

J. C. BOEHM.  
EXCAVATING MACHINE.  
APPLICATION FILED JAN. 28, 1911.

999,953.

Patented Aug. 8, 1911.

4 SHEETS—SHEET 1.

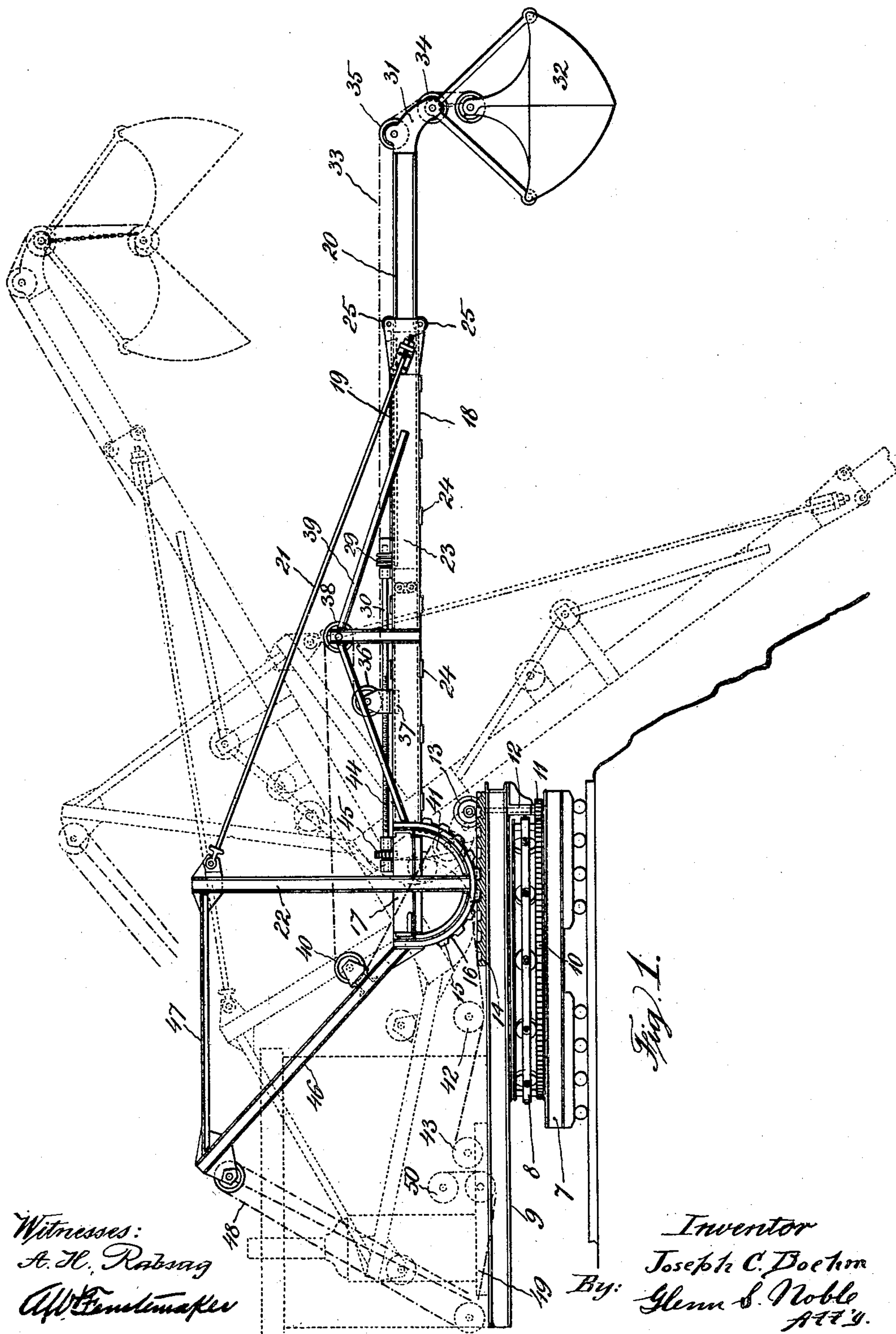


Fig. 1.

