Aug. 12, 1952 W. L. CRYDERMAN 2,606,679

APPARATUS FOR USE IN SHAFT SINKING

Filed Sept. 13, 1949 4 Sheets-Sheet 1

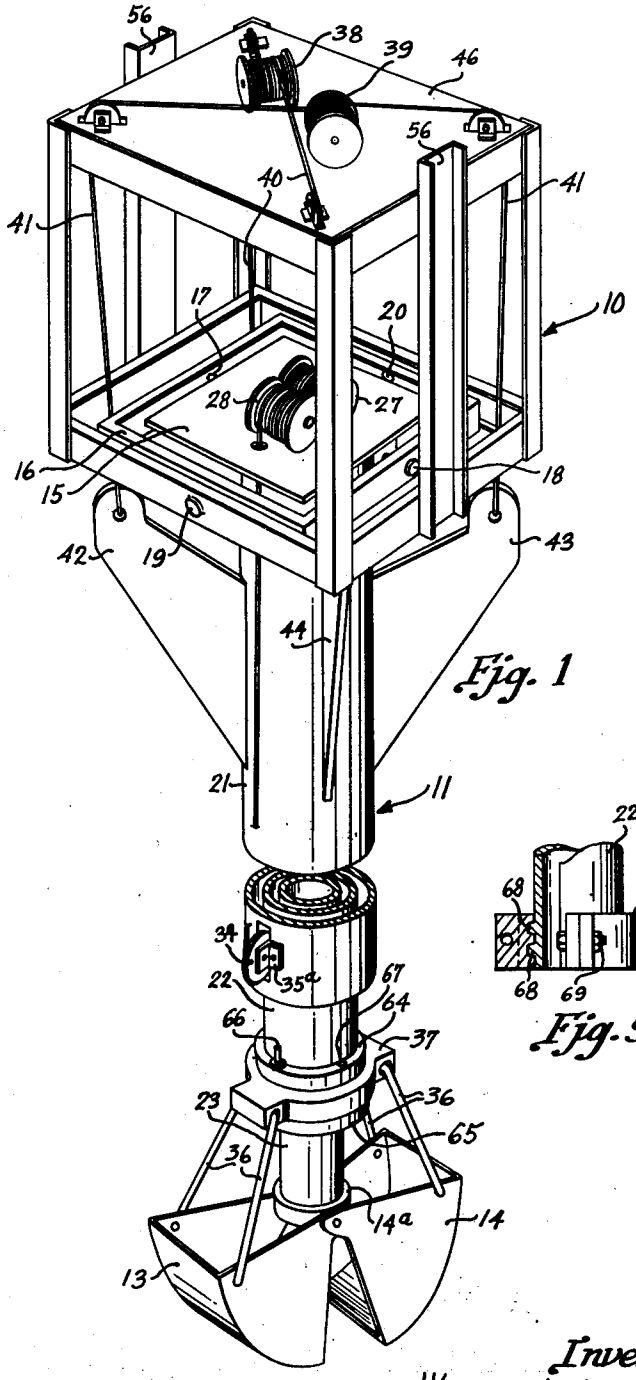


Fig. 1

Fig. 9

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APPARATUS FOR USE IN SHAFT SINKING

