Feb. 24, 1953 L. BERNER 2,629,190

DRAG BUCKET AND CONTROL THEREFOR

Filed Jan. 5, 1948 4 Sheets-Sheet 1

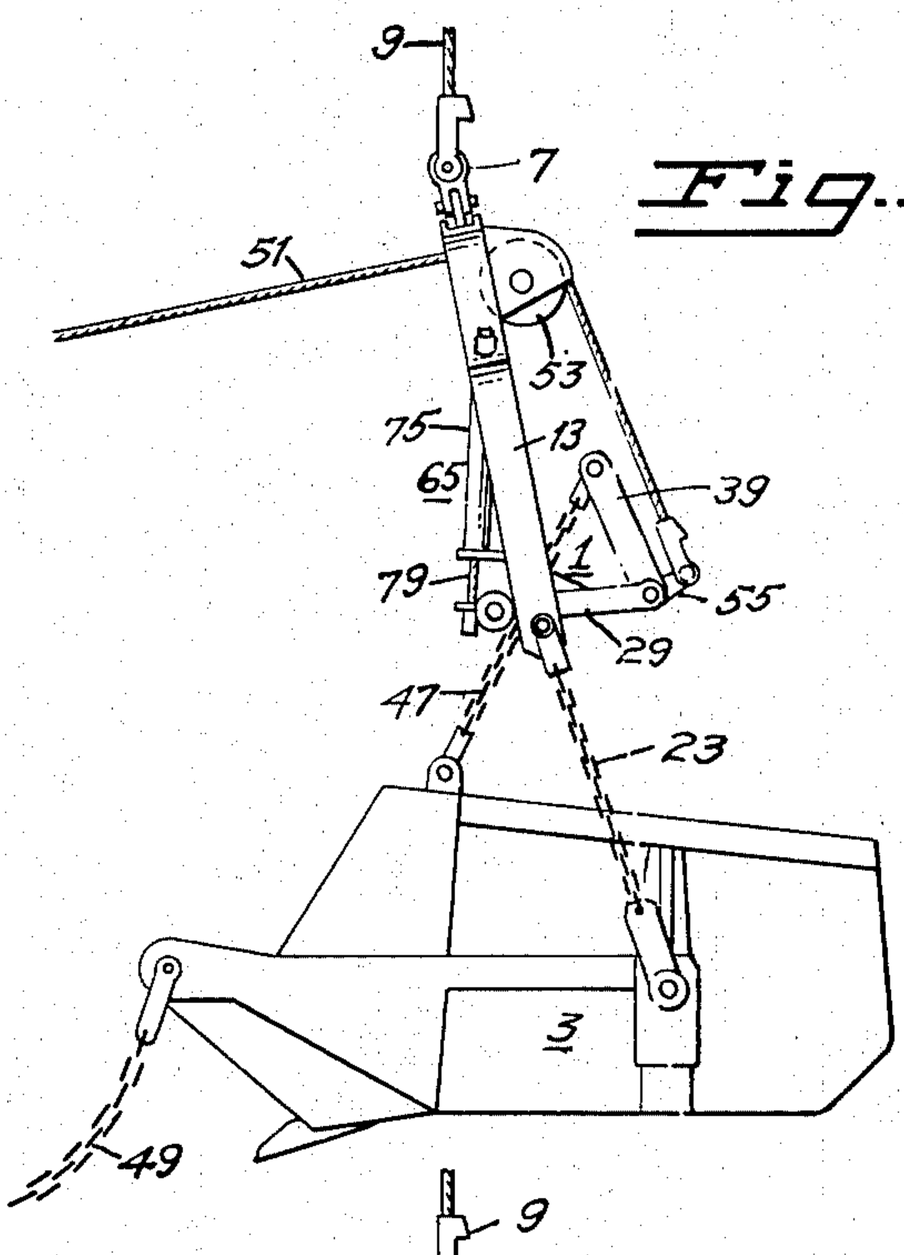


Fig. 1.