Witnesses:  
A. H. Rabin  
A. W. Finkelman

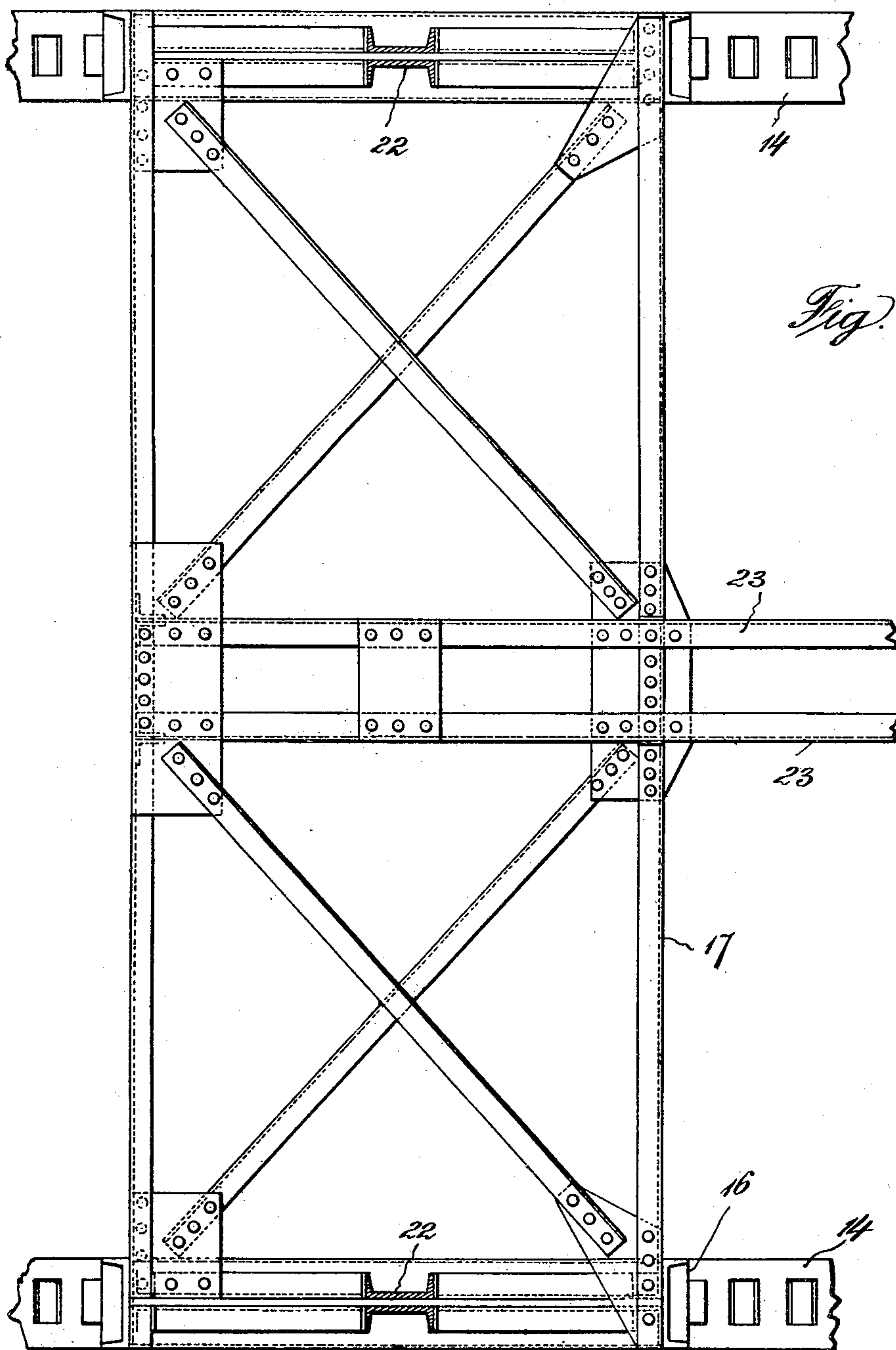
Inventor  
Joseph C. Boehm  
By: Glenn S. Noble  
ATTY.

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4 SHEETS—SHEET 2.



Witnesses:  
A. H. Ralsing  
A. H. Ralsing

Inventor  
Joseph C. Boehm  
By: Glenn S. Noble  
Att'y.

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4 SHEETS—SHEET 3.