Filed Sept. 13, 1949 4 Sheets-Sheet 2

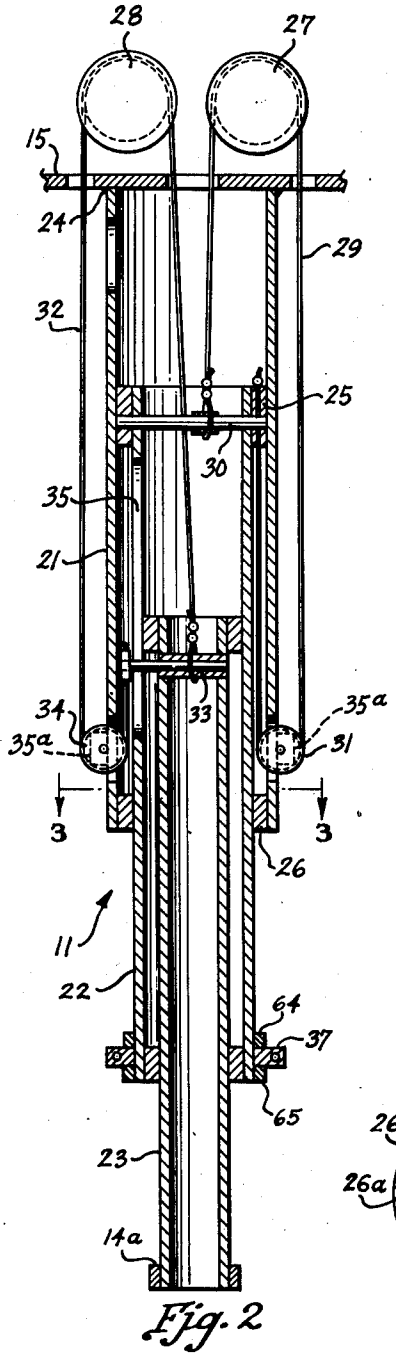


Fig. 2

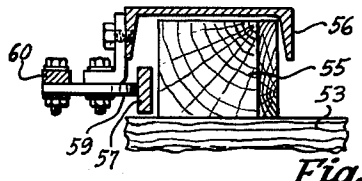


Fig. 5

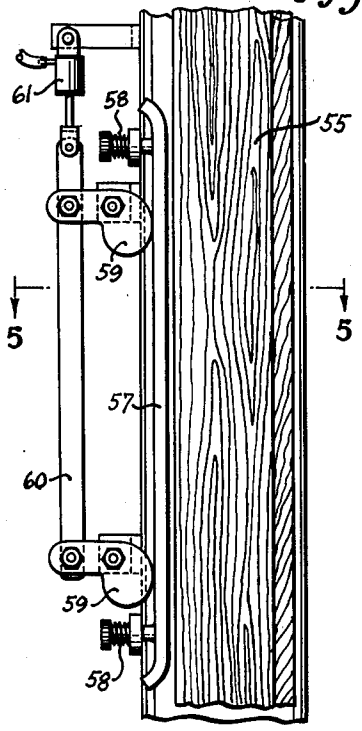


Fig. 4

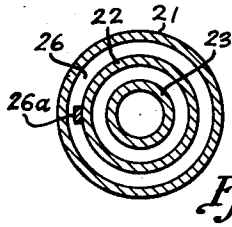


Fig. 3

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APPARATUS FOR USE IN SHAFT SINKING

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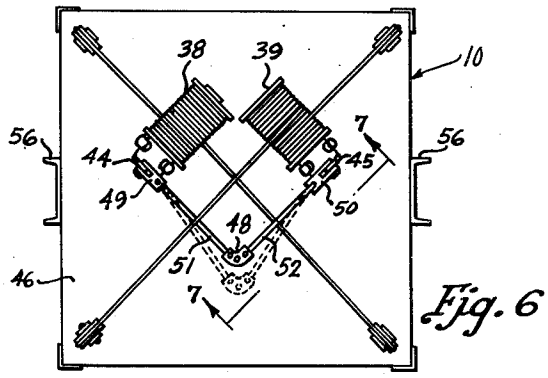


Fig. 6

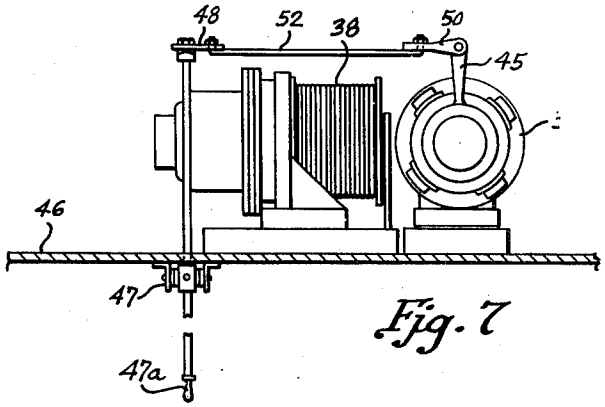


Fig. 7

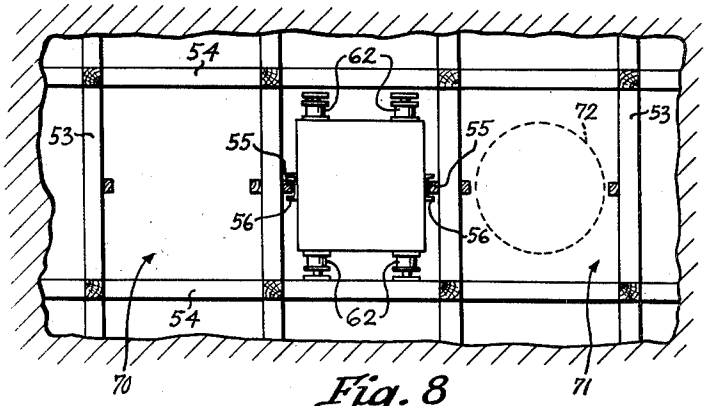


Fig. 8

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APPARATUS FOR USE IN SHAFT SINKING