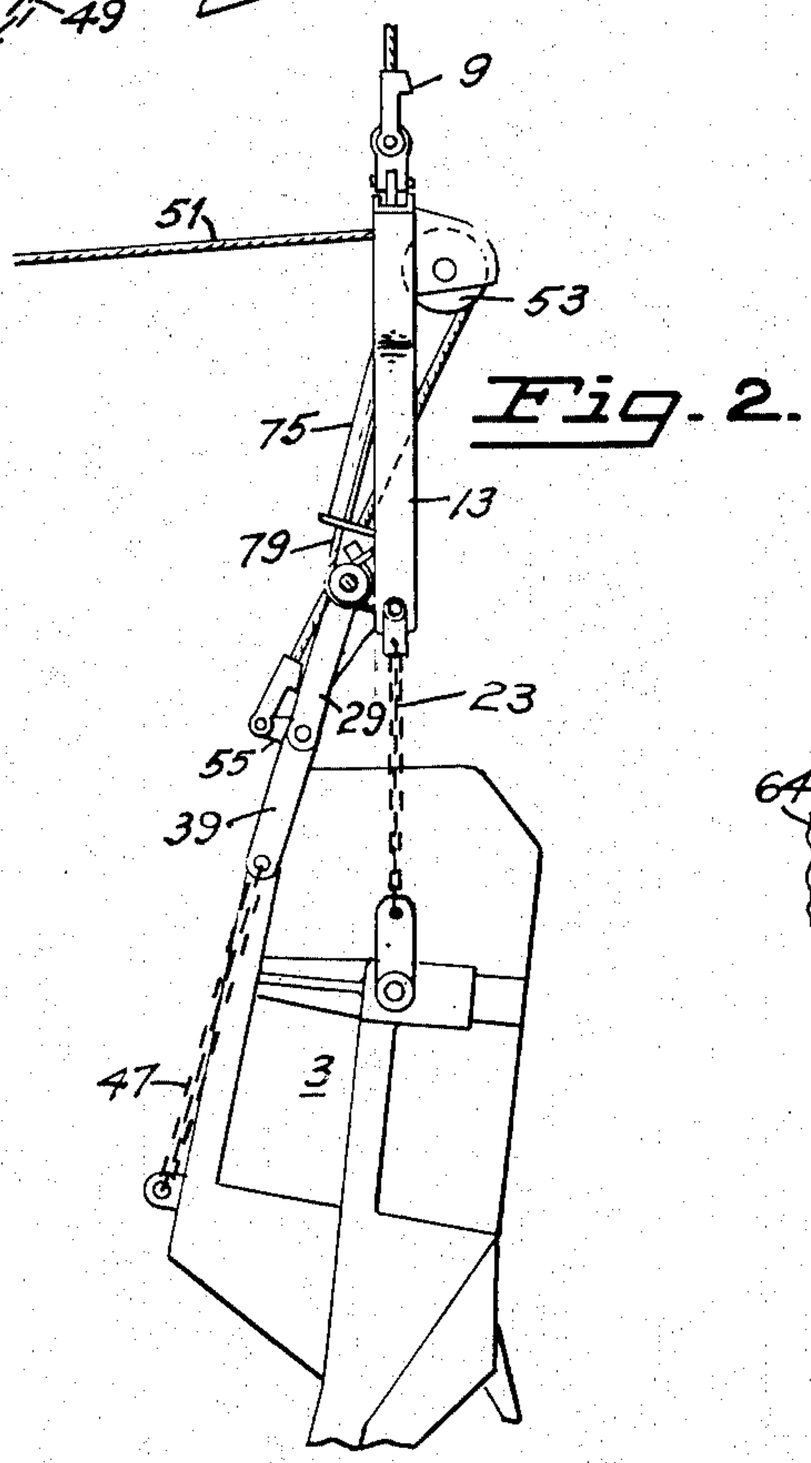


Fig. 2.

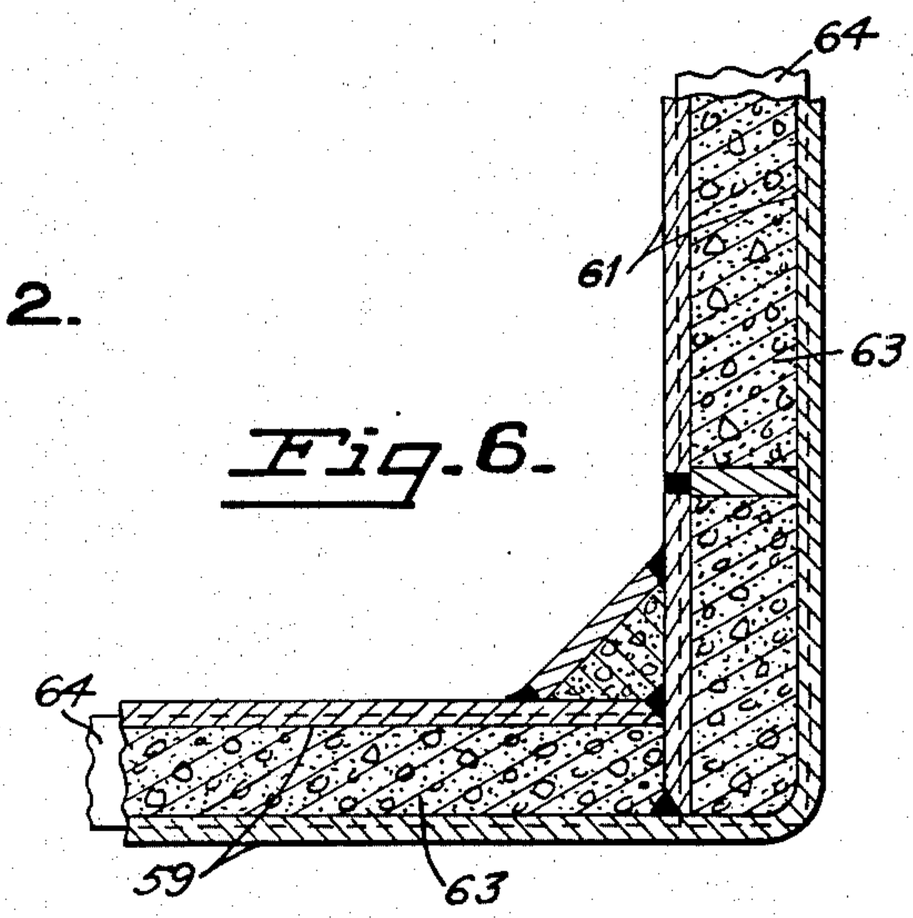


Fig. 6.

INVENTOR.
LEO BERNER

BY
Bruce & Broder

HIS ATTORNEYS

Feb. 24, 1953 L. BERNER 2,629,190

DRAG BUCKET AND CONTROL THEREFOR

Filed Jan. 5, 1948 4 Sheets-Sheet 2

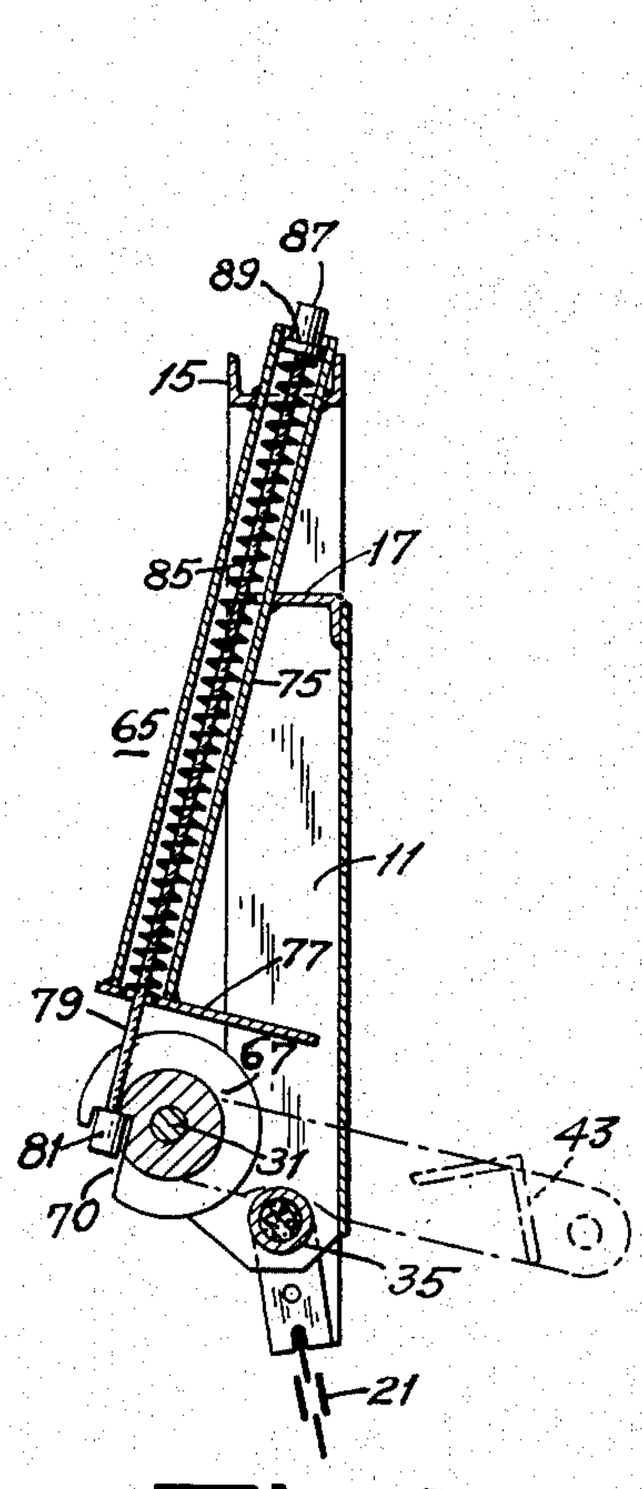


Fig. 5.

