J. C. BOEHM.

DERRICK.

APPLICATION FILED MAY 11, 1910.

1,043,394.

Patented Nov. 5, 1912.

4 SHEETS—SHEET 1.

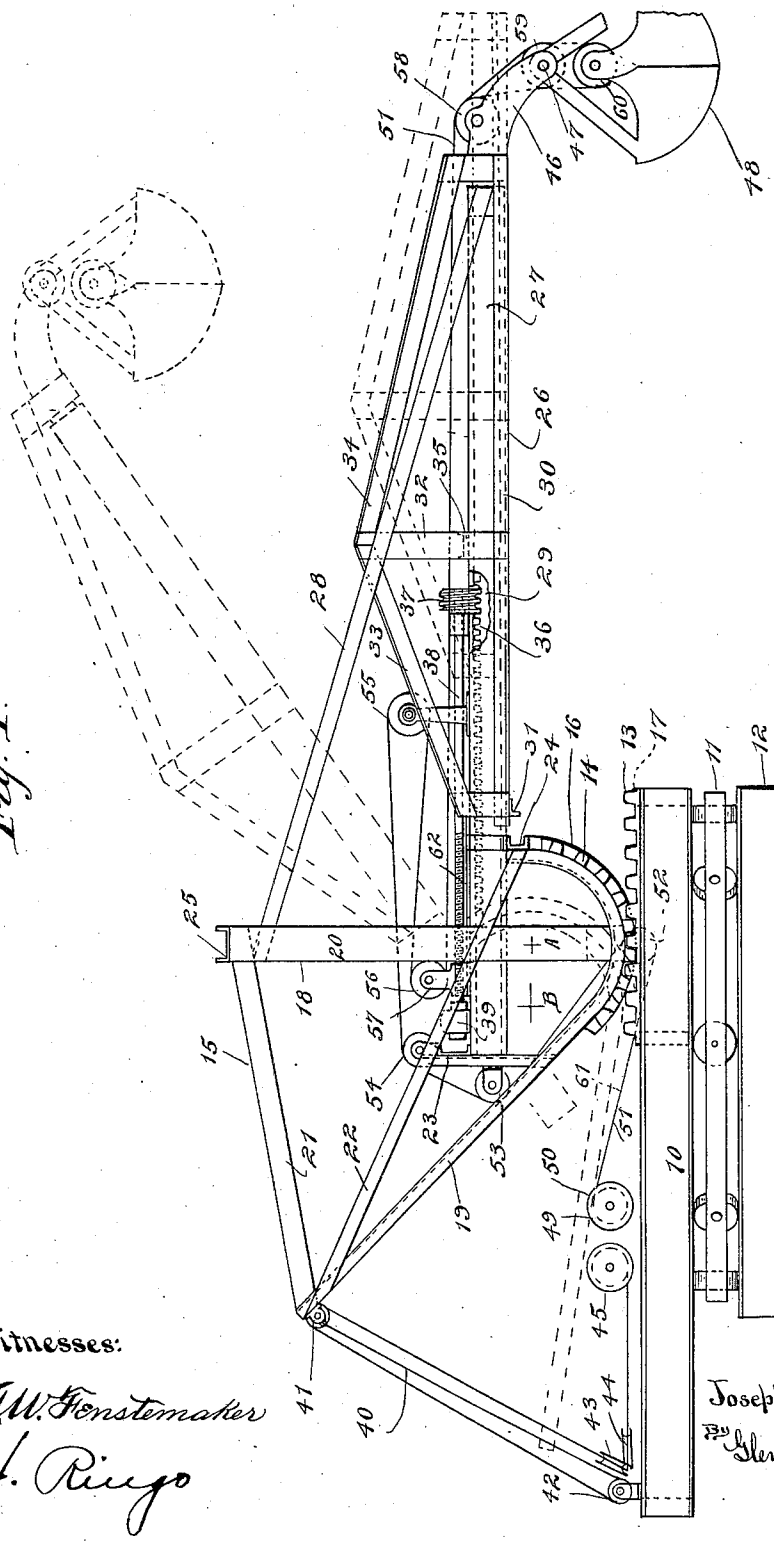

Fig. 1.