Filed Sept. 13, 1949 4 Sheets-Sheet 4

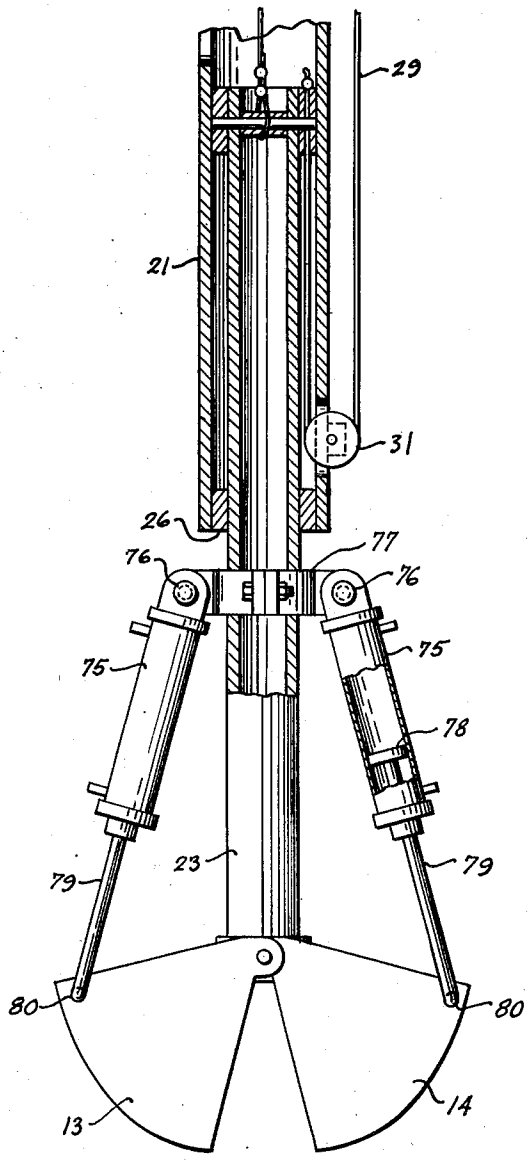


Fig. 10

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Patented Aug. 12, 1952 2,606,679

UNITED STATES PATENT OFFICE

2,606,679

APPARATUS FOR USE IN SHAFT SINKING

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Application September 13, 1949, Serial No. 115,333
In Canada August 26, 1949

10 Claims. (Cl. 214—115)

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This invention relates to device for use in sinking mine shafts, caisson digging and the like.

The removal of the shattered rock, after blasting, from mine shafts has in the past been a relatively slow and costly operation. While a considerable number of inventors have previously turned their minds to the problem of loading the blasted rock or muck into buckets for hoisting to ground level by mechanical means, the costly and slow hand shovel method of loading the rock into bucket hoists is still widely used. The mechanical loaders provided in the past have not been generally accepted for various reasons among them being difficulty of manoeuvering, cost of building, special shaft timbering methods must be employed that are more costly, and all corners in the shaft cannot be readily cleared.

I have invented a mechanical shaft digging machine which is a substantial improvement over the mechanical shaft digging machines of the prior art.

It is then an object of this invention to provide a mechanical mucker that will pick up muck with a positive action and that is easy to manoeuvre.

It is a further object of this invention to provide a mechanical mucker that is rugged and inexpensive to manufacture.

It is a still further object of this invention to provide a mucker having the above mentioned features that can be used with the conventional mine shaft timbering methods.

It is a still further object of this invention to provide a mucking machine capable of removing muck from all corners of the mine shaft.

With these and other objects in view I provide a mucker having a boom guide designed to support a boom for the telescoping movement with respect thereto. According to the invention the boom has a pair of co-operating buckets pivotally mounted at its free end, and means are provided for actuating the buckets in either direction about their pivotal mounting on the boom. Means are also provided for telescoping the boom with respect to the guide. The invention will be clearly understood after reference to the following detailed specification read in conjunction with the drawings.

