No. 609,449. Patented Aug. 23, 1898.

G. J. MILLER.

EXCAVATING MACHINE.

(Application filed Dec. 13, 1897.)

(No Model.) 3 Sheets—Sheet 1.

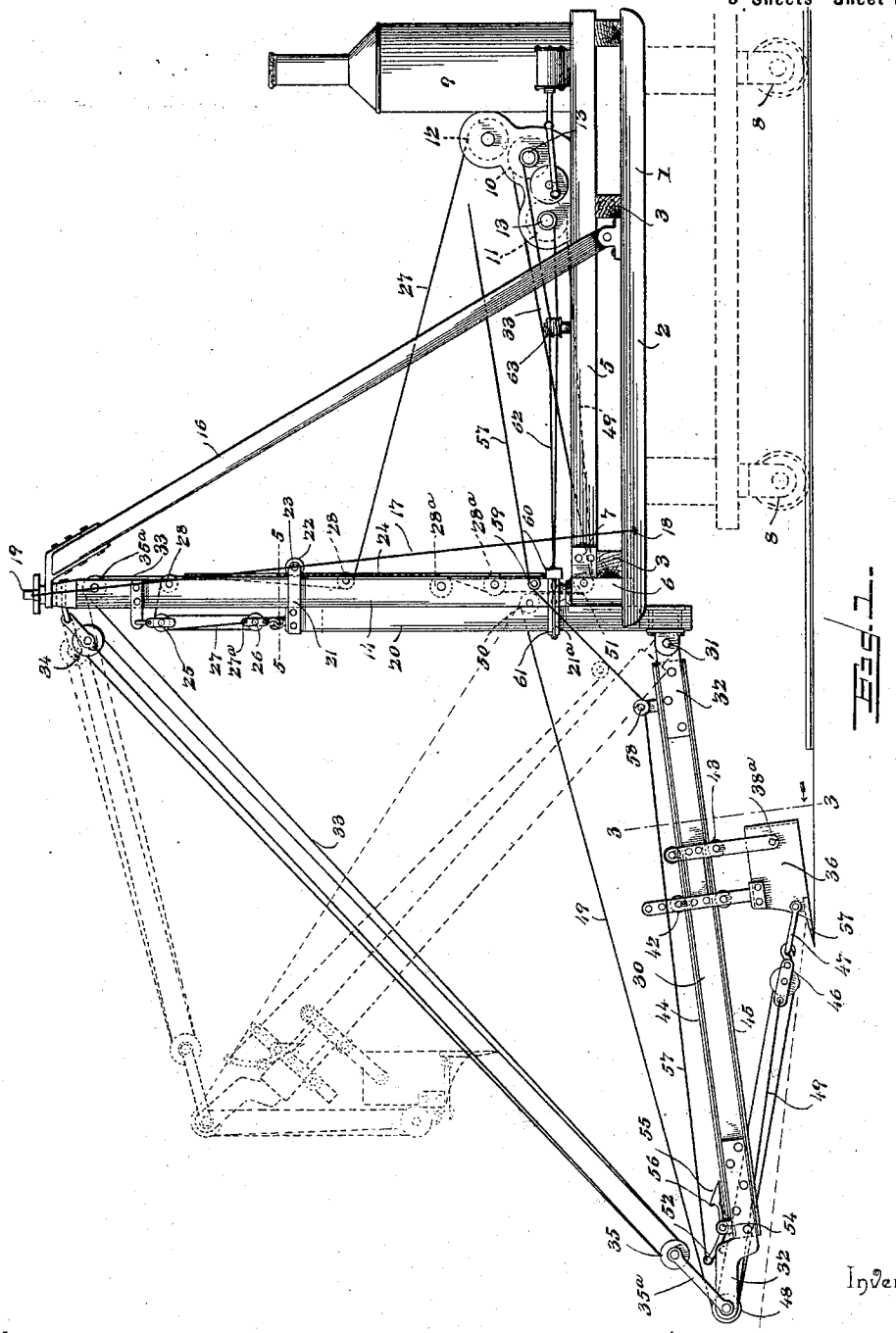

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

