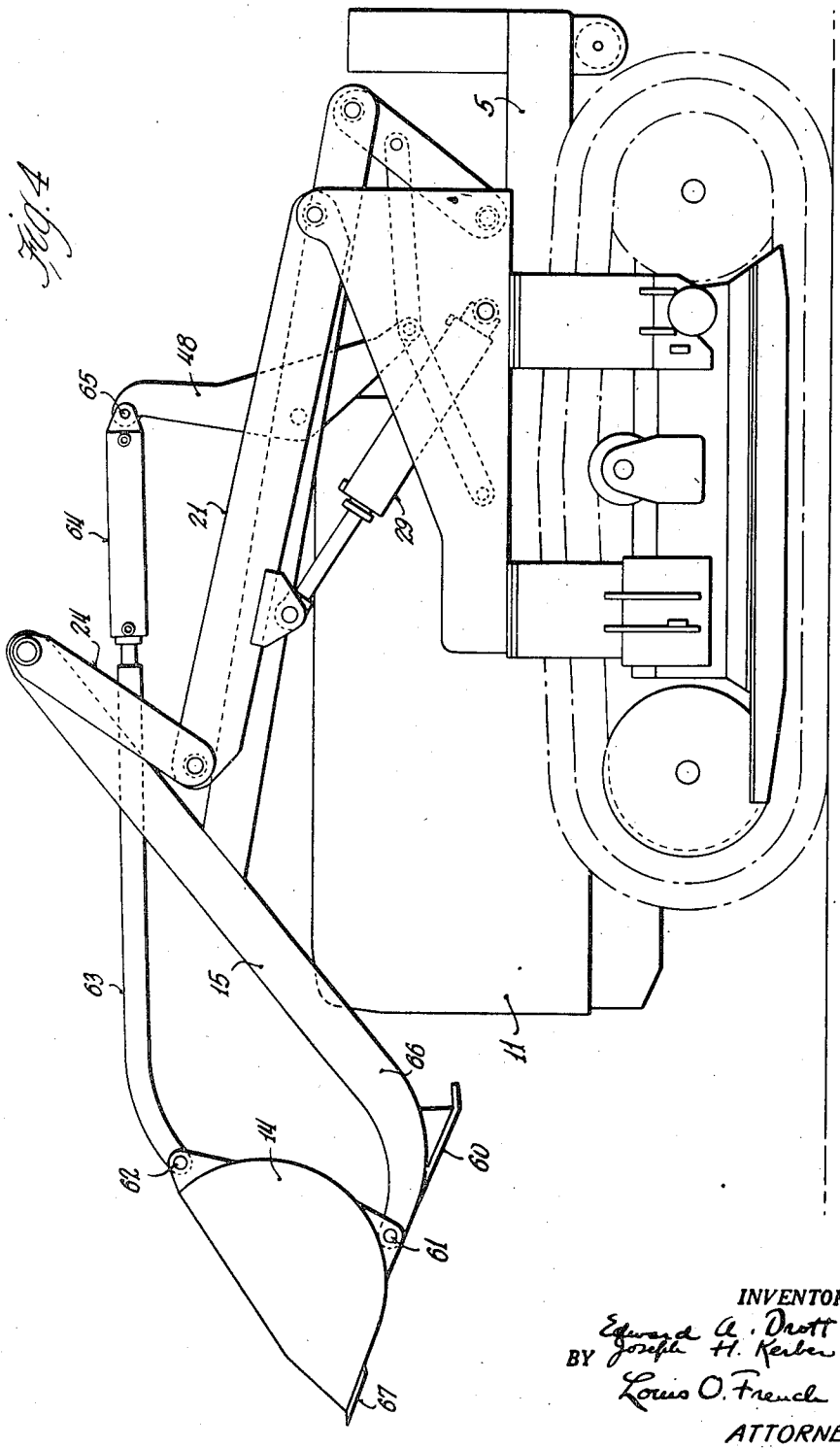
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EXCAVATOR

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Fig. 4



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2,455,474

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2,455,474

EXCAVATOR

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Application February 5, 1945, Serial No. 576,286

12 Claims. (Cl. 214—131)

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The invention relates to excavators and more particularly to a high lift mobile excavator.