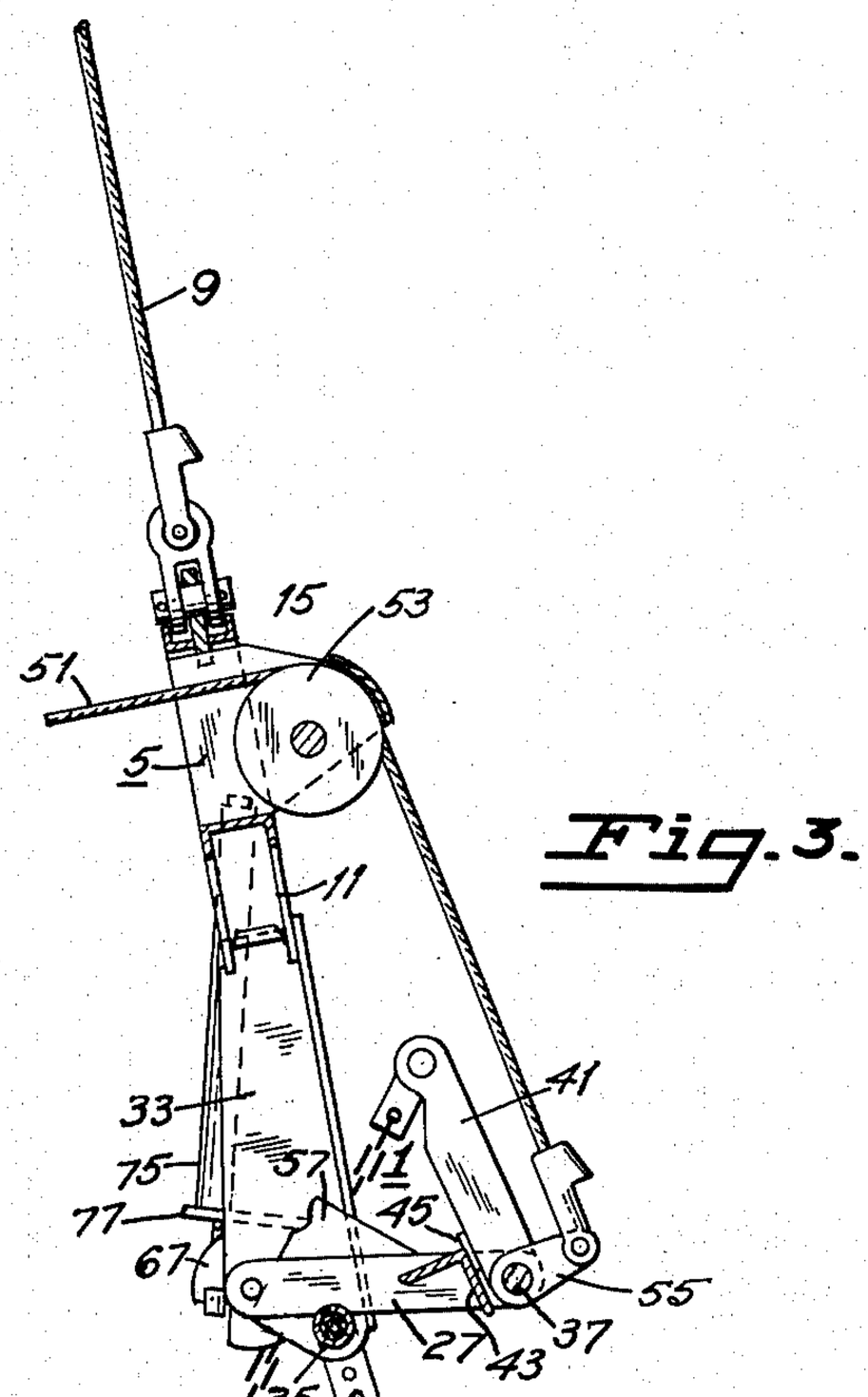
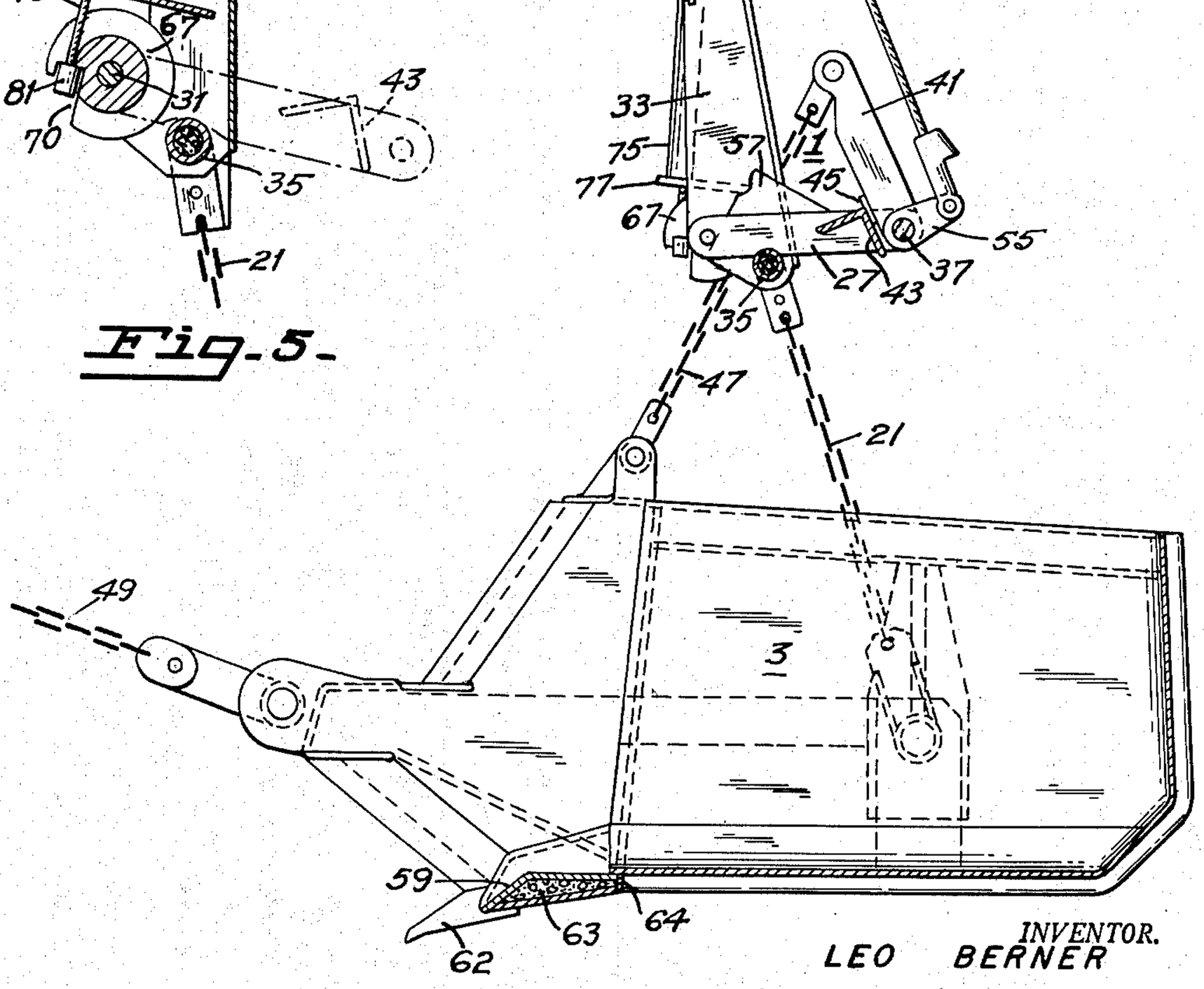