In the drawings:

Figure 1 is a perspective view of a mucking machine according to the invention designed to be raised and lowered into a mine shaft in the same manner as a conventional mine cage.

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A considerable amount of detail in respect of the control means for the device has been omitted from this view to simplify the drawing.

Figure 2 is a sectional view showing the construction of the telescoping boom.

Figure 3 is a sectional view of the telescoping boom along line 3—3 of Figure 2.

Figure 4 is a view showing the air cylinder type operated shoe means for holding the control cage from which the telescoping boom depends.

Figure 5 is a view along the line 5—5 of Figure 4.

Figure 6 is a plan view showing the hoists for swinging the universally mounted telescoping boom to a desired position.

Figure 7 shows the hoists in elevation, looking in the direction of the arrows 7—7 of Figure 6.

Figure 8 is a plan view showing a mine shaft excavation and the manner in which it may be divided by timbers into three compartments.

Figure 9 is a view showing an alternative collar design for operating the buckets.

Figure 10 is a cross sectional view showing an alternative means to the means shown in Figure 2 for actuating the co-operating buckets of the clam.

Referring to the drawings, and at first to Figure 1 in a general way the mine mucking machine there shown will be seen to comprise a control cage 10, having a telescoping boom 23 supported by the boom guide 21 and having a clam comprised of two co-operating buckets 13 and 14 at its free end. The buckets 13 and 14 are pivotally mounted on the ring 14a which is freely rotatable about the end of the boom 23.

In the embodiment of the invention shown, the boom guide 21 is universally suspended from the cage 10 by rigidly securing its upper end to the platform 15 by welding or some other suitable means. The platform 15 is pivotally mounted about one of its cross axes within the frame 16 as at 17 and 18, and the frame 16 is in turn pivotally mounted in the frame of the cage 10 as at 19 and 20 about a cross axis at right angles to the axis about which the platform 16 is mounted therewithin. It will be apparent that a controlled means for rocking the platform 15 and the frame 16 about their respective pivotal axis would serve to swing the universally suspended boom guide 21 to any desired position. Controlled means for swinging the boom guide 21 to a desired position will be referred to in more detail later.

I now propose to describe the manner in which

the boom 23 is supported within the boom guide 21, and the means for actuating the co-operating buckets 13 and 14 in either direction about their pivotal connection with the boom 23.

As best seen in Figure 2, the boom 23 is tubular and is free to telescope directly within the tubular member 22 which is in turn free to telescope directly within the bearings 26 that are supported by the boom guide 21.

Control means, and means responsive to said control means for telescoping the boom 23 within the tubular member 22 are provided. The control means are not shown in the drawing but would include any suitable known apparatus for controllably operating a suitable power source. The present disclosure is not concerned with the operation of control devices because they are well known, and the choice of a suitable one would be only a matter of mechanical skill. The means responsive to the control means for telescoping the boom 23 includes a suitable power source operated by the control means such as an air operated motor (again not shown in the drawing because motors and their selection are well known), and means for transmitting power from the motor to raise and lower the boom 23. The power transmitting means shown in the drawings includes a winding drum 28, a cable 32, and a guide pulley 34 mounted in bracket 35*a* adjacent the lower end of boom guide 21. The drum 28 is coupled to the motor (not shown). The cable 32 is secured at each of its ends to the pin 33 carried by the boom 23 adjacent its upper extremity. As will be seen in Figures 1 and 2 of the drawings one end of the cable 32 extends in an upward direction, through a suitable hole in the floor of the platform 15 to the winding drum 28. The other end of the cable 32 extends in a downward direction, to and around the guide pulley 34 and up to the winding drum 28. The cable 32 extends around the drum 28 for a number of turns and is preferably anchored thereto adjacent the midturn so that as the drum turns, cable will reel on the drum in one direction and reel out from the drum in the other direction without slippage. This is old in the art of hoisting.

The telescoping operation of the boom 23 will be apparent from the description thus far. As the power means (not shown) is operated in response to operation of the control means (not shown) the drum 28 rotates and lengthens one end of the cable 32 and shortens the other end to raise or lower the boom depending on the direction of rotation of the drum. It should perhaps be noted that the tubular member 22 within which the boom 23 telescopes is formed with a longitudinally extending slit 35 to permit the free passage of the pin 30 as the boom 23 telescopes.