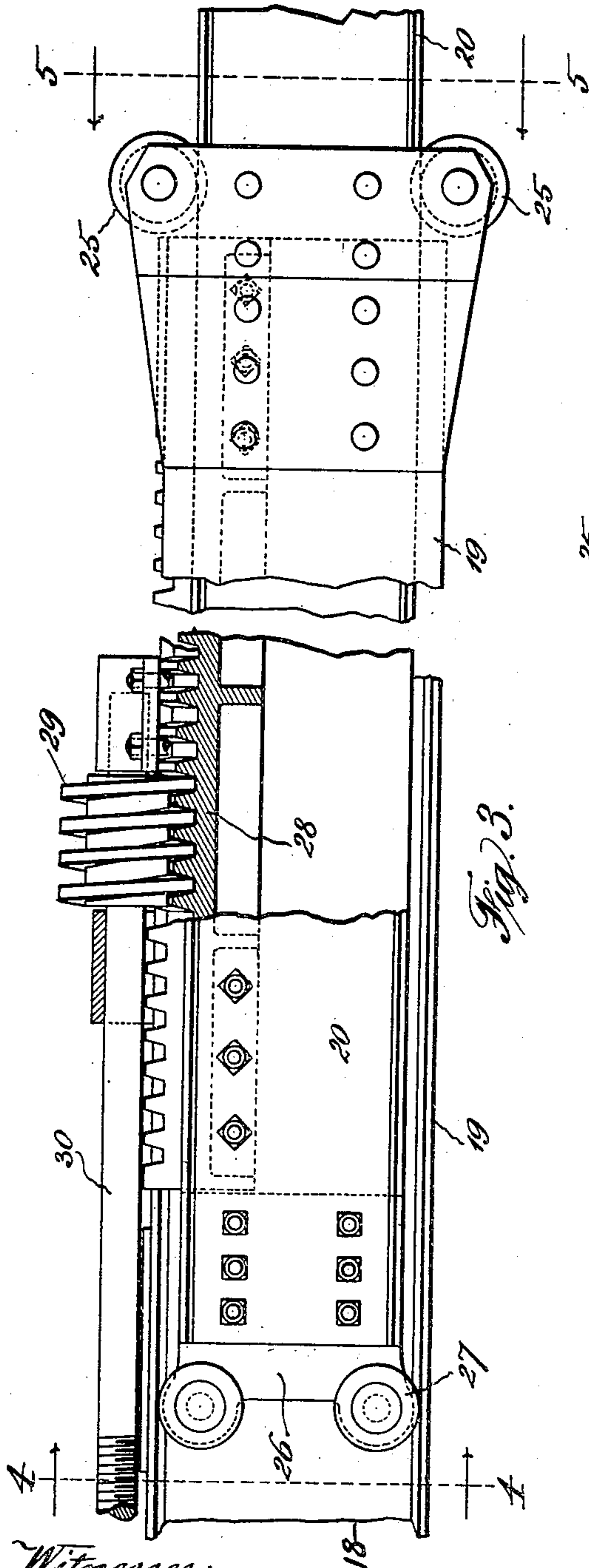


Fig. 3.