Fig. 3.



INVENTOR.
LEO BERNER
BY
Bruce & Brosler
HIS ATTORNEYS

Feb. 24, 1953 L. BERNER 2,629,190

DRAG BUCKET AND CONTROL THEREFOR

Filed Jan. 5, 1948 4 Sheets-Sheet 3

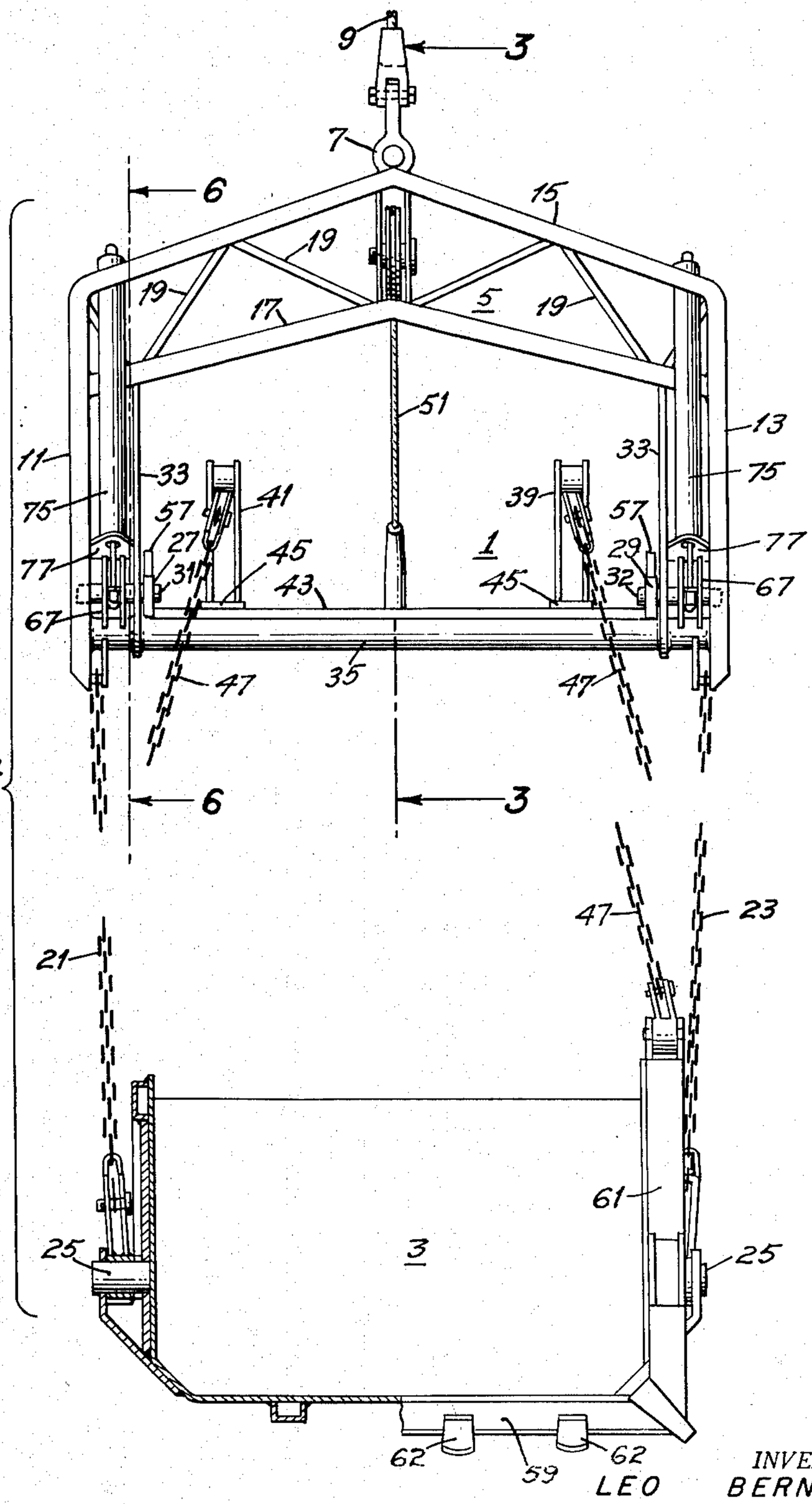


Fig. 4.