The boom of Figure 10 is operated in a similar way to the one of Figures 1 and 2 except that it telescopes directly within the boom guide 21. The intermediate tubular member in this embodiment of the invention is not included.

A control means (not shown) and means responsive to said control means for turning the buckets 13 and 14 about their point of pivotal connection with ring 14*a* at the end of boom 23 are also provided. The means responsive to the control means for actuating the buckets shown in Figures 1 to 9 includes a suitable power source (not shown) such as an air operated motor, a telescoping tubular member 22, means for transmitting power from the power source to raise and lower the tubular member 22, and the links 36.

The power transmitting means shown in the drawings includes a winding drum 27, a cable 29, and guide pulley 31. The winding drum 27 is coupled to the power means (not shown) which could be an air operated motor. This power transmitting means is similar in construction and operation to the power transmitting means for transmitting power to the boom 23. The cable 29 is secured at each of its ends to the pin 30 carried by the tubular member 22 adjacent its upper extremity. One end extends in an upward direction, through a hole in platform 15, to winding drum 27. The other end extends in a downward direction, to and around the guide pulley 31, to the winding drum 27. The cable extends around the drum 27 for a number of turns and actuates the tubular member up and down as its ends are shortened or lengthened by rotation of the drum 27. The drum 27 of course is driven by the control operated power means mentioned above but not shown in the drawings. The links 36, to which reference has been made, pivotally connect with the collar 37 and with the buckets as shown. The collar 37 extends around the tubular member 32 between the rigid shoulders 64 and 65 and is kept from rotating therebetween by the pin 66 which passes through aligned holes in the shoulder 66 and collar 37.

The pivoting action of the buckets as the tubular member 22 telescopes relatively to the boom 23 will be apparent from the drawing. The relative telescoping movement of the tubular member 22 is transformed to pivotal movement of the buckets 13 and 14 through the interconnecting links 36.

It should also perhaps be noted that the tubular member 22 is formed with a longitudinally extending tongue 26*a* which engages in a longitudinally extending groove (not shown) formed in the bearing 26 to prevent it from rotating during operation.

The clam of Figure 2 can be rotated through 90° by removing the pin 66 from the position shown, rotating the collar 37 to cause the hole therein to align with the hold 67 on shoulder 64 and reinserting pin 66 in the aligned holes. The ring 14*a* is freely rotatable on the boom 23.

In Figure 9 I show an alternative method of securing the collar 37 to the free end of the tubular member 22. In this embodiment the tubular member 22 is formed with two circumferentially extending tongues 68 designed to engage in two circumferentially extending grooves formed in the collar 37*a*. The collar 37*a* is of the split construction and is tightened on the free end of the tubular member 22 by means of the bolt 69. In order to rotate the clam, it is merely necessary to loosen the bolt 69, rotate the clam to the desired position, and retighten the bolt.

In Figure 10 I show an alternative means for actuating the buckets 13 and 14 about their pivotal connection on the boom 23. In this embodiment the boom 23 telescopes directly within the boom guide 21, the intermediate tubular member 22 being dispensed with. Cylinders 75 are pivotally connected at one end as at 76 to the ring 77 which is rigidly secured to the boom 23. The cylinders each have a double acting piston 78 with a piston rod 79 extending therefrom that connects with the buckets as at 80. The pistons are preferably air operated within the cylinder and control means (not shown) are provided for admitting air to the ports 75*a* to move pistons in either direction whereby to pivot the buckets 13 and 14 during operation.

Various methods for actuating the buckets 13 and 14 about the free end of the boom 23 supported for telescoping within the boom guide 21 other than the ones shown of interposing a telescoping tubular member between the boom and boom guide and connecting it to the buckets by links, and of inserting a double acting piston in the link arms connecting the buckets with the boom will be apparent to those skilled in the art and I do not of course intend that those disclosures should be read in a limiting sense.