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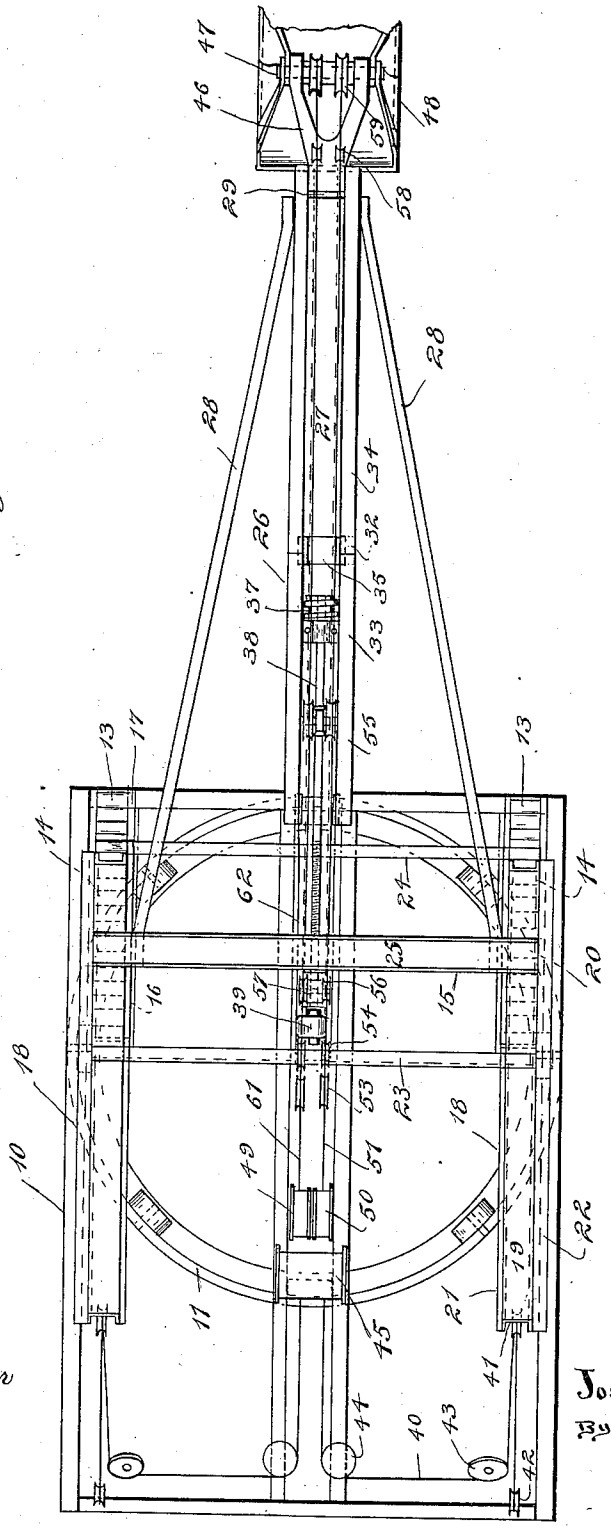
4 SHEETS—SHEET 2.

Fig. 2



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4 SHEETS—SHEET 3.

Fig. 3.