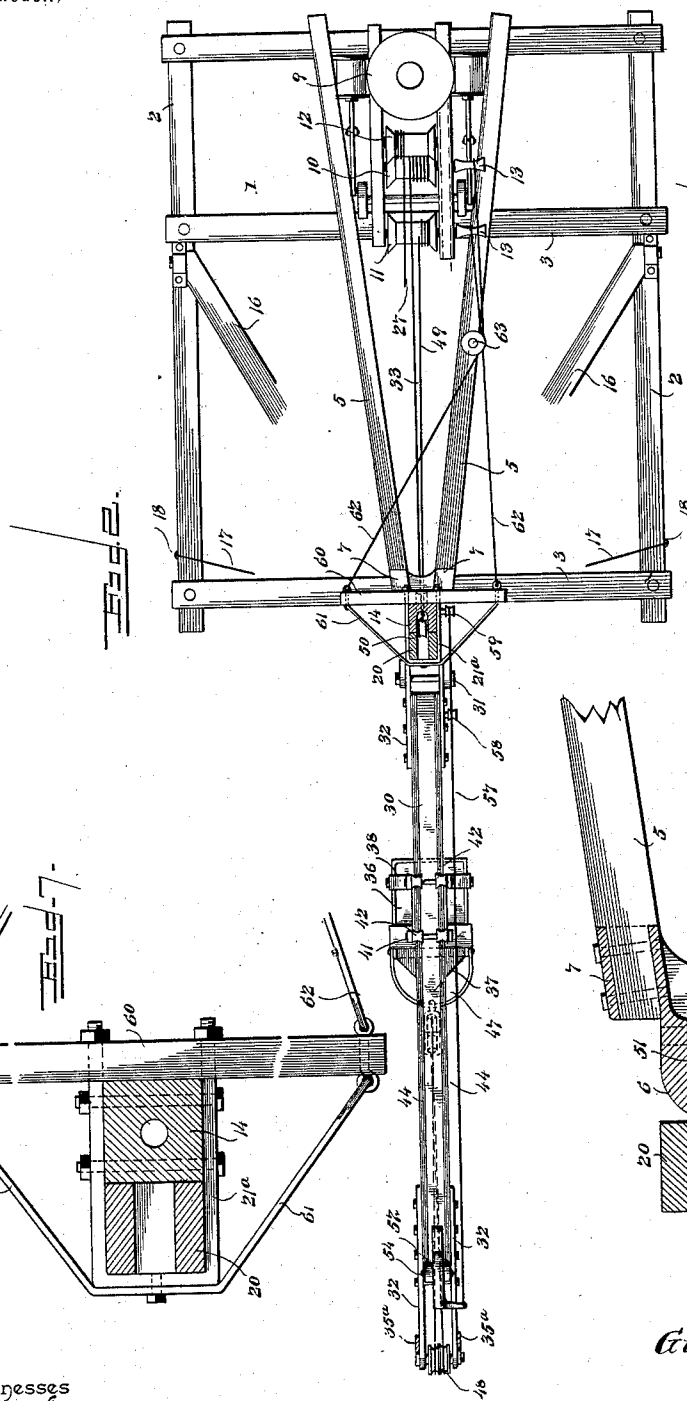

Fig. 2.

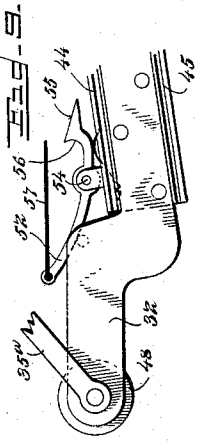

Fig. 9.

Fig. 7.

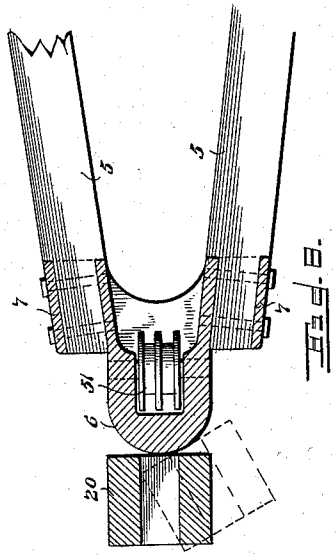

Fig. 8.

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EXCAVATING MACHINE.