The control means for swinging the universally mounted boom 11 as a whole to a desired position includes two hoists 38 and 39 which may be air operated and which are designed to wind ropes 40 and 41 respectively connected at their free ends to the boom fins 42 and 43, and the boom fins 44 and a fin (not shown) diametrically opposed thereto. The ropes 40 and 41 as shown extend around the drums 38 and 39 respectively for a number of turns. It will be apparent that as the free ends of the ropes 40 and 41 are lengthened or shortened by rotation of the drums 38 and 39 that the platform 15 and frame 16 will adjust themselves about their pivotal axes to cause the boom to swing to a corresponding position.

I prefer to use a single control stick for operating the hoist 38 and the hoist 39. In Figures 6 and 7 the hoists 38 and 39 are mounted with their rotational axis at right angles to each other and have their control throttles 44 and 45 in a vertical position. The hoist is designed so that by moving the throttle to one side of the vertical the hoist will rotate in one direction and by moving the throttle to the other side of the vertical the hoist will rotate in the opposite direction. The central control stick for the two hoists 38 and 39 is universally mounted in the roof 46 of the cage 10 as at 47 and carries a plate 48 at its upper end. The throttle handles 44 and 45 are engaged by the bifurcated ends of clevis knuckles 49 and 50 respectively and the clevis knuckles 49 and 50 are in turn connected to the plate 48 by links 51 and 52 respectively. The links 51 and 52 pivotally connect with the clevises and plate 48. It will be apparent that by manipulating the handle 47a either one of the throttle levers 44 and 45 can be actuated independently of the other in either direction or both of the levers 44 and 45 can be operated together. The dotted line position of the links in Figure 6 show the position the links would assume when both throttles are actuated together.

The mucking machine disclosed in the drawings is operated up and down the mine shaft in the same manner as a conventional mine cage. In Figure 8 I show a plan view of a mine shaft divided into three compartments by the horizontal support timbers 53 and 54 which are also designed to support the vertically extending guide timbers 55 for the mine cage 10. The mine cage 10, of course, has diametrically opposed guide channels 56 for co-operation with the vertically extending guide timbers 55 and is hoisted up and down the shaft by cable means from the ground level.

In Figures 4 and 5 I show a suitable means for braking the cage 10 in the desired position on the guide timbers 55, which includes a slipper 57 carried by the guide channel 56 and normally held out of contact with the guide timber 55 by the springs 58. Pivotally mounted clams 59, operated from the link 60 by the air cylinder 61, are provided to force the slipper 57 against the guide timber 55 to brace the cage 10.

In addition to the slipper type brake shown in Figures 4 and 5, I also employ a number of diametrically opposed laterally extending jacks 62 designed to exert a pressure against side walls of the shaft excavation or timbers for the purpose of more rigidly holding the cage 10 in a predetermined position when the mucker is being operated.

The operation of the embodiment of the invention shown in Figures 1 to 9 will be described first. In this embodiment the buckets of the clam are opened by telescoping tubular member 22 and boom 23 relatively to each other. This could be effected by moving tubular member 22 upwardly and holding the boom 23 rigid, or by moving boom 23 downwardly and holding tubular member 22 rigid. After the clam has been opened the boom 23 and the tubular member 22 are telescoped outwardly until the open clam engages with the muck pile. It will be apparent that the tubular member 22 which encircles the boom 23 must telescope with the boom if the clam is to remain in its open position. Any relative motion between the boom 23 and the tubular member 22 would cause the clam buckets to pivot about their mounting on the boom. When the clam engages with the muck pile the tubular member 22 is caused to move outwardly with respect to the boom 23 to cause the clam buckets 13 and 14 to close, and dig into and scoop up a quantity of muck. The boom 23 and tubular member 22 are then telescoped in an upward direction to lift the loaded clam. Again it will be apparent that the tubular member 22 must be raised at the same rate as the boom 23, otherwise it would lock the boom in its lowered position. When the loaded clam is raised it is swung by operation of hoists 38 and 39, within its pivotal mounting to overlie a hoist bucket and actuated to an open position by relative movement between the tubular member 22 and boom 23 to deposit its muck in the bucket. Number 72 is a diagrammatical representation of a bucket for hoisting muck from a mine shaft. The operation is repeated until the bucket is loaded.

In practice I feel that it is desirable in the embodiment of invention shown in Figures 1 to 9, to fit the hoists 27 and 28 with similar speed and similar power rated motors so that when the mucker is lifting a loaded clam both hoists can be conveniently operated so that each hoisting motor will assume one half of the lifting load.