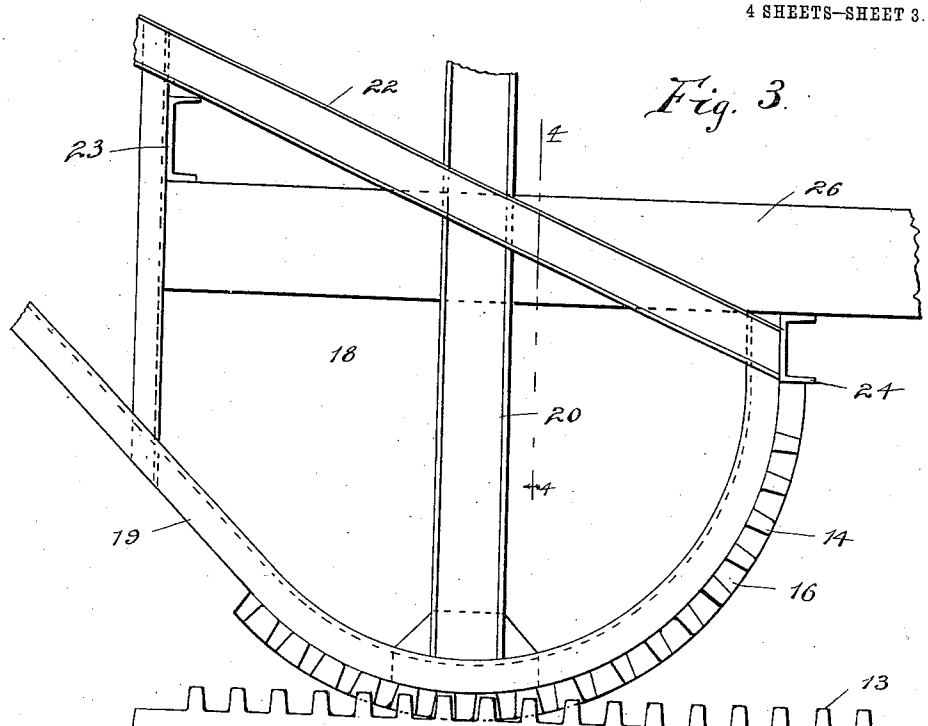
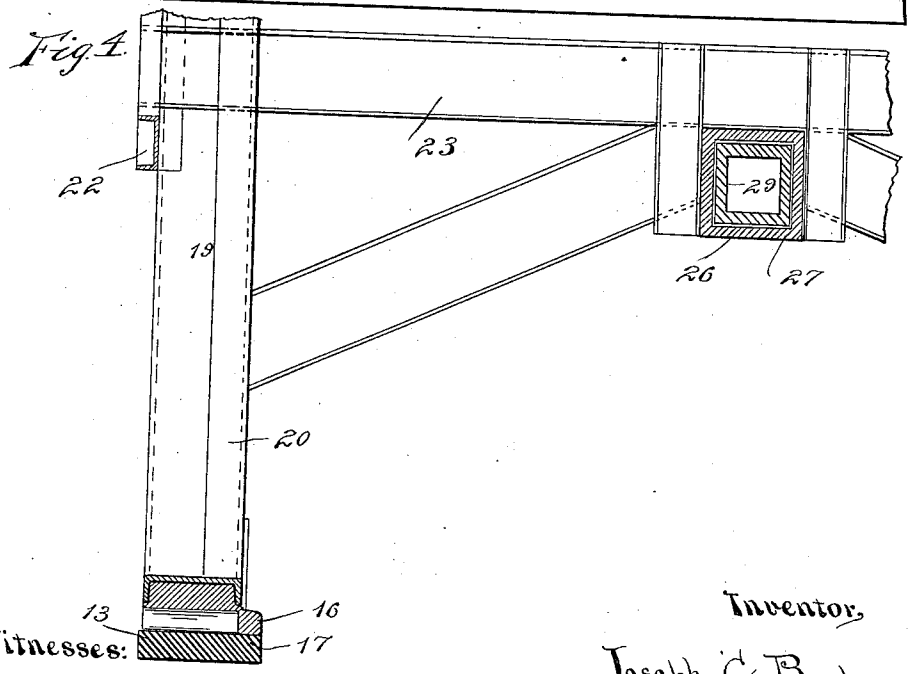


Fig. 4.