(Application filed Dec. 13, 1897.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 3.

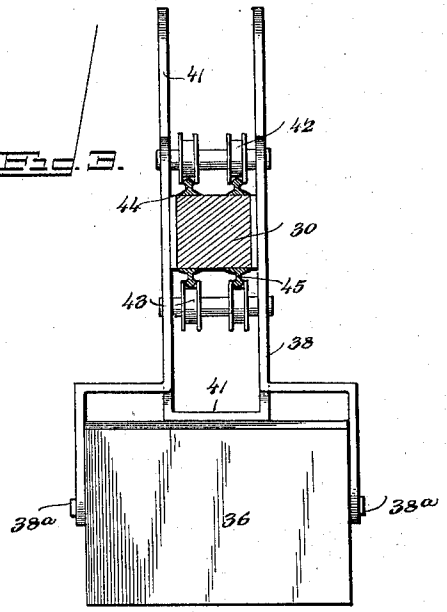


Fig. 4.

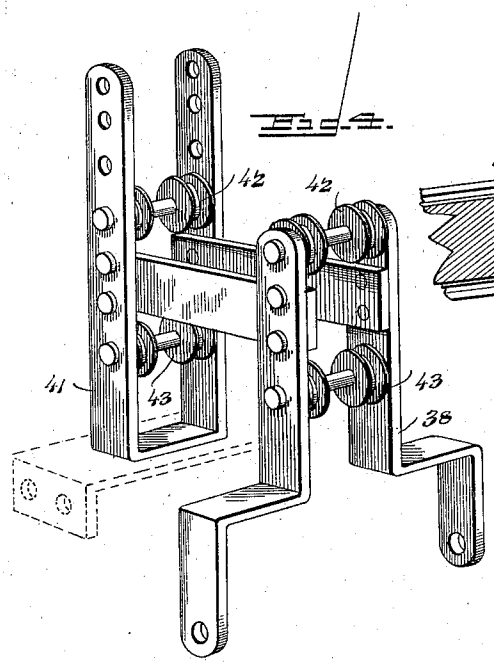


Fig. 6.

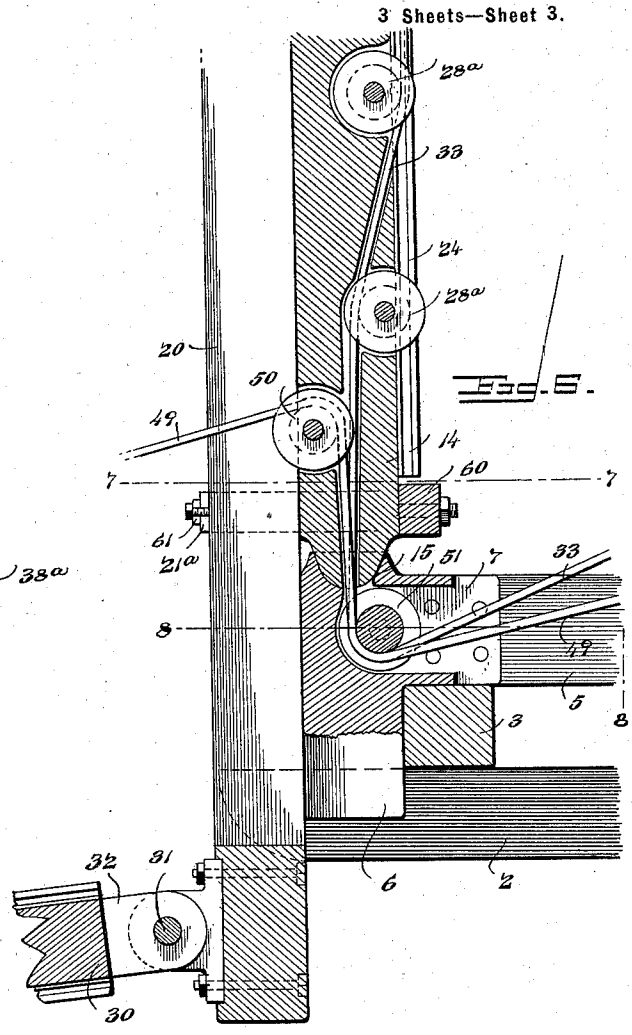
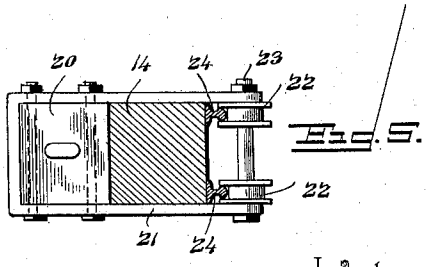


Fig. 5.