In the embodiment of the invention shown in Figure 10 the means for actuating the buckets 13 and 14 of the clam does not include a tubular member 22 and the hoist motor for raising the boom 23 must be powerful enough to raise the loaded clam by itself. With this embodiment of the invention the buckets 13 and 14 of the clam are opened and closed by actuating the double acting pistons 78 inwardly and outwardly within the cylinders 75. The other steps in the use of the machine are the same.

It will be apparent that the separate control means in the various power-operated component parts of the mucker described could all be located at one handy spot for control by a signal operator. The platform 15 would be a suitable point from which to control the operation of the mucker. Other places are possible, however, such as a small seat mounted on one of the fins 42, 43, or 44.

While in the foregoing specification I have

shown cable means and air operated power devices for telescoping the boom and operating the clam it will be apparent that other power means such as hydraulic ones could be employed. With respect to this and other features of the invention then, I do not intend that the foregoing specification should be read in a limiting sense except for the limitations expressed in the following claims.

What I claim as my invention is:

1. In a device for use in sinking mine shafts, and the like, a boom guide, a boom supported by said guide for telescoping movement with respect thereto, two buckets each pivotally mounted on said boom adjacent its free end to co-operate with each other and form a clam, a control, actuating means responsive to said control for actuating said buckets in either direction about their pivotal connection with said boom, a second control, and means responsive to said second control for telescoping said boom with respect to said guide, said boom guide comprising a tubular member, said actuating means for actuating said buckets about their pivotal connection including a second tubular member mounted for telescoping with respect to the boom guide, a plurality of links pivotally connecting with said second mentioned tubular member adjacent its free end, and means for transmitting power to said second mentioned tubular member to telescope it with respect to said boom guide.

2. In a device for use in sinking mine shafts, and the like, a boom guide, a boom supported by said guide for telescoping movement with respect thereto, two buckets each pivotally mounted on said boom adjacent its free end to co-operate with each other and form a clam, a control, actuating means responsive to said control for actuating said buckets in either direction about their pivotal connection with said boom, a second control, and means responsive to said second control for telescoping said boom with respect to said guide, said boom guide comprising a tubular member, said actuating means for actuating said buckets about their pivotal connection including a second tubular member mounted for telescoping with respect to the boom guide, a plurality of links pivotally connecting with said buckets and with said second tubular member adjacent its free end, a drum, power means for rotating said drum, cable means secured at each of its free ends to said second tubular member adjacent its upper extremity, guide means for guiding said cable in an upward direction from one of its free ends and in a downward direction from the other one of its free ends, said cable extending around said drum for a plurality of turns between its ends.

3. In a device for use in sinking mine shafts, and the like, a boom guide, a boom supported by said guide for telescoping movement with respect thereto, two buckets each pivotally mounted on said boom adjacent its free end to co-operate with each other and form a clam, a control, actuating means responsive to said control for actuating said buckets in either direction about their pivotal connection with said boom, a second control, and means responsive to said second control for telescoping said boom with respect to said guide, said boom guide comprising a tubular member, said actuating means for actuating said buckets about their pivotal connection including a second tubular member mounted for telescoping directly within said boom guide, a plurality of links pivotally connecting with said buckets and with said second mentioned tubular member adjacent its free end, and means for transmitting power to said second mentioned tubular member to telescope it within said boom guide.

4. In a device for use in sinking mine shafts, and the like, a boom guide, a boom supported by said guide for telescoping movement with respect thereto, two buckets each pivotally mounted on said boom adjacent its free end to co-operate with each other and form a clam, a control, actuating means responsive to said control for actuating said buckets in either direction about their pivotal connection with said boom, a second control, and means responsive to said second control for telescoping said boom with respect to said guide, said boom guide comprising a tubular member, said actuating means for actuating said buckets about their pivotal connection including a second tubular member mounted for telescoping directly within said boom guide member, a plurality of links pivotally connected with said buckets and said second tubular member adjacent its free end, a drum, power means for rotating said drums, cable means secured at each of its ends to said second tubular member adjacent its upper extremity, guide means for actuating said cable in an upward direction from one of its ends and in a downward direction from the other one of its free ends, said cable extending around said drums for a plurality of turns between its ends.