One object of the invention is to provide a hydraulically operated shovel lifting mechanism which permits disposition of the shovel or bucket directly adjacent the radiator or front portion of the tractor vehicle and a vertical lifting of the shovel to a considerable height without pitching forward, thus eliminating a big overhang of the shovel while carrying its load and thereby reducing the stresses and strains on the front portions of the propelling mechanism which in the case of the track type tractor reduces stresses and strains on the front roller and idler. From a load transporting position the bucket carrying mechanism of this invention permits the bucket to be raised several feet higher, and during this raising movement through a linkage arrangement and without any additional hydraulic equipment the bucket is projected several feet out ahead of the tractor which allows it to dump in the middle of a truck body.

In addition to the elimination of a large overhang, a further advantage obtained by the invention is elimination of any obstruction to the operator's views while the unit is being filled and transported, as there is then nothing ahead of him any higher than his vision, and after the bucket is raised still higher, he again has full view under the bucket.

A further object of the invention is to provide a new and improved mounting and control of the bucket. Previously all high lift shovels, either hydraulic or cable, had a set position for the bucket both for loading and unloading. The only way positions could be changed was manually while the unit was standing still, and in all cases the only way to lift the bucket out of the ground was by lifting the entire unit. According to the present invention, the bucket is under continuous hydraulic control and can be moved to tilt the cutting edge down or up to suit the varying conditions, can be dumped at any height, and either close to the tractor or several feet ahead of the same while the tractor is in motion or standing still.

More particularly, according to the present invention, the bucket is pivotally connected to its carrying arms which include a part that can be brought in contact with the ground while the bucket is turned from its digging or scraping position to a load carrying position and may then be raised to a dumping position. The tilting of the bucket relative to its supporting arms permits the making of a smooth cut as the supporting part

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of the arms may ride on the smooth cut made by the cutting edge of the bucket during the digging operation, and when the bucket is filled while traveling forward, it is not necessary to lift the carrying arms in order to discontinue the cut or bring the cutting edge of the bucket out of the ground but simply to roll the bucket back on its supports, thus lifting the bucket out of the ground and putting all of the weight on the supporting arms which are then through the shoes in contact with the ground, and the bucket may then be semi-skidded or floated on the shoes to the place of disposal of the material and the whole assembly then lifted high enough to dump the contents of the bucket into a receiving truck.

Another advantage of the rolling or pivotal mounting of the bucket relative to its supporting arms is that when shoveling into a bank or a so-called straight face, the bucket can be tilted shaving off whatever portion of the bank is desired. All operations including lifting and lowering the bucket carrying mechanism, tilting, or rolling the bucket are under complete hydraulic control at all times.

The invention further consists in the several features hereinafter set forth and more particularly defined by the claims at the conclusion hereof.

In the drawings:

Fig. 1 is a side elevation view of an excavator embodying the invention, in a digging position;

Fig. 2 is a plan view thereof, parts being broken away and parts being shown in section;

Fig. 3 is a view similar to Fig. 1 showing the excavator in a dumping position and also parts thereof in dotted lines in a partly raised position;

Fig. 4 is a side elevation view of an excavator embodying the invention, showing certain modifications.

Referring to the drawings, the numeral 5 designates a tractor vehicle here shown as a tractor having endless propelling and supporting treads 6 at opposite sides of the vehicle and whose sprockets 7 are suitably mounted on a track frame 8 which is pivotally connected to a shaft 9 associated with the frame 10 of the vehicle, the power plant 11 on the vehicle frame being suitably connected with one of the sprockets 7 to drive the same, but as the details of the tread structure and its drive from the vehicle are not here claimed as new, further description thereof is deemed unnecessary.

Frame parts 12 on each side of the vehicle are mounted on brackets or frame parts 13 on the track frames 8.

The shovel or bucket 14 is mounted on a supporting structure which is not directly connected to any of the frame parts of the vehicle but has a floating or semi-floating connection therewith.

This structure includes a pair of arms 15 pivotally connected at their forward ends by pins 16 to the lower portion of the digging bucket and pivotally connected at their rearward ends by pins 18 to the upper ends of a pair of swinging links 19 pivotally connected at their lower ends by pins 20 to the frame parts 12, thus forming a bucket supporting structure having a floating or semi-floating connection with a frame of the carrying vehicle.