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UNITED STATES PATENT OFFICE.

GUSTOF J. MILLER, OF DULUTH, MINNESOTA, ASSIGNOR OF ONE-HALF TO J. A. WATTERWORTH AND H. FEE, OF SAME PLACE.

EXCAVATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 609,449, dated August 23, 1898.

Application filed December 13, 1897. Serial No. 661,666. (No model.)

To all whom it may concern:

Be it known that I, GUSTOF J. MILLER, a citizen of the United States, residing at Duluth, in the county of St. Louis and State of Minnesota, have invented a new and useful Excavating-Machine, of which the following is a specification.

My invention relates to improvements in excavating-machines which may be used for a variety of purposes, such as excavating foundations for buildings, trenchwork adapted for the installation of sewers, water-pipes, and the like, for loading and unloading materials to and from cars—as, for example, soft iron-ore, coal, and the like—or for loading or unloading sand or gravel to or from scows or cars, or for excavating and loading work generally.

In my machine I have provided a suitable foundation or framework on which is erected a main mast preferably stepped in a bearing to turn in a horizontal plane, and with this mast is combined a vertically-slidable mast, a boom carried by said vertically-slidable mast, a traveling excavator shovel or bucket, mechanism for imparting vertical adjustment to the slidable mast and the boom which is carried thereby, means for actuating the excavator bucket or shovel to adapt the latter to have traveling movement back and forth on the boom, and means for swinging the main mast, the slidable mast mounted thereon, the boom, and the excavator bucket or shovel in a horizontal plane.

The invention further consists in the construction of the means for carrying the traveling excavator bucket or shovel, the means for locking and tripping the excavator bucket or shovel, and the means for supporting and guiding the slidable mast; and the invention further consists in the novel construction and arrangement of parts which will be hereinafter fully described and claimed.

To enable others to understand my invention, I have illustrated the same in the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a side elevation of an excavating apparatus or machine constructed in accordance with my invention. Fig. 2 is a plan view thereof. Fig. 3 is an enlarged view, partly in section, on the plane indicated by the dotted line 3 3 of Fig. 1, looking in the direction of the arrow and illustrating the construction of the boom and the excavator shovel or bucket. Fig. 4 is a detail view of the traveling carriage for the excavator bucket or shovel. Fig. 5 is a transverse horizontal sectional view through the main mast and the vertically-adjustable mast on the plane indicated by the dotted line 5 5 of Fig. 1. Fig. 6 is an enlarged sectional elevation through the lower part of the mainmast, the vertically-slidable mast, and the casting forming a part of the foundation-framework of the apparatus. Fig. 7 is a detail horizontal sectional view on the plane indicated by the dotted line 7 7 of Fig. 6 and illustrating the rocking bar by which the horizontal turning movement is imparted to the mainmast. Fig. 8 is a detail section on the line 8 8 of Fig. 6. Fig. 9 is an enlarged detail view of the bracket at the outer end of the boom.

Like numerals of reference denote like and corresponding parts in each of the several figures of the drawings.

1 designates the foundation-framework of my excavating apparatus, and in the preferred embodiment of this foundation-framework I construct it to insure portability or movement thereof, so that the apparatus may be advanced as the work progresses. This is not material, however, because the framework may be stationary. In the embodiment of the foundation or main frame I employ the base-sills 2, the cross-sills 3, and the angular or diagonal timbers 5, all of which are bolted or otherwise united together to produce a strong substantial structure. As shown by the drawings, this foundation or main frame is mounted on the casters 8 to adapt the main frame to be moved along as the nature of the work requires; but in lieu of these casters I may employ suitable rollers, or the base-sills 2 may be constructed as runners. The timbers 5 are arranged diagonally across the foundation or main frame to occupy horizontal positions and to converge toward the front end of the foundation or main frame, and the adjacent ends of these angular or diagonal timbers are fitted in sockets 7 of a casting 6, said casting and the diagonal or angular tim-