INVENTOR.
LEO BERNER

BY
Bruce & Brooks

HIS ATTORNEYS

Feb. 24, 1953 L. BERNER 2,629,190

DRAG BUCKET AND CONTROL THEREFOR

Filed Jan. 5, 1948 4 Sheets-Sheet 4

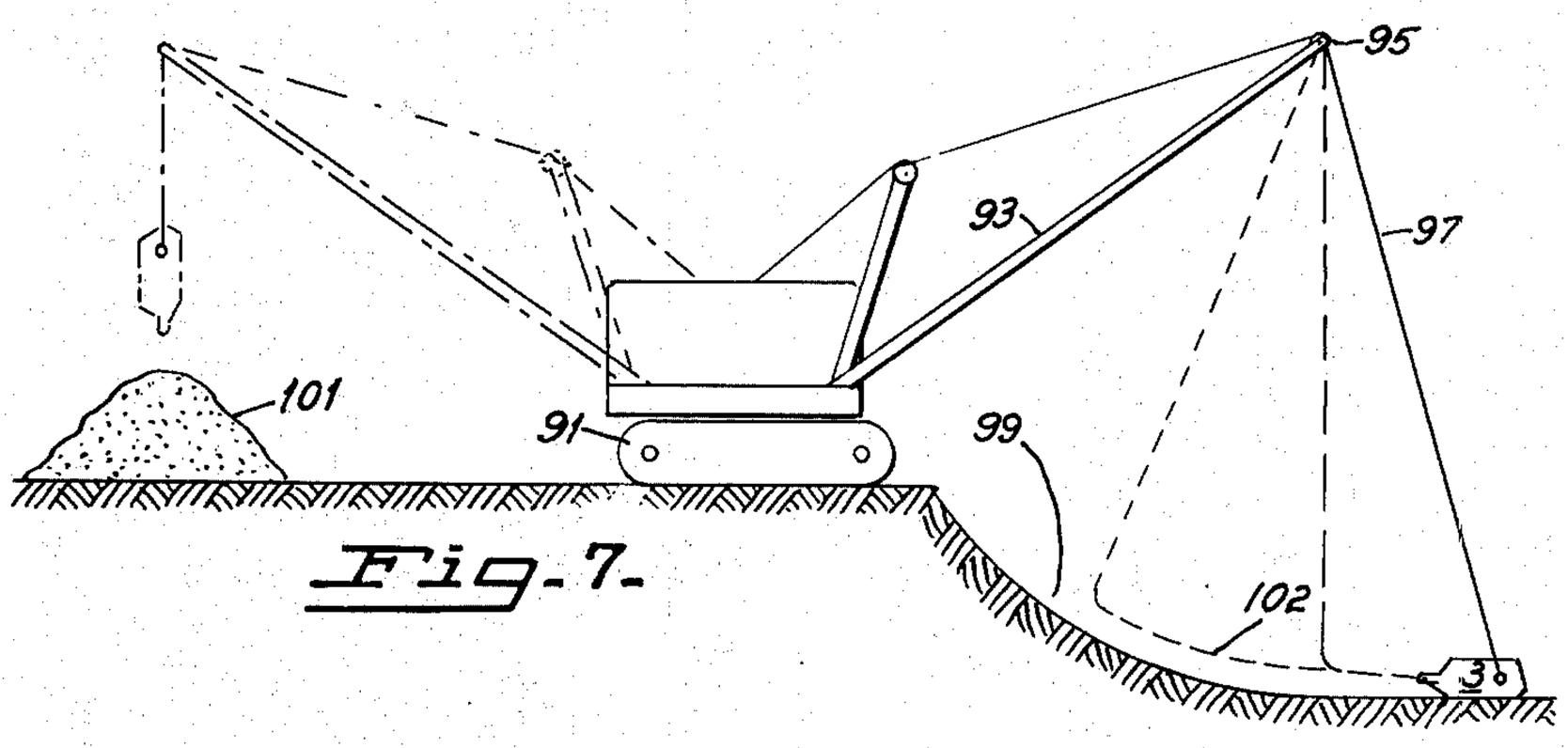


Fig. 7.

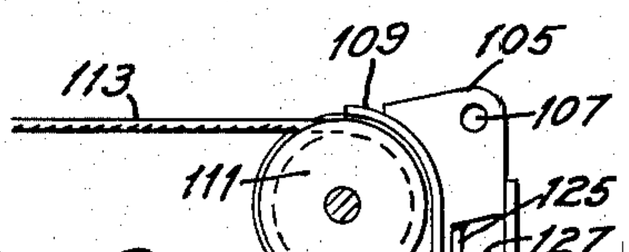


Fig. 9.