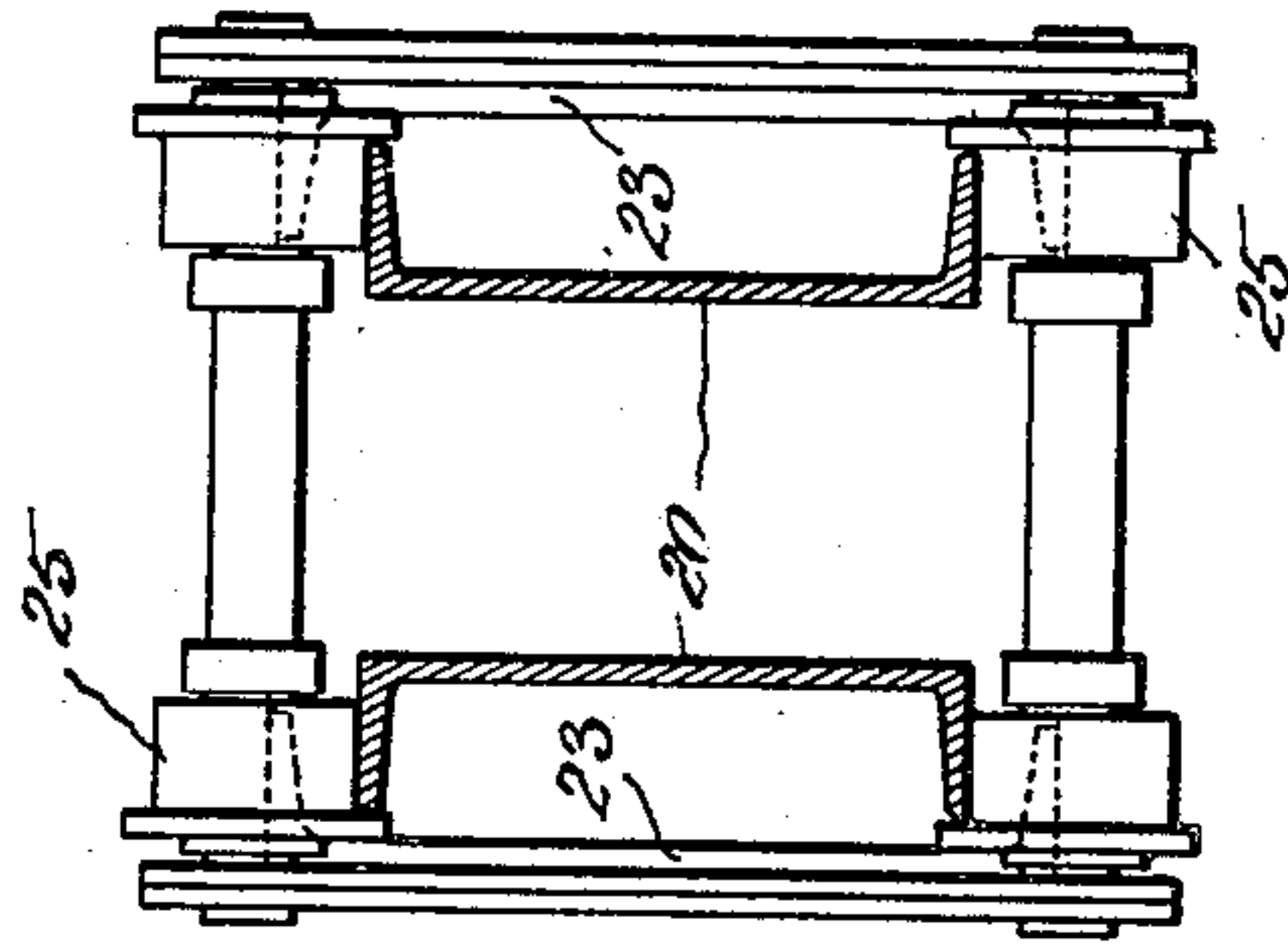


Fig. 5.

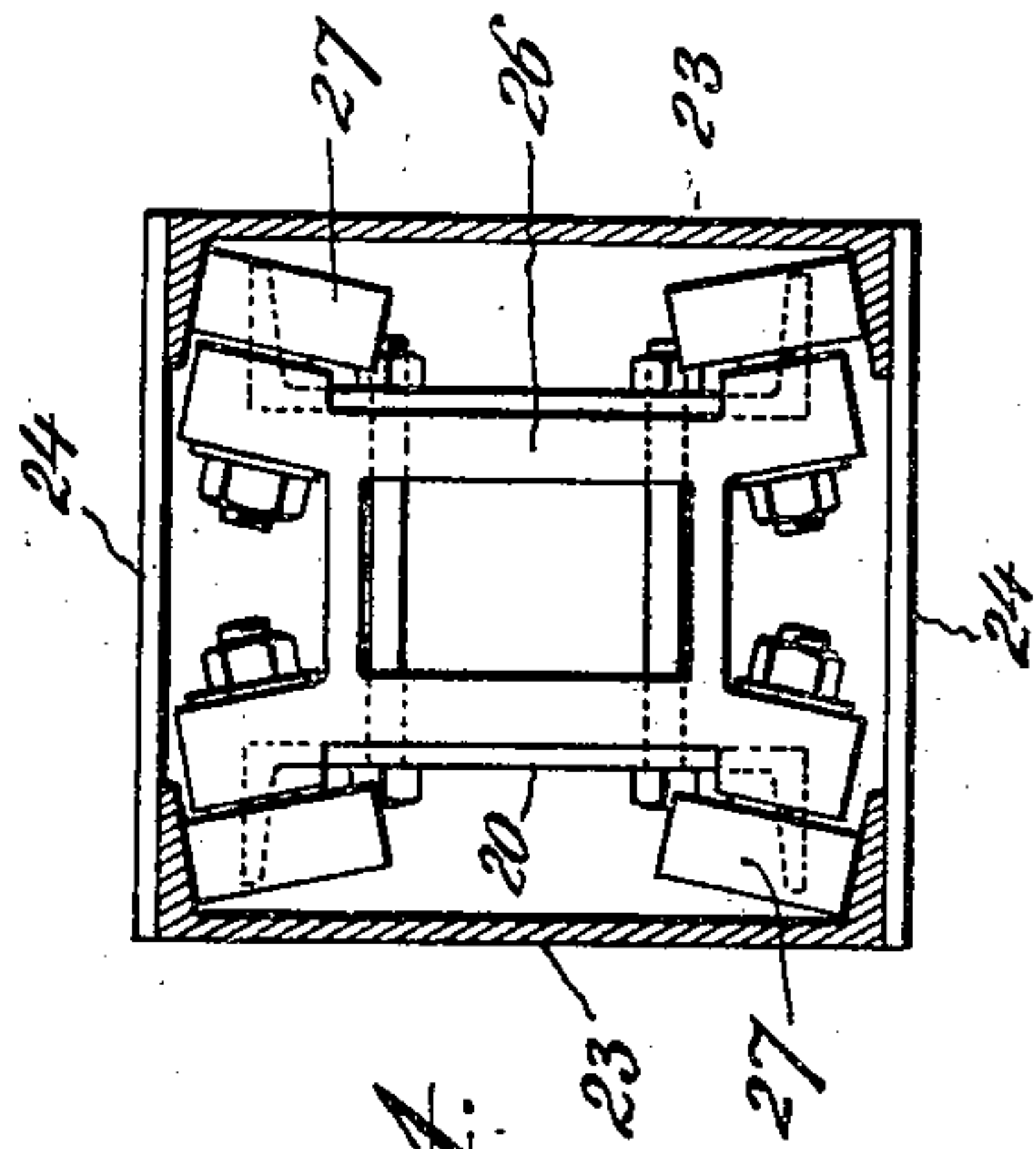


Fig. 4.