bers being bolted together to effect their union in a substantial manner. This casting 6 occupies a central position at the front end of the foundation or main frame, and, as shown by Figs. 5 and 6, this casting is extended or projected below the cross-sills 3 of the main frame to furnish a guide for the vertically-slidable mast. The front vertical face of this casting 6 is exposed at the extreme front side of the foundation or main frame, and against said exposed face of the casting is adapted to ride the slidable mast, as will be readily understood by reference to Fig. 5.

On the rear part of the foundation or main frame is erected a suitable hoisting-engine and its boiler, which may be of any convenient or preferred type, and said engine is equipped with a sufficient number of drums for operating the various working parts of the excavating apparatus. As shown by the drawings, Figs. 1 and 2, the hoisting-engine is equipped with a winding-drum 10 for use in connection with the cable that operates to raise and lower the boom, a winding-drum 11 for the cable that operates the excavator bucket or shovel, another winding-drum 12 for the cable that imparts the vertically-adjustable play or movement to the mast, and the "nigger-heads" or drums 13 for the cables that impart the swinging movement to the mainmast and the elements associated therewith.

14 designates the mainmast, which is erected at the front end of the foundation or main frame. The lower end of said mainmast is stepped or pivotally mounted at 15 in a socket provided for its reception in the casting 6, and said mainmast is held in position by means of the inclined fixed braces 16 and the guy-ropes 17. The upper ends of the inclined fixed braces 16 are suitably joined together to form a bearing for a pintle 19 for the upper extremity of the mainmast 14, thus pivotally supporting the mainmast on vertical pivots to adapt it to have the desired turning movement in a horizontal plane. The guy-ropes 17 are suitably fastened to the braces or the devices thereon forming the support for the mainmast-pintle 19, and the lower end of said guy-ropes are attached to eyebolts 18 or other suitable appliances on the main or foundation frame 1.

20 designates the slidable mast. This mast is fitted laterally against the front vertical face of the mainmast 14 and the vertical casting 6 to be free to move endwise in a vertical direction, while at the same time it is held in close lateral relation to said mainmast and the casting 6. The rear side of the mainmast 14, or that face thereof opposite to the face against which the mast 20 is adapted to move, is provided with the vertical track-irons 24, which are suitably fastened to said mast 14 to extend substantially throughout the length thereof, said track-irons being spaced laterally in relation to each other and form between themselves a channel or space through which the ropes or cables may pass that adjust the slidable mast 20 and the boom 30, attached to said mast 20. To the upper end of the vertically-slidable mast 20 is rigidly fastened a transverse keeper 21, which is adapted to embrace the relatively-fixed mainmast 14 and the track-irons 24 on said mainmast, and to the lower part of the mainmast 14, preferably at a point adjacent to the stepped bearing 15 thereof, is secured a fixed keeper 21^a, which is arranged to loosely embrace the slidable mast 20, said fixed keeper 21^a being situated in a horizontal position at the lower terminals of the track-irons 24. The upper keeper 21, attached to the mast 20, is adapted to move or play therewith in the vertical adjustments which may be imparted to said mast 20, and to reduce the friction and wear between the keeper and the mainmast, as well as to obviate any tendency of the slidable mast 20 to bind against the mainmast 14, I provide the friction-rollers 22, which are journaled on a short shaft 23. The shaft 23 is carried by the inner end of the slidable keeper 21 on the mast 20, and the rollers 22 are mounted on said shaft 23 in position to ride and travel on the fixed track-irons 24 of the mainmast 14. The lower extremity or foot of the vertically-slidable mast is adapted to project below the foundation or main frame 1 of the apparatus whenever it is desired to employ the apparatus for excavating in deep trenches, and said mast 20 is adapted to have such a range of vertical adjustment on the framework and the mainmast 14 erected thereon that the slidable mast and the boom may be raised or lowered, according to the demands of the work under progress.