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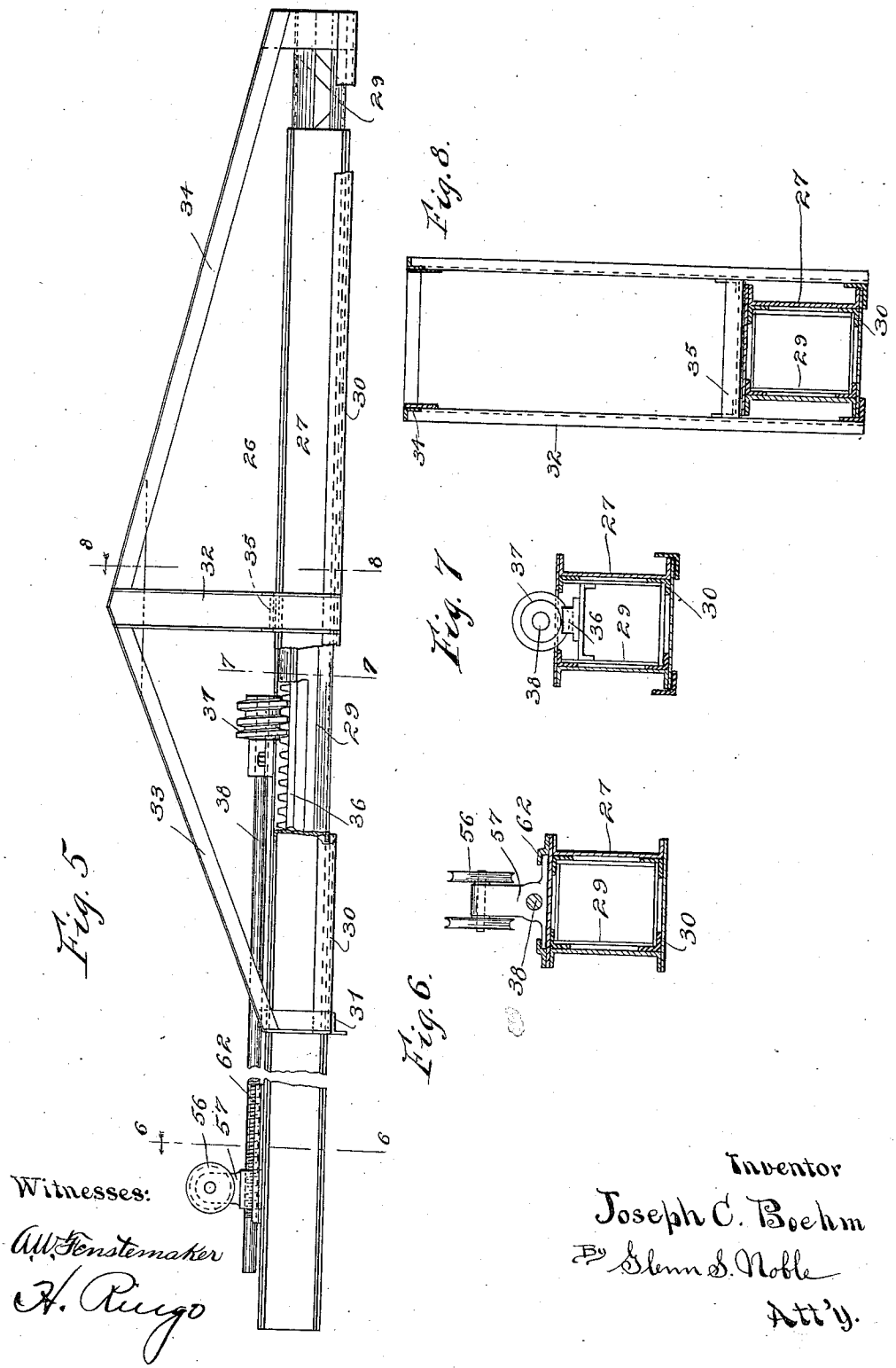
4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

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DERRICK.

1,043,394. Specification of Letters Patent. Patented Nov. 5, 1912.

Application filed May 11, 1910. Serial No. 560,667.

To all whom it may concern:

Be it known that I, JOSEPH C. BOEHM, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Derricks, of which the following is a specification.

This invention relates to machines for excavating, digging trenches, or handling materials in various ways, and is particularly applicable to be used with various types of buckets, clam-shells, or other similar devices. Its objects are to provide a machine of the character indicated, which will serve to assist in forcing the digging device, such as a clam-shell, into the material to be excavated; which is preferably provided with a telescoping or extension boom which may be lengthened or shortened during the operation of the device; which is so mounted that the load may be raised with comparatively small amount of power, and whereby the pivotal center will be shifted backwardly as the load is raised, thereby bringing the weight farther from the edge of the frame; and to provide such additional advantages as will appear hereinafter.