For supporting this floating frame structure, there are a pair of arms 21 pivotally connected at their rear ends by pins 22 to the frame parts 12 and at their forward ends by pivot pins 23 to a pair of links 24 pivotally connected at their other ends by a cross bar 25 to a projecting portion 26 of arms 15, it being noted that these arms are formed by parts 27 and 28 extending at an obtuse angle to each other, so that when said arms are lowered, the digging bucket will be disposed at the front of the vehicle and directly in front of the radiator for the power plant 11.

The raising and lowering of the linkage above described is accomplished by double acting hydraulic cylinders 29, one for each of the arms 21 and operatively connected thereto. Each cylinder 29 is pivotally mounted on a pin 30 carried by the frame part 12 at one side of the tractor, and its operating piston has its rod 31 working through a stuffing box 32 at the other end of the cylinder and pivotally connected by a pin 33 to a mounting bracket 34 on the other end portion of its arm 21. The cylinders 29 are in a hydraulic circuit and under the control of any suitable operator controlled valve mechanism 35 which in known manner permits introduction of pressure fluid to one of the ends of the cylinders while exhausting from the other and which permits retention of fluid in both ends of the cylinder to hold the piston in any desired set position. Thus through the action of the cylinders 29, the arms 21, and the linkage associated therewith is raised or lowered or held in any adjusted position and pressure may also be placed on the linkage when the bucket is in a digging position.

For controlling the movements of the floating linkage and for securing a forward thrust thereof as the bucket reaches its elevated position, a pair of toggle links 36 are associated with each set of linkages. One of these links is pivotally connected at 37 to the outer end portion of one of the swinging links 19, and the other of these links 36 is pivotally connected by a pin 38 to the frame part 12. From Fig. 2 it will be noted that the frame parts 12 include spaced plates 39 to carry the pivot pins above referred to.

Various forms of digging buckets 14 may be used in connection with the supporting means heretofore described, and by way of example we have shown two forms of buckets, that shown in Figs. 1 to 3 being a two part bucket generally similar to the bucket structure shown in our prior U. S. Letters Patent No. 2,326,338, while that shown in Fig. 4 being a one part or tilting bucket.

Details of the structure of the bucket shown in Figs. 1 to 3 will be found in the above referred to letters patent, so need not be specifically shown or described here, but this bucket is formed by a plow part 40 and an open ended scoop part 41 pivotally connected at spaced points to a transverse shaft 42 carried at the top portion of said plow part.

The outer ends of the arms 15 are pivotally connected by the pins 16 to the lower portion of the plow part 40, and the upper portion of the plow part 40 is pivotally connected by pins 43 to the outer ends of links 44 whose inner ends 45 are pivotally connected by pins 46 to one of the arms 47 of a pair of bell crank levers 48 which are pivotally carried at 49 on the arms 15 and whose other arms are pivotally connected by pins 50 to the knee of the toggle links 36, said pin being a common connector for said links.

At spaced points, the upper end of the scoop part 41 is connected fast to the shaft 42 which carries crank arms 51 pivotally connected by links 52 with the outer ends of levers 53 whose inner ends are pivotally carried at 54 on the arms 15. At intermediate points on the levers 53, pivot pins 55 pivotally connect them with piston rods 56 of double acting hydraulic cylinders 57 which are pivotally mounted at 58 upon the outer ends of the bell crank levers 48. Reciprocation of the rods 56 under the action of hydraulic fluid introduced into the cylinders 57 by operation of suitable control valve mechanism 59 will act to open or close the scoop part 41, and the movement of said valve mechanism 59 to a lapped position will act to hold said scoop part 41 in any desired set position. As in accordance with the aforesaid patent, it will be noted that the scoop part 41 is in a partially open position while the plow part 40 plows or scrapes up a load of material in front of it, and then as the digging progresses, the scoop part is moved to a closed position, and the loaded bucket is then raised as indicated by the dotted lines in Fig. 3 to a transporting position and may then be raised to the elevated dumping position shown in said figure and the scoop part then moved to open position to dump the load.

The one piece bucket construction is shown in Fig. 4, and it will be observed that the lower ends of the arms 15 are provided with shoes 60 that may be brought in contact with the ground and that the lower portion of the bucket 14 is pivotally connected by pins 61 to the outer ends of the arms 15 in front of the shoes 60, thus providing a tiltable mounting for the bucket 14.