The means for adjusting the slidable mast 20 in a vertical direction consists of a haulage-cable 27, which is guided by suitable rollers or sheaves 28 on the mainmast and is conducted to the reversible drum 12 of the hoisting-engine 9. This hoisting-cable for the slidable mast is led through a double block or sheave 25, suitably attached to the mainmast near the upper extremity thereof, thence down to and around a block or sheave 26, attached to the upper extremity of the slidable mast 20, and thence carried back to the block or sheave 25, and finally it is carried back to the sheave 26 and attached to the block thereof at the point 27^a, as shown by Fig. 1.

It will be understood that when the drum 12 of the engine 9 is rotated in one direction the cable 27 will be drawn taut to lift the slidable mast 20 with relation to the main frame and the mast 14; but when the drum 12 is rotated in the opposite direction the weight of the slidable mast and the parts associated therewith cause the mast to descend by gravity and draw on the cable 27 until the tension of the cable checks and arrests the descent of the mast 20 and the parts carried thereby.

The boom 30 is pivotally attached to the vertically-slidable mast 20 to move in the ver-

tical direction therewith and to have an independent movement on its pivot or hinge without respect to the adjustment in a straight vertical line of the mast 20. The hinge connection between the foot or lower extremity of the slidable mast 20 and the inner end of the boom 30 is indicated at 31 in the drawings, and at the outer or free end of this pivoted swinging boom 30 is provided a pair of parallel angular bracket-shaped plates 32, which are fastened at their inner ends rigidly on the boom by suitable bolts. These plates, which constitute the angular bracket, project for a suitable distance beyond the extremity of the boom to have their upper ends terminate in a horizontal plane above the line of said boom 30, and said angular bracket 32 provides the means for supporting the trip and a guide sheave or roller, which will be hereinafter more fully described.

The pivoted boom 30 is designed to be raised and lowered on its hinge connection with the foot of the slidable mast 20 by a cable 33, one end of which is attached to the hanger or bracket of a sheave 34, suitably hung on the upper extremity of the mainmast 14. This cable extends to and around one member of a double sheave 35, attached by hangers or links 35^a to the angular bracket 32 on the boom, and from this member of the double sheave 35 the cable 33 passes to and around the sheave of the single block 34^a on the mainmast, thence to and around another member on the double block 35, thence up to and around the sheave 35^a on the mainmast, thence around the sheaves 28^a on said mast, and finally it is carried to the drum 10 of the hoisting-engine 9.

While I prefer to employ the specific rigging of the cable 33 for adjusting the boom 30, I would have it understood that I do not desire to limit myself to the precise arrangement of its guide-sheaves, as I am aware that the same may be varied by a skilled mechanic. It is evident that the drum 10 of the hoisting-engine may be operated to haul in or let out the cable 33 for the drum to raise or lower the same, as may be required in the practical operation of the apparatus.

36 designates the bucket, consisting of parallel side walls and an end wall, suitably constructed of sheet metal to provide an open front end to said bucket. The bottom of the bucket is integral with the side walls or rigidly united to said side and the end walls, and said bottom is suitably reinforced to enable it to stand the wear and usage to which the bucket is subjected when in service. At its front end the bucket is provided with a shovel 37, preferably of steel and detachably secured thereto in a manner to project beyond the open front end of the bucket, and said shovel may be removed when worn for the purpose of replacing it by a new shovel whenever desired. The bucket is carried by a slidable carriage consisting of the hanger 38 and the saddle 41, and said hanger and saddle of the bucket-carriage are provided with rollers 42 43, arranged therein at different elevations to ride against the track-irons 44 45 on the swinging boom 30. The hanger 38, constituting a part of the bucket-carriage, is constructed of plate or bar metal in sections, which are suitably secured together and shaped to embrace the boom 30 and the sides of the bucket 36, and between the members or sections of this hanger are arranged the pairs of rollers 42 43, adapted to be loosely journaled between the members of the hanger in position to ride against the track-irons on the boom. The hanger 38 has its members constructed to extend below and to embrace the opposite walls of said bucket, and the bucket and hanger are attached together pivotally, as at 38^a, to cause the hanger to be permanently connected to said bucket. The bucket and hanger are pivotally attached together at a point in rear of the middle of said bucket, so that the bucket may be said to be pivoted eccentrically to the hanger, and the supporting devices are so arranged that it is normally held in proper position against the saddle 41 for the purpose of preventing the bucket from tilting downward to its dumping position, said saddle 41 serving to limit the upward movement of the open front end of the bucket with relation to the boom 30. This saddle 41 is likewise constructed in sections arranged to embrace the boom and present a solid or continuous lower part adapted to lie transversely across the upper side of the bucket and to bear against the walls thereof; but said saddle is not connected to the bucket and is adapted to rest thereon only when a bucket is in operative position—as, for example, when engaged in scooping up the load and when being raised with the boom preparatory to dumping the bucket and emptying its contents. This saddle 41 is rigidly connected with the hanger 38 in any suitable way—as, for instance, by transverse bars or rods to cause the saddle and hanger to maintain parallel positions to each other at all times; but, if desired, the hanger and saddle may be made of plate metal to constitute a single carriage for the bucket.