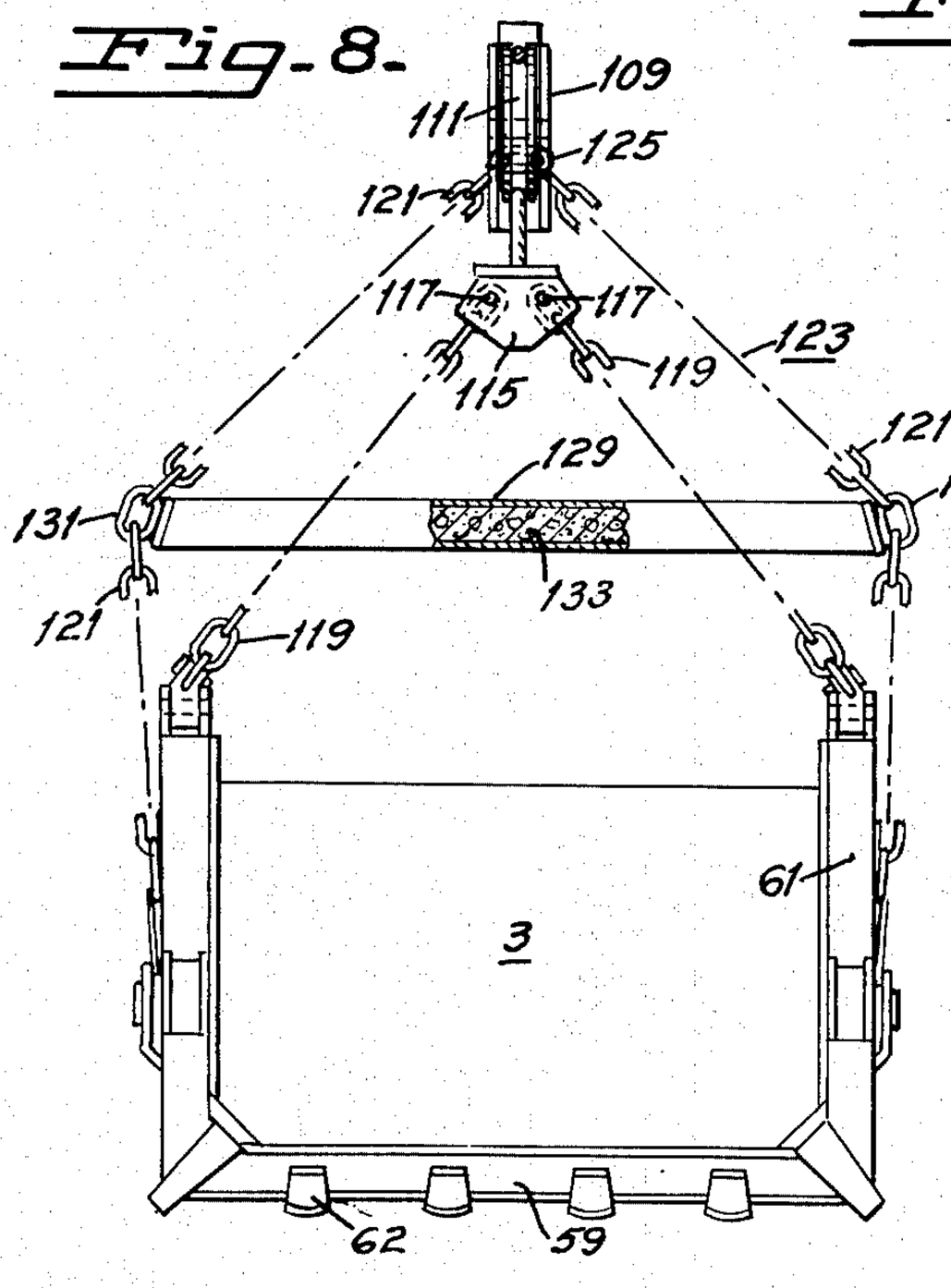


Fig. 8.

INVENTOR.
LEO BERNER
BY
Bruce & Broder
HIS ATTORNEYS

Patented Feb. 24, 1953 2,629,190

UNITED STATES PATENT OFFICE

2,629,190

DRAG BUCKET AND CONTROL THEREFOR

Leo Berner, San Jose, Calif., assignor to Pacific Coast Engineering Company, Alameda, Calif., a corporation of California

Application January 5, 1948, Serial No. 516

3 Claims. (Cl. 37—135)

1

My invention relates to excavating apparatus, and more particularly to drag buckets and control therefor.

Among the objects of my invention are:

(1) To provide a novel and improved drag bucket;

(2) To provide a novel and improved drag bucket of light weight and improved weight distribution;

(3) To provide a novel and improved drag bucket in which the front choking resistance is materially reduced and which otherwise has improved digging qualities;

(4) To provide a novel and improved drag bucket of light weight but which is possessed of great strength and rigidity, whereby greater loads may be handled and more economically;

(5) To provide a novel and improved drag bucket which offers less interference with the drag chain and dump rope during use;

(6) To provide a novel and improved drag bucket which shall not be subject to the wear of conventional type buckets, thereby materially reducing repairs, servicing and replacement;

(7) To provide a novel and improved drag bucket and control which permit simplification of the operating cycle over that of conventional type drag buckets and control, thereby cutting down the time per cycle of operation whereby the pay load handled may be very much increased;

(8) To provide a novel and improved drag bucket and control which will permit of the bucket being hoisted at any point in its digging stroke and without dumping its load;

(9) To provide a novel and improved drag bucket and control which allow the bucket to hang in its carrying position in the presence of a slack dragline;

(10) To provide a novel and improved drag bucket capable of use interchangeably with conventional control means for short boom service, and with my improved control for long boom service.

Additional objects of my invention will be brought out in the following description of a preferred embodiment of the same, taken in conjunction with the accompanying drawings wherein:

Figures 1 and 2 are comparative views illustrating the drag bucket and control of the present invention in carrying position and in dumped position respectively;

Figure 3 is an enlarged side elevational view of the bucket and control of Figure 1, depicting features of construction in greater detail;

2

Figure 4 is a front elevational view of the drag bucket and control of Figure 3, partly broken away, to illustrate additional features of its construction not apparent in the side elevational view of Figure 3;

Figure 5 is a view illustrating in detail a reset feature of the control of the present invention;

Figure 6 is a view illustrating a detail in the construction of the bucket of the present invention;

Figure 7 is a view depicting visually, certain of the many advantages arising from the use of my improved bucket and control with a long boom;

Figure 8 is a front elevational view of my improved bucket in combination with a novel suspension or carrying rig for short boom operation;

Figure 9 is a side elevational view depicting features of the assembly of Figure 8.

The present drag bucket and control are improvements upon the invention of my earlier filed Patent No. 2,168,643 of August 8, 1939.

In general, the present invention involves a control 1 in the form of toggle means for a drag bucket, and a drag bucket 3 embodying features of construction which admirably adapt it for use with such toggle control means.

The control, of the present invention, is supported by and within a bail 5, the upper midpoint of which carries an eye 7 for attachment to a hoist rope 9. Such bail is formed from channel iron and includes a pair of parallel side arms 11—13 connected by a peaked main arch 15 and reinforced by a cross-arch 17 which is preferably welded at each end to one of the side arms and connected to the main arch by angle iron members 19 to form a structural beam.

From the lower ends of the side arms, the bucket is suspended by means of spreader chains 21—23, each connecting to a trunnion 25 located on each side of the bucket.

The toggle control involves a pair of spaced toggle levers 27 and 29, each fixed at one end to a stub shaft 31 and 32 respectively each of which is journaled at one end in a side arm, and with its outer end passing through a bracket plate 33 supported in parallel spaced relationship to such side arm. These bracket plates are rigidly supported in position by welding them at their upper ends to the lower or cross-arch 17, and by passing through the lower ends thereof, a cross-bar or pipe 35 which in turn is preferably welded at its ends to the side arms of the bail. By welding the bracket plates to this cross-arm, their positions will be more rigidly fixed.

It is noted that the stub shafts lie on a common axis slightly to the front of the bail and at an elevation slightly above that of the cross-bar. This common axis constitutes the pivot axis of the toggle control.

The cross-bar thus can function as a stop or rest for the toggle levers in the stable carrying position of the toggle control.

A bar **37** is journalled in the free ends of these levers, to which bar I affix, as by welding, a pair of spaced toggle links **39** and **41** extending in an upward direction, which position is determined by an angle iron member **43** extending between and welded to the levers **27**. This member thus functions as a stop for the links in the stable carrying position of the toggle control. A small metal plate **45** affixed to each link where it abuts the angle iron stop member, eliminates wear at these points.

From the upper end of each of these links to the associated upper front corner of the bucket, there extends a toggle chain **47** of a length to maintain the bucket in a substantially horizontal position which determines the carrying position of the bucket. To represent a stable situation, under circumstances recited, these toggle chains must lie to the right of the toggle pivot axis as viewed in Figure 3 of the drawings and this represents an inherently stable condition. Consequently, the drag line **49** which conventionally connects to the discharge end of the bucket may be relaxed without danger of causing dumping of the bucket.

From what has been said above, it becomes apparent that if the toggle chains be shifted to the other side of the toggle axis, the horizontal or carrying position of the bucket will no longer remain stable, but the discharge end of the bucket, in the absence of any opposing force, will be free to drop, thus causing the bucket to rotate on its trunnions to a dumping position.