Witnesses:  
A. H. Rabson  
O. H. Fustemaker

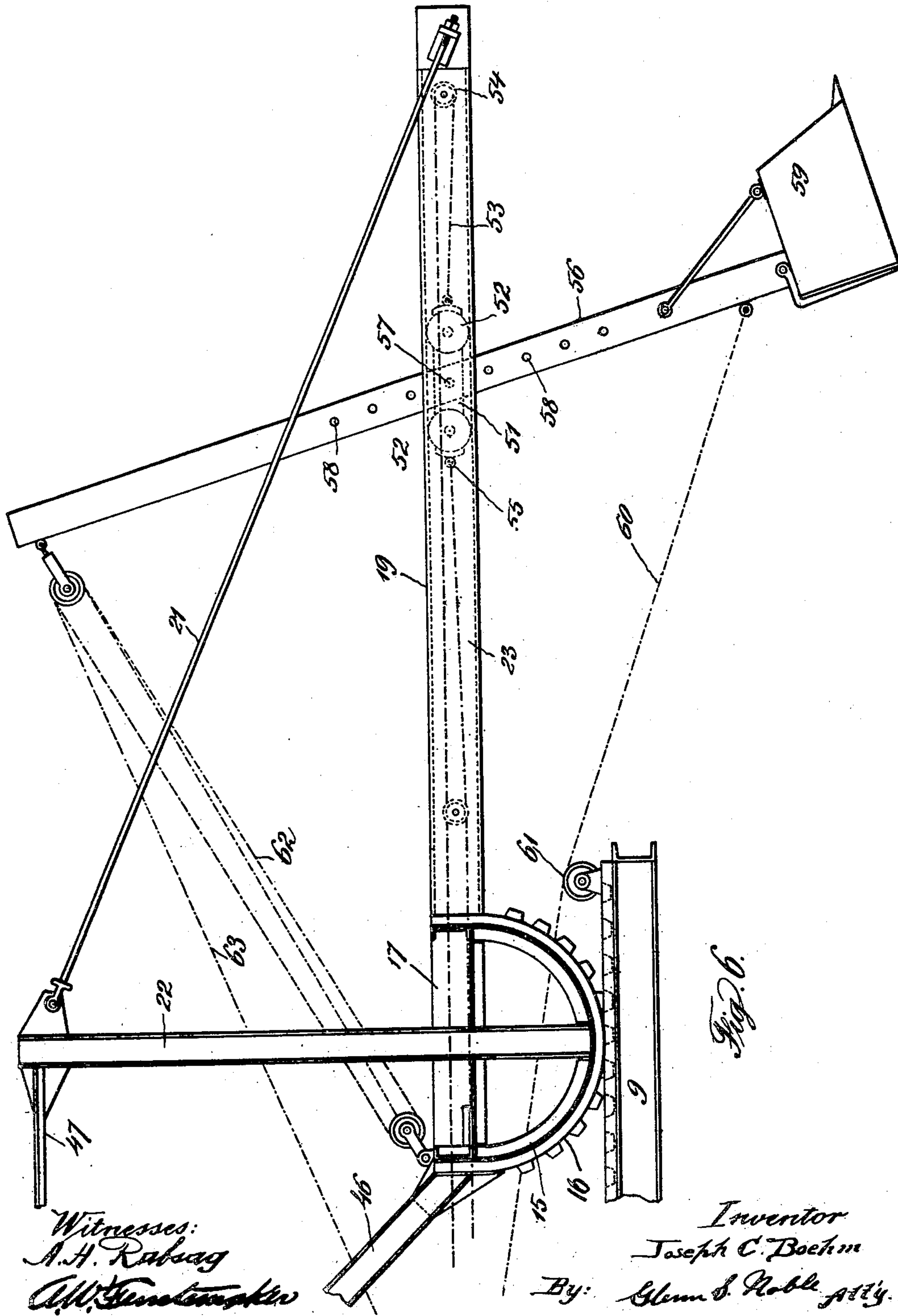
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4 SHEETS—SHEET 4.





# UNITED STATES PATENT OFFICE.

JOSEPH C. BOEHM, OF CHICAGO, ILLINOIS.