It will be understood that the saddle as well as the hanger is provided with the bearing-rollers 42 43 and that the rollers 42 are arranged in the upper part of the saddle and hanger to ride upon the track-irons 44, which are secured to the upper side of the boom 30, while the rollers 43 are journaled in the hanger and saddle to ride against the track-irons 45, secured against the lower face of the boom 30, whereby the scoop-carriage is prevented from swaying or binding on the boom and is free to have the desired longitudinal travel or movement along the track-irons of the boom. To the open front end of the bucket 36 is pivotally attached a bail 47, to an eye of which bail is connected a hook of the sheave-frame 46, having the sheave journaled loosely therein. To this

sheave-frame on the bail of the bucket is attached one end of the haulage-cable 49, which leads around a double sheave or block 48 on the angular bracket 32 at the free end of the bail, from which sheave of the block 48 the cable 49 leads back to the sheave of the block 46, thence around another sheave in the block 48, thence carried around a guide-sheave 50 51 on the mast, and finally led to the drum 11 of the hoisting-engine.

At or near the free end of the boom 30 I provide a trigger or latch 52, which is preferably pivoted in the angular bracket 32 at a point intermediate of its length to have one end of the trigger overbalance the other hook-shaped end of said trigger. This trigger is pivoted at a point (indicated by 54) to lie in the direction of the length of the boom, and the inner end of said trigger is curved to form the hook 56 and provided with an inclined or beveled nose 55. The trigger or latch 52 lies in the path of the bucket-carriage to engage with the shaft of the upper rollers 42, journaled in the saddle 41, and when the bucket-carriage and the bucket are moved longitudinally along the track-irons of the boom by the strain of the haulage-cable 49 the nose of the latch or trigger is adapted to ride against said roller-shaft in a manner to tilt the trigger or latch and permit the hook thereof to engage with the bucket-carriage, thus confining the carriage and bucket against retrograde traveling movement on the boom. The carriage and bucket are thus practically locked at the outer or free end of the boom to prevent said bucket from traveling backward when the boom is raised to the position indicated by dotted lines in Fig. 1. The trigger or latch may be retracted from engagement with the bucket-carriage by means of a trigger-line 57, attached to the overbalanced end or arm of the trigger or latch and leading over suitable guide-sheaves 58 59, mounted, respectively, on the boom and the mainmast, said line leading to a point within convenient reach of the engineer.

From the foregoing description, taken in connection with the drawings, it will be understood that the bucket is pivoted eccentrically to the hanger of its carriage, while the saddle is adapted to travel with the hanger and to rest upon the bucket to limit its upward movement under the strain of the haulage-cable 49 toward the boom 30. Now when the boom is raised on its pivotal connection with the slidable mast the bucket and carriage are held locked by the trigger, and the hauling-cable 49 is maintained in a taut condition to prevent the bucket from tilting or turning on its pivotal connection with the hanger during the elevation of the boom. After the parts have been adjusted over the place upon which it is desired to dump the load the haulage-cable 49 is slackened to permit the bucket to turn on its pivotal connection with the hanger 38, thus lowering the bucket to its dumping position and emptying the load. When it is desired during the lowering adjustment of the pivoted boom to permit the bucket and its carriage to travel endwise along the boom and return to their operative positions, the engineer pulls on the trigger-line 57 to release the trigger or latch from the carriage, and the haulage-cable 49 is slackened, thus allowing the bucket and its carriage to travel by gravity toward the pivoted end of the boom.