Releasing of the toggle mechanism to accomplish dumping of the bucket in this manner may be accomplished through the actuation of a dump line **51** which extends over a sheave **53** supported by the bail adjacent the upper central portion thereof, such dump line then pivotally connecting to one end of a dump lever **55** which in turn is rigidly affixed to the cross-bar **37** in the plane of the sheave. A pull on the dump rope will accordingly swing the toggle mechanism on its axis sufficiently to shift the toggle chains to the other side of the toggle axis, whereupon the bucket will then be free to dump.

The extent to which such bucket may dump under these circumstances may be limited by a stop in the form of a small triangular-shaped plate **57** affixed along its long side to each of the toggle levers, adjacent the pivot axis, so that as such toggle levers swing about the pivot axis during the dumping of the bucket, such plates will engage or abut the cross-bar or pipe **35** which joins the lower ends of the bail. By notching that portion of each of the stop plates where they engage the cross-bar, a more stable engagement will be realized and with less opportunity for wear at this point.

The rate at which dumping of the bucket occurs following release of the toggle mechanism, may be held under control through the exercise of tension on the dump line, and this is greatly facilitated when the bucket embodies certain features of design and construction constituting part of the instant invention.

In this connection the weight of the bucket and the weight distribution thereof become important factors. It is desirable, for example, that the center of gravity lie between the open or discharge end of the bucket and the trunnions and closer to the trunnions particularly in its loaded condition, whereby the turning moment while favoring the dumping of the bucket in the manner indicated, will nevertheless not be so great that the same cannot be very easily controlled by an operator through the exercise of tension on the dump line.

Prior conventional constructions of drag buckets did not favor such conditions, for such buckets were constructed with a heavy arch across the upper front corners thereof, which arch invariably overhung the lip of the bucket. In these prior conventional type buckets, the arch served to strengthen the open end of the bucket and at the same time provide for the connection thereto of a dump line. The increased turning moment attributable to such factors, however, renders it more difficult to control the dumping rate of the bucket by an operator.

The bucket of the present invention corresponds generally in size and shape with conventional type buckets but embodies features of importance which distinguish it from the conventional type.

Of importance in this connection is the fact that the front rim of the bucket which defines the entrance thereto and includes a lip **59** and vertical side edges **61**, are of hollow steel construction, and may be fabricated as a separate unit from steel plate in any desired manner, with the lip tapered and adapted to receive and hold teeth **62** and the rear edge open.

Such lip and vertical side edges are all reinforced by a filling **63** of light-weight concrete through the rear edge, that is a concrete in which a light-weight aggregate such as "Haydite," "Pearlite," "Pumice," "Zonite" or the like, is employed in lieu of the conventional gravel. Such light-weight concrete weighs on the order of 40 to 70 pounds per cubic foot as compared with steel which weighs on the order of 486 pounds per cubic foot. Following the filling operation, the filler unit is sealed by strips **64** of steel plate welded across the open edge and the unit then welded to the rest of the bucket which has previously been fabricated of steel plate.

I have found that this light-weight concrete filling bonds itself to the steel plates, prevents them from denting and very strongly resists buckling and bending. By reason of such construction, I am enabled to eliminate the arch conventionally employed in prior art buckets, without impairing the ability of the bucket to do the heaviest type of digging and carrying.

Also through such elimination of the arch and the additional reduction in weight permitted by the edge construction described above, the center of gravity of the bucket may be shifted somewhat toward the trunnions to thereby allow reduction in the turning moment and thus facilitate the handling of the bucket by an operator, when it is desired to release the toggle mechanism and dump the load.

Restoration of the bucket to stable carrying position is accomplished automatically upon setting the bucket down upon a supporting surface such as the ground. Mechanism **65** for accomplishing this involves a take-up reel **67** in the form of a pulley or sheave keyed or welded to the stub shaft **31**, between a side arm of the bail and the associated bracket plate, the sheave being

formed with a recess 70 into the peripheral groove thereof.

Associated with such take-up reel is an open-ended spring return mechanism including a tubular spring housing 75 disposed between such side arm and bracket plate, with its upper end passing through the bail arch 15 to which it is affixed as by welding. The lower end of the tubular housing abuts against a cross-plate 77 which connects the side arm and bracket plate and to which the lower end of the spring housing is welded. This cross-plate has a hole on the axis of the spring housing for free passage of a cable 79.

One end of this cable terminates in a ferrule 81 to permit this end of the cable to be anchored in the recess of the take-up reel.

The cable extends through the spring housing, axially of a coil compression spring 85 located therein, and terminates at the upper end of such housing in a ferrule 87 against which is also disposed a washer 89 of diameter sufficient to abut the extremity of the spring and at the same time permit of its movement axially of the spring housing.

It becomes apparent from an analysis of the above described structure, that in the process of dumping the bucket, the accompanying rotation of the take-up reel, which takes in the greater portion of a complete revolution, will cause the reel to take up on the cable against the resisting action of the associated spring, thereby causing a compression of such spring.

Therefore, when the dumping load is removed as when the bucket is set down upon a solid supporting surface, the spring is freed from such restraint, to restore itself to its original condition, and in so doing will restore the toggle mechanism to its stable carrying condition.

Preferably a restoring mechanism of the type described is incorporated at each side of the bail, whereby restoration of the toggle mechanism to its stable carrying condition may be accomplished more efficiently and with less strain and wear on the components.

The bucket of the present invention is applicable for use in the conventional manner on short booms, where the bucket requires no additional dragging after loading, that is where the bucket will be in position to be hoisted as soon as it is loaded. Under such conditions, advantages inherent in the use of the control of the present invention are not so pronounced. Nevertheless the light-weight construction of the bucket does provide many advantages over buckets of prior art conventional design as has been pointed out in connection with the objects and purposes of the present invention.

However, where the conditions are such as require a long range or reach of the drag line, that is where the distance from the pit to the spoil pile is substantial, the advantages of the present invention arising out of the combined use of my improved bucket and associated toggle control becomes most pronounced.

Referring to Figure 7 of the drawings for a further discussion of such advantages, we have schematically shown apparatus including a crawler frame 91 supporting a revolving frame which in turn carries a boom 93. At the outer end of the boom is a hoist sheave 95 over which the hoist line 97 is supported, for transporting a drag bucket from a digging location such as a pit 99 to a spoil pile 101 where the load is dumped.

The centrifugal force incidental to the swinging of the boom from a position over the spoil pile to its position over the pit, or a pendulum action induced through momentary pull on the drag line, may land the bucket beyond the normal reach of the boom, to initiate a digging stroke. The bucket is dragged forward by a pull on the drag line to accomplish such digging and may become full by the time it reaches a position directly below the upper end of the boom.