## EXCAVATING-MACHINE.

999,953.

Specification of Letters Patent.

Patented Aug. 8, 1911.

Application filed January 28, 1911. Serial No. 605,267.

*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 Excavating-Machines, of which the following is a specification.

This invention relates more particularly to machines or apparatus for digging or excavating ditches, basements, or the like, for back-filling ditches, for loading or unloading cars, and in general for all purposes where a digging shovel or digging bucket is adapted to be used for handling material.

Among the objects of this invention are to produce a comparatively light, simple and inexpensive machine which will do the same kind of work now ordinarily done by steam shovels, to provide such machine having a wide range of operation both in a vertical and horizontal plane, to arrange the operative parts of the machine in such a manner that the fulcrum or support of the load of the machine will be shifted backwardly as the load is lifted, to arrange the parts so that the boom or arm carrying the excavating shovel or bucket may be lowered or operated in restricted places, as for instance between the cross braces commonly placed in ditches to support the sides, and in general to provide a simple and efficient machine adapted for general use in excavating and handling material of various kinds.

In the accompanying drawings illustrating my invention—Figure 1 is a side view of the machine, with the boom shown in lowered digging position and also in raised dumping position; Fig. 2 is a detail plan view of a portion of the rocking frame and racks for supporting the same; Fig. 3 is a detail view showing a portion of the telescoping boom and operating mechanism; Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3; Fig. 5 is a sectional view taken on the line 5—5 of Fig. 3; and Fig. 6 is a side view showing a modified form of boom and shovel operating devices.

As indicated in these drawings, 7 represents a base or support having thereon a turntable 8 which carries a swinging frame 9. This swinging frame may be turned in any desired manner, a convenient method being to provide the support 7 with a gear 10 with which meshes a pinion 11 on a

shaft 12 mounted in the swinging frame 9. This shaft may be driven by means of a motor or engine, as indicated at 13. The swinging frame 9 is provided with racks 14 on either side thereof, which are engaged by curved racks or segmental gears 15 which are adapted to rock or roll thereon. These racks and gears may be made in a variety of ways but are preferably made so that the faces 16 of the rocking members 15 will have a considerable bearing at the sides of the teeth of the racks in order to furnish a substantial support for the rocking or rolling part of the machine and its load, and the teeth of the segmental gears are made sufficiently large and enter into the openings in the rack sufficiently deep so as to prevent any liability of the rocking frame from becoming disengaged from the supporting racks. The segmental gears or rocking members 15 are secured to and support a cross frame 17, which in turn carries the boom 18. For some classes of work, this boom is preferably made telescoping and consists of a stationary portion 19, which is secured to the frame 17, and a sliding portion 20. The stationary portion 19 is further supported by means of rods or braces 21 leading to the upper ends of posts 22, which posts are connected with and form a part of the frame 17. As shown in detail in Figs. 3, 4 and 5, the relatively stationary portion 19 of the boom is formed of channels 23 connected at the top and bottom by means of cross plates 24. At the outer end of this stationary portion of the boom are rollers 25 which support the inner or slidable portion 20 of the boom at this point. The inner end of the slidable portion 20 is provided with a frame 26 having wheels or rollers 27 which are adapted to engage with the flanges of the side members 23 to support the inner end of the slidable portion, so that this slidable portion is carried by means of the rollers 25 and 27 and may be readily moved inwardly and outwardly with respect to the member 19. In order to operate this slidable portion 20, I provide the same with a rack 28 which is engaged by a worm 29 mounted on a shaft 30 having its bearings secured to the member 19. When the machine is to be used with a clam-shell type of bucket, I provide a downwardly curved fork or arm 31 at the outer end of the boom and attach the clam-



shell 32 directly thereto. By curving the fork or arm 31 downwardly as indicated, the clam-shell is permitted to swing freely and may be opened to its fullest extent when the boom is raised, without striking the boom.