5. In a device for use in sinking mine shafts, and the like, a boom guide, a boom supported by said guide for telescoping movement with respect thereto, two buckets each pivotally mounted on said boom adjacent its free end to co-operate with each other and form a clam, a control, actuating means responsive to said control for actuating said buckets in either direction about their pivotal connection with said boom, a second control, and means responsive to said second control for telescoping said boom with respect to said guide, said boom guide comprising a tubular member, said actuating means for actuating said buckets about their pivotal connection including a second tubular member mounted for telescoping directly within the boom guide, a plurality of links pivotally connecting with the said buckets and with said second mentioned tubular member adjacent its free end and means for transmitting power to said second mentioned tubular member to telescope it with respect to said boom guide, said boom telescoping directly within said tubular member.

6. In a device for use in sinking mine shafts, and the like, a mine cage, a boom guide, means for universally suspending said boom guide from said mine cage, control means, actuating means responsive to said control means for actuating said suspended boom guide to a desired position, a boom supported by said guide for telescoping movement with respect thereto, two buckets each pivotally mounted on said boom adjacent its free end to co-operate with each other and form a clam, a second control, actuating means responsive to said second control for actuating said buckets in either direction about their pivotal connection with said boom, a third control, and means responsive to said third control for telescoping said boom with respect to said guide, said boom guide comprising a tubular member, said actuating means for actuating said buckets about their pivotal connection including a second tubular member mounted for telescoping with respect to the boom guide, a plurality

of links pivotally connecting with said buckets and with said second mentioned tubular member adjacent its free end, and means for transmitting power to said second mentioned tubular member to telescope it with respect to said boom guide.

7. In a device for use in sinking mine shafts, and the like, a mine cage, a boom guide, means for universally suspending said boom guide from said mine cage, control means, actuating means responsive to said control means for actuating said suspended boom guide to a desired position, a boom supported by said guide for telescoping movement with respect thereto, two buckets each pivotally mounted on said boom adjacent its free end to co-operate with each other and form a clam, a second control, actuating means responsive to said second control for actuating said buckets in either direction about their pivotal connection with said boom, a third control, and means responsive to said third control for telescoping said boom with respect to said guide, said boom guide comprising a tubular member, said means for actuating said buckets about their pivotal connection comprising a second tubular member for telescoping with respect to the boom guide, a plurality of links pivotally connecting with said buckets and with said second tubular member adjacent its free end, a drum, power means for rotating said drum, cable means secured at each of its free ends to said second boom adjacent its upper extremity, guide means for guiding said cable in an upward direction from one of its free ends and in a downward direction from its other free end, said cable extending around said drum for a plurality of turns between its ends.

8. In a device for use in sinking mine shafts, and the like, a mine cage, a boom guide, means for universally suspending said boom guide from said mine cage, control means, actuating means responsive to said control means for actuating said suspended boom guide to a desired position, a boom supported by said guide for telescoping movement with respect thereto, two buckets each pivotally mounted on said boom adjacent its free end to co-operate with each other and form a clam, a second control, actuating means responsive to said second control for actuating said buckets in either direction about their pivotal connection with said boom, a third control, and means responsive to said third control for telescoping said boom with respect to said guide, said boom guide comprising a tubular member, said actuating means for actuating said buckets about their pivotal connection including a second tubular member mounted for telescoping directly within said boom guide, a plurality of links pivotally connecting the said buckets and with second mentioned tubular member adjacent its free end, and means for transmitting power to said second mentioned tubular member, and telescoping it to said boom guide, said boom telescoping directly within said second mentioned tubular member.

9. In a device for use in sinking mine shafts, and the like, a mine cage, a boom guide, means for universally suspending said boom guide from said mine cage, control means, actuating means responsive to said control means for actuating said suspended boom guide to a desired position, a boom supported by said guide for telescoping movement with respect thereto, two buckets each pivotally mounted on said boom adjacent its free end to co-operate with each other and form a clam, a second control, actuating means responsive to said second control for actuating said buckets in either direction about their pivotal connection with said boom, a third control, and means responsive to said third control for telescoping said boom with respect to said guide, said boom guide comprising a tubular member, said means for actuating said buckets about their pivotal connection including the plurality cylinders with double acting pistons having piston rods extending therefrom, said cylinders and piston rods pivotally connecting with said boom and with said buckets whereby said buckets are actuated about their point of pivotal connection as the pistons move within the cylinders.

10. A device for use in sinking mine shafts, and the like, as claimed in claim 9 in which said cylinders are air operated.

WARNER L. CRYDERMAN.

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