I have illustrated a machine embodying the principal features of my invention in the accompanying drawings, in which—

Figure 1 is a side view, parts being omitted or shown diagrammatically for convenience in illustration; Fig. 2 is a top plan view of the same; Fig. 3 is an enlarged detail of a portion of the supporting or rocking devices; Fig. 4 is a front view of the same; Fig. 5 is an enlarged detail view of the telescoping boom; and Figs. 6, 7 and 8 are sectional views taken on correspondingly marked lines of Fig. 5.

As illustrated in these drawings, 10 indicates a substantial framework forming the base of the machine. When the machine is to be swung in a horizontal plane, this framework is mounted on any suitable form of turntable, such for instance as indicated at 11, the turnable being supported on a substantial base 12. Any of the well known means for turning the frame may be used, but as such means forms no part of the present invention, it is not shown in the drawings. The framework 10 is provided at either side with racks 13 which are engaged by segmental gears 14 on the rocking or rolling boom-supporting frame 15. As particularly indicated in Figs. 3 and 4, the segmental gears 14 may be provided with a flange or shroud 16 on one or both sides, which flanges serve to prevent lateral movement of the frame 15 and which also may serve to carry a portion or all of the weight by rocking on suitable shoulders 17 at the sides of the racks 13. The rocking or rolling boom-operating frame, which is designated as a whole by the numeral 15, comprises side frames 18, which are preferably mounted sufficiently far apart so that there will be sufficient room between their rear extensions for the boiler and engine (not shown) to be located on the frame 10 when such boilers and engines are used to furnish the motive power. These side frames 18 may be made in any desired manner, for instance, by bending a channel iron 19 to conform with the segmental gear 14, providing a post 20 and connecting such channel and post by means of suitable cross braces 21 and 22. The side frames 18 are connected by suitable cross pieces 23, 24 and 25, and such other bracing as may be found necessary or desirable. The cross pieces 23 and 24 support a forwardly projecting boom 26, which boom may be of ordinary construction, but which, for various purposes, I prefer to make of telescoping construction. To this end, a hollow, tubular, and preferably rectangular, boom section 27 is firmly secured to the cross beams 23 and 24, and its outer end is further supported by means of diagonal braces 28 extending from such outer end to the upper ends of the side frames 18, such diagonal braces furnishing both vertical and lateral support to such fixed boom section.

The slidable or movable portion of the telescoping boom may consist simply of a slidable member or beam 29 fitting within the section 27 and adapted to be reciprocated therein so as to extend or retract its outwardly projecting end. However, I prefer to reinforce such inner slidable boom member by means of trusses or reinforcements which engage with the outer end of said member and also engage with the outer portion of the fixed member 27. Such trusses or additional supports consist of stiff bars 30 which run along the lower sides of the relatively stationary member 27 and which are connected at their front ends to the outwardly projecting end of the slidable member 29. These bars are also connected at their rear ends by means of a cross piece

31 which may engage the lower side of the member 27, in some instances, to form a point of support or slide for the trusses, but when the lower bars 30 are made of angle iron, as indicated in Figs. 5 to 8, inclusive, they form a continuous support along the lower edge of the boom member 27. The trusses are completed by means of posts 32 and diagonal top chords 33 and 34. The posts 32 are connected by means of a cross brace 35 which bears upon the upper side of the boom member 27. It will be noted that by means of this construction the inner slidable boom member 29 is not only supported by its engagement with the inner side of the tubular member 27, but, as soon as it is moved outwardly, is also supported by the truss arrangement which has been described, inasmuch as the cross piece 35 and the rear cross piece 31, engaging with the outer sides of the member 27, furnish supports for the outer ends of the trusses, which in turn are connected to the outer end of the inner member. It will be observed that, if desired, rollers or antifriction members of any well known form may be applied to this sliding portion of the boom, without departing from the spirit of this invention. This telescoping boom may be made in any desired form, but, as indicated in the detail drawings thereof, it may be conveniently made of standard steel bars connected by means of plates or lattice-work so as to form an outer rectangular, tubular member and a correspondingly shaped inner member adapted to slide therein.