With ordinary clam-shells or buckets of the type indicated, it is necessary to have a closing rope or cable for closing the bucket and holding the same in closed position while the load is being raised and swung to dumping position. I provide a cable 33 for this purpose, and in order that this cable may have a substantially constant tension on the bucket while the telescoping portion of the boom is moved inwardly and outwardly, I arrange guide sheaves therefor as indicated in Fig. 1. The end of the cable 33 is secured to the closing sheave of the bucket 32 and is then rove over the guide sheaves 34 and 35 at the outer end of the boom, then back and around a guide sheave 36 mounted in a slidable support or bearing 37, then forward and around another guide sheave 38 mounted between the uprights of a truss 39 on the member 19, then back and around guide sheaves 40 and 41 suitably positioned on the frame 17, and thence back under an idler 42 on the frame 9 to the winding drum 43. This winding drum may be driven in any well known manner, and preferably comprises one of the drums of an ordinary hoisting engine. The bearing or carriage 37 is slidably mounted in the member 19 and is threaded to engage with the threaded portion 44 of the shaft 30, such threads being given the proper pitch so that the bearing 37 will move at substantially half the speed of the slidable portion 20 of the boom. This shaft may be driven in any convenient manner, as by means of a gear 45, which may be driven by an engine or motor not shown. On account of this arrangement of the guide sheaves or pulleys for the cable 33, the outer end thereof will remain in substantially constant position relative to the movable portion of the boom, regardless of the longitudinal movement thereof or of the swinging of the boom up and down by means of the rocking frame. In order to operate the rocking frame, I provide rearwardly extending arms or beams 46 from the frame 17, which are also supported by ties 47 from the upper ends of the posts 22, and means for pulling down on the outer ends of these arms. A convenient means for this purpose consists in the ropes and tackle 48 connecting between the outer ends of these arms and the rear portion of the frame 9, the inner ends of the ropes 49 leading to a drum or drums 50 on the hoisting engine.

My improved machine provides many distinct advantages in operation which will be readily appreciated by those familiar with

such machines. When used for digging purposes, the operator will slack off on the drum 50 until the clam-shell 32 reaches its digging position, and at such time the weight of the boom and some of the connected parts will tend to press down on the bucket so as to hold it closely in engagement with the material to be excavated. If the downward movement of the boom does not bring the bucket to the exact desired digging point, the outer end of the boom is run out or in by turning the shaft 44, so that the operator may quickly and easily bring the bucket to the exact desired digging position. This is of considerable advantage, as it frequently occurs that the bucket will fill more easily and will pick up a larger load when placed in an advantageous position than it otherwise would. As soon as the bucket reaches its digging position, the operator winds in on the drum 43, thereby causing the closing cable 33 to close the bucket, and on account of the boom being connected directly to the bucket, this does not tend to raise the bucket out of its digging position but merely tends to draw the end of the boom and the closing sheave of the bucket closer together. As soon as the bucket is filled, the operator winds in on the drum 50, thereby causing the rocking frame to swing backwardly. At this point occurs one of the principal advantages of the machine in that as soon as the load is started to be lifted from any point, the fulcrum or support tends to move backwardly and away from the front end of the frame 9, thereby tending to distribute the load more evenly over its support and also reducing the weight at the front end of the support, which reduces the liability of the ground being caved in adjacent to the front end of the machine. For instance, it will be noted that when the boom is swung downward an extreme position, as indicated by dotted lines in Fig. 1, the fulcrum or support of the swinging frame is close to the outer edge of the machine. At this time, however, the load on the outer end of the boom is relatively close to the support. Then, as the boom swings upwardly, the leverage increases until it reaches its horizontal position, but at this time the point of support has moved a considerable distance back from the front edge of the frame 9 and continues to move back as the boom is swung still farther upwardly. If it is desired to dump the bucket at either side of its filling position, this is readily and conveniently done by swinging the frame 9, through the medium of the swinging gears 10 and 11, and when the boom reaches its dumping position, the operator slackens off on the closing cable 33, which allows the bucket to discharge its load. In this connection, it will be noted that the swinging of the boom 18, through as wide a range as is possible, with this ma-



chine, is of distinct advantage, for instance, over the ordinary boom derrick, as in such derricks the boom cannot ordinarily be swung downwardly to any considerable extent on account of the unusual strains which would thereby be placed on the operating lines.

In the modified form of construction shown in Fig. 6, the stationary portion 19 of the boom, or the portion which is rigidly attached to the rocking frame, is provided with a longitudinally movable carriage 51, having wheels 52 adapted to run on the lower flanges of the side channels. This carriage is moved by means of a rope or cable 53, one end of which is attached to the outer end of the carriage 51, then runs out and around a sheave 54 in the end of the boom, then back over suitable guide sheaves, and its opposite end is secured to the rear end of the carriage as indicated at 55. From this, it will be seen that when the winding drum is turned in one direction, the carriage will run out, and when the drum is reversed the carriage will run back. A beam or arm 56 is pivoted at 57 in the carriage 51 so that the arm is free to swing in a vertical plane. In order to adjust the arm to different positions, a plurality of holes 58 are provided for receiving the pivot pin. At the lower end of the arm 56 is a digging shovel 59, which may be of any well known type, but if desired, a clam-shell or orange peel bucket may be used in its place. A rope or cable 60 is attached to the lower end of the arm 56 and runs back over a sheave 61 to a winding drum on the engine, this cable serving for pulling the bucket back to filling position. In order to swing the lower end of the arm 56 forward to fill the bucket, I provide a block and tackle 62 which extends from the rocking frame 17 to the upper end of the arm 56, the cable 63 of this block and tackle running back to a winding drum on the engine. With this form of machine, it will be seen that a very flexible and effective digging apparatus is provided which can be used for a large variety of work. For instance, in digging comparatively narrow ditches for sewers or water pipes, where the sides of the ditch have to be braced, the boom 19 may be swung up and down and the arm 56 swung to such position that the bucket 59 may be passed down between the braces, then, by drawing back on the cable 60 until the bucket is in digging position and forcing the bucket ahead by pulling on the cable 63, it may be quickly filled. As soon as the bucket is filled, the boom 19 may be swung up until the bucket clears the braces or the top of the ditch, then, by pulling in still further on the cable 63, the arm 56 may be swung until it is substantially parallel with the boom 19, thereby enabling the bucket to be raised as high as desired