The upper end of this one part bucket is pivotally connected by pins 62 to the outer curved ends of the piston rods 63 whose pistons work in double acting hydraulic cylinders 64 pivotally carried at 65 on the outer ends of the bell crank levers 48. With this arrangement introduction of hydraulic pressure fluid into the back ends of the cylinder 64 while exhausting from their front ends will tilt the scoop or bucket 14 downwardly and introduction of hydraulic fluid into the front ends of the cylinders 64 while exhausting from their back ends will tilt the scoop upwardly, and lapping of the hydraulic control 59 (shown in Fig. 3) will hold hydraulic fluid in both ends of said cylinders 64 to hold the bucket or scoop in any desired angular position relative to its supporting arms 15. It will be noted that with this form of bucket the outer ends 66 of the arms are curved, so that the bucket may be brought down close to the front of the tractor and the shoes 60 rest on the ground just in front of the treads 6.

With this arrangement when starting to load the arms 15 are lowered to bring the shoes 60 in contact with the ground, and the bucket 14 is then tilted on its pivot 61 to bring its cutting

edge 67 to the desired digging angle. Then during digging by rocking the bucket 14 about its pivot under the action of the cylinders 64 the shoes 60 are automatically lifted off of the ground by the pressure of the cutting edge being forced down to the desired depth of cut, and then by tilting back the bucket to a level with the shoes, a perfectly smooth cut can be made as the shoes at the back ride on the smooth cut made by the cutting edge. When the bucket is filled while traveling forward, it is not necessary to lift the arms 15 in order to discontinue the cut or bring the bucket out of the ground since by reversing the action of the cylinders 64 the bucket 14 can be rolled or tilted back against the arms 15 swinging it about the pivot 61 under the action of the piston rods 63 and the cylinders 64. This rolling motion lifts the bucket off of the ground and puts all of the weight on the arms 15 and the shoes 60, and in this position the bucket may be semi-skidded or floated to the place of disposal of the dirt. Thereafter, the arms 15 may be raised to bring the bucket to any elevated position and the cylinder 64 operated to tilt the bucket downwardly to discharge the load. Also in digging into a bank or a so-called straight face the bucket 14 can be tilted about its pivot 61 to shave off whatever portion of the bank is desired and then be tilted back on the arms 15 to carry its load. In this way the bucket does not have to be pulled upwardly against the entire resistance of the bank to receive its load but may take successive bites in the face of the bank to remove the material therefrom. All operations including lifting and lowering the bucket carry mechanism, tilting or rolling the bucket are under complete hydraulic control at all times through the action of the cylinders 29 and 64.

In connection with both forms of the invention it will be noted that when the arms 15 are lowered and the bucket is in a digging position, the links 36 are in an off center position (see Fig. 1) and that as hydraulic fluid is introduced into the back end of the cylinders 29 raising the arms 21 about their fixed points that through the connection of the links 24 with the arms 15 said arms 15 are raised on their floating pivots 18 and that the links 36 gradually move to a straight line position, but that during this movement the overhang of the loaded bucket in front of the vehicle is not materially changed and the parts assume the dotted line position shown in Fig. 3 which is a position that may be used for transporting the loaded bucket to a place of deposit. Thereafter, as the arms 21 are further raised, the links 36 move from their straight line position to the full line position shown in Fig. 3, and this movement causes the links 19 through the breaking of the toggle links 35 to swing forwardly, thus swinging the arms 15 forwardly to bring the bucket to an overhanging position which is the position it assumes in its fully elevated condition, and the bucket may then be opened or tilted as heretofore described to discharge the load. The bucket 14 may, of course, be dumped at any elevated position, if desired, but is raised to its high position for dumping when loading into a truck.

We desire it to be understood that this invention is not to be limited to any particular form or arrangement of parts except in so far as such limitations are included in the claims.

What we claim as our invention is:

1. In an excavator, the combination with a movable support, of a digging bucket, a supporting structure for said bucket mounted to float relative to said support, and raising and lowering means for said supporting structure comprising arms pivoted at a fixed point on said support and operatively connected to an intermediate portion of said supporting structure and hydraulically operated cylinders operatively connected with said arms.

2. In a load handling apparatus, the combination with a movable support, of a load receiving means, supporting arms for said load receiving means, links pivotally connecting said arms with said support to form a floating connection therewith, raising and lowering means for said arms, and linkage means connecting said first named links with said support and with said arms to control their movement and cause said arms to move forwardly as they are raised to a position for dumping the said load receiving means.