Various means may be used for reciprocating or sliding the relatively movable portion of the boom, of which I have illustrated a preferred form. This consists of a rack 36 secured to the rear end of the boom section 29. A worm 37 on a shaft 38 engages with the rack 36 so that when the worm is turned, the rack will move back and forth to actuate the boom section 29. The shaft 38 is mounted in suitable bearings on the relatively fixed boom section 27, and may be driven by an engine or motor as indicated at 39 or in any other convenient manner. However, I prefer to mount the engine or motor at the rear end of the boom, as indicated, in order that its weight may assist in counterbalancing the boom.

In order to raise and lower the outer end of the boom, I provide a rope and tackle connecting between the rearwardly extending ends of the beams 19 of the side frames and the rear end of the main frame 10, and direct the rope by means of suitable pulleys to the winding drum of the engine. Such rope and tackle may be arranged in various ways. For instance, as shown in the drawings, one end of the rope 40 is secured to the block 41 at the upper end of the beam 19, and the rope is then passed down and under a sheave 42 secured to the frame 10, then up and over the sheave in the block 41, then down and around sheaves 43 and 44 suitably arranged on the frame 10, and then to the winding drum 45. By having such tackle or ropes leading to both of the side frames 18, such frames will be rocked or rolled with uniform movement and an even strain placed upon the machine when the boom is raised or lowered in the operation of the machine.

It will be noted that the portion of the machine thus far described furnishes a simple and efficient derrick or machine with a boom which may be raised and lowered and lengthened and shortened as well as swung in a horizontal direction and which is adapted for various purposes. However, one of the principal uses for which the machine is designed is in the operation of digging buckets, preferably of the clam-shell type, and certain attachments desirable therefor will now be described. At the outer end of the movable boom member 29 is a forked, downwardly and outwardly curved arm or support 46 which engages with the shaft 47 at the upper end of a clam-shell 48, thereby furnishing a rigid connection between the boom and the clam-shell bucket. Such clam-shell buckets are usually opened and closed by means of separate ropes or cables, and it is desirable to have the winding drum for such operating ropes adjacent to the winding drum used for raising and lowering the boom. This is accomplished by having two winding drums 49 and 50 preferably mounted on the same shaft, such drums being driven from any convenient source of power, not shown. From the drum 50 a rope or cable 51 leads down and under one of a pair of sheaves 52 mounted on the frame 10 at about the center of rotation of the segmental gear, then up and around one of a pair of sheaves 53 mounted at the rear end of the boom, then over one of a second pair of sheaves 54, then forwardly and around one of a pair of sheaves 55 mounted on a stand on the stationary portion of the boom, then back and around one of a pair of sheaves 56 mounted in a slide 57 on the stationary portion 27 of the boom, then backwardly along the boom and around guide sheaves 58 and 59 and down to the opening and closing sheave 60 of the clam shell 48. A similar rope or cable 61 follows the same course from the drum 49 to the sheave 60, one of these ropes or lines being used for opening the clam-shell and the other for closing the same. It will be noted that when the slidable portion of the boom is moved back and forth, these lines would be tightened or loosened, unless provision was made for maintaining the proper tension. The sheaves 55, being mounted on the stationary portion of the boom, and the sheaves 56, be-

ing slidably mounted on the stationary portion of the boom, it will be observed, provides means for keeping the lines tight when the sheave 56 is slid or moved along the stationary boom at about one-half the speed of the movement of the slidable portion of the boom. In order to secure such movement, the shaft 38 is properly threaded to engage with the slidable bearing 57 in order to move such bearing in its guideways 62 at about one-half the rate of movement given to the slidable portion of the boom by the worm 37. It will also be noted that by having the sheaves 52 located at about the center of movement of the frame 15, there will be but slight tendency toward slackening or tightening the ropes 51 and 61 as the boom is raised or lowered.