for dumping the same. At the same time the carriage 51 may be run in or out in order that the bucket may be more readily filled or brought to a better dumping position. It will also be noted that, if desired, the digging bucket 59 may be reversed, so that the cable 60 can be used for filling the same, thereby enabling the bucket to dig close to the machine.

Having thus described my invention, which, however, I do not wish to limit to the exact form of construction or arrangement of parts herein shown and described, except as pointed out in the appended claims, what I claim and desire to secure by Letters Patent is:

1. In a digging apparatus, the combination of a relatively stationary frame, a rocking frame mounted on said stationary frame, adjacent to one end thereof, a boom secured to said rocking frame, an excavating device carried by said boom, arms extending from said frame, and means connected with said arms and said stationary frame for rocking said rocking frame, the arrangement being such that the boom may be swung downwardly adjacent to the frame, and then, as the boom is raised, the point of support on said stationary frame will move back from such end of the frame.

2. In an excavating machine, the combination of a relatively stationary frame, racks on said frame, gears engaging with said racks, a rocking frame carried by said gears, a boom mounted on said frame, rearwardly extending arms from said frame, and means connecting with said arms for rocking the frame.

3. In a machine of the character set forth, the combination of a relatively stationary frame, racks mounted on said frame, substantially semi-circular gears engaging with said racks, a boom carried by said gears, said boom lying in a plane passing substantially through the diameters of said gears, an excavating device secured to the end of said boom, and means for rocking said frame, the arrangement being such that the boom may be swung downwardly close to the end of the frame, and then, as the boom is raised, its point of support will recede from the end of said frame.

4. In an excavating machine, the combination of a frame, rack bars on said frame, segmental gears engaging with said bars, a cross frame carried by said gears, a boom carried by said cross frame, a carriage mounted in said boom, means for moving said carriage along the boom, an arm pivoted in said carriage, an excavating device carried by said arm, and means for swinging said arm in a plane parallel to the boom.

5. In an excavating machine, the combination of a support, a rocking frame mounted on said support, a boom carried by said



rocking frame, an arm pivotally mounted in said boom, a digging bucket or shovel at the lower end of said arm, a rope or cable for drawing back the lower end of said arm, and a second rope or cable for drawing back the upper end of said arm.

6. In an excavating machine, the combination of a relatively stationary frame, racks on said frame, gears mounted on said racks, a cross frame between said gears, a boom carried by said cross frame, a carriage mounted in said boom, a shovel arm pivotally mounted in said carriage, a shovel at one end of said arm, cables for swinging said arm, and means for rocking said cross frame to swing said boom up and down.

7. In an excavating or digging machine, the combination of a bed or support, a plurality of racks on said bed, arranged at some distance apart, segmental gears engaging with said racks, a frame connecting between said gears, a boom mounted on said frame, and means for actuating said frame for raising and lowering said boom.

8. In an excavating machine, the combination of a bed, two substantially parallel supports on said bed, curved members engaging with said supports, a frame connecting between said curved members, a boom or the like carried by said frame, and means

for rocking said curved members to cause a swinging movement of the boom.

9. In a machine of the character set forth, the combination of a base, a turntable on said base, a support mounted on said turntable, racks at the sides of said support, gears engaging with said racks, means for preventing lateral movement of said gears, a frame carried by said gears, having rearwardly extending projections, ropes and tackle connecting between said projections and said support for rocking said frame, and a boom carried by said frame.

10. In a machine of the character set forth, the combination of a bed or support, racks or the like on said support, toothed wheel segments engaging with said racks, a cross frame secured to said segments, having rearwardly projecting arms, means connecting between said arms and said support for rocking said frame, a telescoping boom carried by said cross frame, means for swinging said frame, and means for reciprocating the movable member of said telescoping boom.

JOSEPH C. BOEHM.

Witnesses:

O. J. THIME,

A. W. FENSTEMAKER.