When operating in accordance with conventional practice, that is without the utilization of the control of the present invention, the loaded bucket can be lifted only against opposing tension in both the hoist line and the dump line to avoid spilling of the load, and in order to establish this relationship, the loaded bucket must be dragged a considerable distance 102 beyond the point where it has first become full.

Inasmuch as the control means of the present invention permits of the lifting of a loaded bucket in the absence of any tension on the drag or dump line, it becomes apparent that the loaded bucket may be lifted or hoisted at any point in the digging stroke or as soon as the bucket has taken on a full load. As one example of what this may mean, a bucket which might ordinarily become loaded in a digging stroke of 20 feet, might in accordance with prior conventional practice, have to be dragged another 40 feet before the same can be hoisted. Inasmuch as the greatest wear on the bucket will occur during this additional drag under full load conditions, a considerable reduction in wear and a corresponding extension in life of the bucket will be realized through the elimination of such drag made possible through the use of my control.

Furthermore, this extra drag materially increases the operating time cycle of the hoist and consequently the resulting reduction in such cycle permitted by my improved control makes possible a very substantial increase in the daily output of the drag line.

As an added advantage, the tendency of any bucket to tilt or roll on a steep slope, is not only inhibited in my arrangement by the low center of gravity of the bucket, attributable largely to the elimination of the conventional arch, but should such tilting or rolling occur, the flexible chain suspension to the bucket, offers considerable leeway without endangering the toggle control mechanism.

For short boom service, the suspension depicted in Figures 8 and 9 is admirably suited for use with the light-weight bucket previously described.

This suspension involves a supporting plate 105 having a perforation 107 for attachment of a hoist line. Affixed to the front edge of this supporting plate is a sheave housing or guard 109 in which is journaled a sheave 111 over which is run the dump rope or cable 113, which in turn terminates in a junction link 115. This junction link has a pair of spaced pins 117 therethrough for anchoring supporting chains 119 leading to the front end of the bucket.

The greater portion of the bucket weight however, is carried by spreader chains 121, connected at their lower ends to clevises at the sides of the bucket. The spread chains are in effect a continuous chain 123 in the assembly illustrated, the middle link 125 of which is welded to the supporting plate transversely thereof, by positioning it in a notch 127 formed in the rear edge of the plate, and welding the link therein. This exposes the loop ends of the link to permit

free movement of the adjacent connecting links therein.

The two halves of the chain pass over the ends of a spreader bar 129 to which the contacting links 131 of the chain are welded.

This spreader bar is designed to offer a minimum of weight by fabricating the same of sheet steel into a bar preferably of rectangular section, which is then filled with a filling 133 of light-weight concrete. The ends of the spreader bar are preferably sloped to permit maximum freedom of movement to those links of the chain which connect to those which are welded to the spreader bar.

A rib 135 affixed to the supporting plate across the notch, serves as a protective feature in the event that the link welded therein should accidentally break loose due to defective welding or otherwise.

The entire suspension, it will be appreciated, will have the advantage of light weight as well as involving structure of the utmost simplicity and which can be fabricated and serviced economically.

While I have disclosed my invention in considerable detail, the same is subject to alteration and modification without departing from the underlying principles involved. I, accordingly, do not desire to be limited in my protection to such details, except as may be necessitated by the appended claims.

I claim:

1. A drag bucket assembly comprising a bucket having means for suspending said bucket from a hoist line, said means including a bail for connection to said bucket, said bail having a crossbar extending between the sides and adjacent the lower ends thereof; toggle means carried by said bail for connection to the front end of said bucket and adapted in its set condition to hold the front end of said bucket in stable carrying position, and in its upset condition adapted to permit dropping of the front end of said bucket to its dumping position; and including means pivotally securing said toggle means on an axis slightly to the front of said bail, said pivotal securing means permitting said toggle means to rest upon said crossbar; flexible means lying to one side of said axis and connecting said toggle means to the front end of said bucket; and means for selectively upsetting said toggle means from a remote point to dump said bucket.

2. A drag bucket assembly comprising a bucket having means for suspending said bucket from a hoist line, said means including a bail for connection to said bucket, said bail having a crossbar extending between the sides and adjacent the lower ends thereof; toggle means carried by said bail for connection to the front end of said bucket and adapted in its set condition to hold the front end of said bucket in stable carrying position, and in its upset condition adapted to permit dropping of the front end of said bucket to its dumping position, said toggle means including a

pair of spaced levers, means pivotally securing said levers at one end at points lying on a common axis and permitting said levers to rest upon said crossbar, means interconnecting said levers at their other ends, a pair of toggle links mounted on said interconnecting means in spaced relationship to each other; flexible means lying to one side of the axis of said pivotal securing means and connecting the free end of each toggle link to the front end of said bucket; and means for selectively upsetting said toggle means from a remote point to dump said bucket.

3. A drag bucket assembly comprising a bucket having means for suspending said bucket from a hoist line, said means including a bail for connection to said bucket, said bail having a crossbar extending between the sides and adjacent the lower ends thereof; toggle means supported within and by said bail for connection to the upper front end of said bucket and adapted in its set condition to hold the front end of said bucket in stable carrying position, and in its upset condition adapted to permit dropping of the front end of said bucket to its dumping position, said toggle means including a pair of spaced levers, means pivotally securing said levers at one end at points lying on a common axis slightly to the front of said bail and permitting said levers to rest upon said crossbar, means interconnecting said levers adjacent their other ends, a pair of toggle links mounted on said interconnecting means in spaced relationship to each other and rotatable with respect to said spaced levers, flexible means lying to one side of the axis of said pivotal securing means and connecting the free end of each toggle link to an upper front end of said bucket; and means for selectively upsetting said toggle means from a remote point to dump said bucket, said upsetting means including a lift lever secured to said spaced-lever interconnecting means and adapted when raised, to swing said flexible connecting means to the other side of the axis of said pivotal securing means, and a sheave supported by said bail, for passage of a dump rope connectable at one end to said lift lever.

LEO BERNER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
827,144	Connell	July 31, 1906
1,136,844	Springer	Apr. 20, 1915
1,833,587	Page	Nov. 24, 1931
1,986,853	Rauch	Jan. 8, 1935
2,001,924	Strong	May 21, 1935
2,028,598	Gibson	Jan. 21, 1936
2,168,643	Berner	Aug. 8, 1939
2,286,765	Settersten	June 16, 1942
2,325,336	Mikan	July 27, 1943
2,338,831	Whitcomb et al.	Jan. 11, 1944
2,415,156	Arps	Feb. 4, 1947