The operation of the machine, when used for digging with a clam-shell, will now be described, and those familiar with the art will readily understand therefrom how the machine may be applied to other uses. With the parts shown in position in full lines in Fig. 1, the bucket is lowered by slackening off on the drum 45, thereby allowing the bucket and boom to swing downwardly until the bucket comes in contact with the material to be excavated or handled. It will be noted that the weight of the bucket is supplemented by the weight of the boom, which tends to force the bucket into the material, and if desired, the slidable portion of the boom may also be driven outwardly in order to further force the bucket against the material, or in case the stationary section of the boom is not sufficiently long to reach the point where the load is to be taken. The bucket is then closed by drawing up on the line 51, which, instead of tending to raise the bucket away from the earth, as is ordinarily the case with the usual operation of such buckets, in this instance merely draws the end of the boom more closely into engagement with the bucket, thereby holding the bucket securely against the material until it has been closed. The drum 45 is then turned in order to wind up the cables 40, which draw down on the outwardly projecting end of the beams 19, thereby rocking the frame 15 backwardly and raising the boom. In this rocking movement, the fulcrum or point of application of the weight moves backwardly as soon as the boom starts from its lowermost position and continues to move backwardly until it reaches its highest elevation. For instance, as indicated in Fig. 1, the center passes from the point marked A to the point marked B while the boom is being raised from the position shown in full lines to the position shown in dotted lines. This backward movement of the fulcrum or point of application of the weight brings the load farther back onto the frame 10, thereby lessening the liability of overturning the machine and also relieving the load at the forward end of the frame which is ordinarily adjacent to the ditch or excavation when the machine is being used for such work. As soon as the bucket has been raised to the desired height, the frame 10 may be swung around horizontally on the turntable 11, and the material discharged by opening the clam-shell through the medium of the rope or line 61. By means of the telescoping boom, the load may be accurately placed at any desired distance from the center of the machine, within the limits of movement of the sliding portion thereof, thereby furnishing an exceedingly convenient mechanism for loading cars or placing the dirt where desired on the dump pile.

Having thus described my invention, which I do not wish to limit to the exact construction shown, except as set forth in the appended claims, what I claim and desire to secure by Letters Patent is:

1. A telescoping boom comprising a rectangular tubular member, a beam or the like slidably mounted in said tubular member, means for reciprocating said beam, and trusses engaging with the outer sides of said tubular member and with the projecting end of said beam whereby said projecting end is supported.

2. In a machine of the character set forth, the combination of a telescoping boom, means for reciprocating the slidable portion of said boom, a rope or cable extending lengthwise of said boom and adapted to support or hold a load at the outer end of said slidable portion of the boom, and means connected with said cable and said boom whereby the position of the cable with respect to the slidable portion of the boom will remain substantially constant when said slidable portion is moved either outwardly or inwardly with respect to the stationary portion of the boom.

3. In a derrick or the like, the combination of a relatively stationary boom, a slidable extension engaging with said boom, a rack on said extension, a worm engaging with said rack, a shaft on which said worm is mounted, said shaft having threads thereon, means for turning said shaft, a stand slidably mounted on said stationary portion of the boom and having threads engaging with the threaded portion of the shaft, a sheave mounted on said stand, a second sheave mounted on the stationary portion of said boom in advance of the first-named sheave, guide sheaves at the rear end of the stationary portion of the boom and at the outer end of the slidable portion of the boom, and a cable for holding or supporting a load at the outer end of said slidable portion said cable being rove over the guide sheaves at the inner end of said boom, then

over a second sheave mounted on said boom, then back over the sheave mounted in said stand and then out over the sheave at the outer end of the slidable portion of the boom, the arrangement being such that when the shaft is turned to operate the slidable portion of the arm, said cable will be maintained in a substantially constant relation with respect to said slidable portion.

4. In a machine of the character set forth, the combination of a frame, a rocking support for said frame, a telescoping boom mounted on said frame, said boom comprising a relatively stationary member and a reciprocating member, a bed supporting said rocking frame, a winding drum on said bed, a cable leading from said winding drum around suitable sheaves and out to the outer end of said reciprocating portion of the boom, and compensating means arranged to coact with said stationary and reciprocating portions of the boom for maintaining the outer end of said cable in constant relation with the reciprocating portion of the boom when said portion is reciprocated.

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