3. In a load handling apparatus, the combination with a movable support, of a load receiving means, supporting arms for said load receiving means, links pivotally connecting said arms with said support to form a floating connection therewith, raising and lowering means for said arms, and means including toggle links connecting said first named links with said support and said arms to control their movement and cause said arms to move forwardly as they are raised to a position for dumping said load receiving means.

4. In a load handling apparatus, the combination with a movable support, of a load receiving means, supporting arms for said load receiving means, links pivotally connecting said arms with said support to form a floating connection therewith, arms pivotally mounted on said support and operatively connected to said supporting arms, hydraulic cylinders controlling the movement of said last named arms, and linkage means connecting said links with said support and to said arms to control their movement and cause them to move said supporting arms and said load receiving means forwardly as they are raised to a position for dumping load receiving means.

5. In an excavator, the combination with a movable support, of a digging bucket, supporting arms for said bucket, links pivotally connecting said arms with said support to form a floating connection therewith, arms pivotally mounted on said support and operatively connected to said supporting arms, hydraulic cylinders controlling the movement of said last named arms, a pair of toggle links connecting the upper portions of said first named links with said support and controlling their movement, bell crank levers pivotally mounted on said supporting arms and having one of their arms pivotally connected to the knees of said toggle links, and bucket dumping mechanism including hydraulic cylinders carried by the other arms of said bell crank levers.

6. In an excavator, the combination with a movable support, of a tiltable digging bucket, supporting means for said bucket including arms pivotally connected to the lower portion of said bucket and having ground engaging shoes back of their pivotal connection with the bucket for assisting in the making of a smooth cut, positively acting means for tilting the bucket about its pivotal connections with said arms during digging, and means for raising and lowering said arms.

7. In an excavator, the combination with a movable support, of a tiltable digging bucket, supporting means for said bucket including arms pivotally connected to the lower portion of said bucket and having ground engaging shoes back

of their pivotal connection with the bucket, positively acting means for tilting the bucket to vary its digging angle during digging and to swing the loaded bucket back onto said arms, and means for raising and lowering said arms.

8. In an excavator, the combination with a movable support, of a tiltable digging bucket, supporting means for said bucket including arms pivotally connected to the lower portion of the said bucket and having ground engaging shoes back of said pivotal connections, hydraulically operated means carried by said arms and operatively connected to the upper portion of the bucket for tilting said bucket about its pivot and holding it in different positions of tilt, and means for raising and lowering said arms.

9. In an excavator, the combination with a movable support, of a digging bucket, supporting arms for said bucket, links pivotally connecting said arms with said support to form a floating connection therewith, arms pivotally mounted on said support and operatively connected to said supporting arms, a pair of toggle links operatively connecting said first named links with said support, and means connecting the knees of said toggle links to said supporting arms to shift the position of said first named links as said arms are moved upwardly and swing said links forwardly as the bucket reaches its upper position to project said arms forwardly from their initial lowered position relative to said support.

10. In an excavator, the combination with a movable support, of implement supporting arms, links pivotally connecting said arms with said support to form a floating connection therewith, said arms having upwardly extending portions, links pivotally connecting said arms with said support to form a floating connection therewith, lifting arms pivotally mounted on said support, links operatively connecting the outer ends of said arms with said extensions of said implement supporting arms, means for raising and lowering said lifting arms, a pair of toggle links connecting said first named links with said support, means operatively connecting the knees of said toggle links to said supporting arms whereby to break the knee of said toggle links as said supporting arms are moved to a raised position and project said first named links forwardly to extend said arms beyond their initial position.

11. In a material handling device, the combination with a movable support, implement supporting arms, linkage pivotally connecting said arms with said support to form a floating connection therewith, raising and lowering means for said arms, toggle links connecting said first named linkage with said support, and means connected to the knees of said toggle links for breaking the toggle as said supporting arms are moved upwardly and thereby moving said first named linkage to a position to project said arms forwardly from their initial position.

12. In a load handling apparatus, the combination with a movable support, of a load-receiving means, a supporting structure for said load-receiving means, a movable mounting for said structure to allow it to float relative to said support, raising and lowering means for said supporting structure having a fixed pivotal mounting on said support, and linkage means between said movable mounting, said structure and said support to project said load-receiving means forwardly as it moves to a raised dumping position.

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