I will now proceed to describe the means for turning the mainmast 14 in a horizontal plane to carry around with it the slidable mast and the boom 30, pivoted thereon, so that the bucket may, if desired, be suspended over the tram-car or scow. This turning movement of the mainmast 14 is effected by a horizontal cross-arm or bar 60, which is rigidly fastened by bolts to the lower part of the mainmast 14 at a point below the track-irons thereon and opposite to the fixed keeper 21^a for the slidable mast 20. This cross-arm or bar 60 is braced by a stay or brace 61, which is bent around the fixed keeper 21^a and is fastened to the cross-arm at or near the ends thereof, and to said cross-arm is fastened the ropes or lines 62, which lead around suitable guide-sheaves 63 to the nigger-heads 13 of the hoisting-engine 9. The nigger-heads may be operated to draw in on one of the lines 62 and slacken the other line 62 for the purpose of turning the bar or cross-arm 60 and with it the mainmast and its associated parts, or the last-named line 62 may be operated to turn the mainmast and its associated parts in the reverse direction.

In the practical service of the apparatus the base or foundation frame is positioned in close relation to the work in hand, for which purpose the engine 9 may be utilized as a means for propelling the machine, particularly when it is mounted on the rollers or casters. In excavating shallow trenches it may not be necessary to move the slidable mast in a vertical direction each time the boom is raised and lowered, and in some classes of work it is only necessary to properly adjust the mast 20 at a suitable distance above the line of the excavation, which adjustment may readily be effected by the cable 27 and its described connection with the engine, or, if desired, said cable 27 may be fastened to a cleat or other confining means. The boom 30 is lowered on its pivotal connection 31 with the mast to bring the excavator-bucket to the bottom of the excavation, and the haulage-cable 49 is drawn by the proper drum of the engine to force the shovel 37 into the material to be removed, thus causing the carriage and bucket to travel longitudinally on the boom until the latch or trigger 52 engages with the bucket-carriage. The bucket is thus loaded automatically and is confined by the latch or trigger against sliding movement on the boom in a direction toward its pivot, and during the traveling movement of the

bucket toward the latch the saddle 41 rests upon the front end of the bucket to limit its upward movement toward the boom and prevent this bucket from turning out of position due to the resistance of the material through which it is drawn for the purpose of loading the bucket. The boom 30 is now raised to an inclined position by causing the engine to draw on the haulage-cable 33, and during such elevation of the boom the latch or trigger engages therewith, and its cable 49 is held taut to maintain the bucket in the proper position on the boom and prevent it from dumping or tilting to discharge its load. The mainmast 14 may now be turned horizontally by the cross-arm or bar 60 and the line 62, leading to the nigger-heads, thus carrying with it the slidable mast, the boom, and the bucket, and when the bucket reaches the point where it is desired to deposit the load the haulage-cable 49 is slackened, allowing the bucket to turn automatically on its pivotal connection with the hanger 38, such turning movement of the bucket being in no wise interfered with by the saddle 41 or the trigger 52. While the boom is in its raised position, the trigger may be released by the line 57 and the bucket and its carriage allowed to travel by gravity toward the pivotal end of the boom, and this operation of the parts allows the bucket to return automatically while the mainmast and the boom are being swung around and the boom is being lowered, thus restoring the bucket and its carriage to position for operation again.

One of the important advantages attained by the improved means for supporting and actuating the bucket is that the weight of the boom and its operating parts is utilized to hold the bucket in proper relation to the work and to confine it between the bed of the excavation and the boom. In this connection the saddle 41 serves an important purpose in that it confines the bucket against upward lifting movement toward the boom while it is being drawn through the material, but said saddle does not interfere in any way with the tilting or dumping of the bucket to discharge the load therein, because the saddle is not attached directly to the bucket. Another advantage due to the construction and arrangement of parts is that I am able to employ a bucket having a rigid non-tiltable bottom, thus dispensing with a latch-and-trip mechanism for controlling the opening or closing of the bucket, but, on the other hand, a single rigid structure is provided, having an eccentric pivotal connection with a carriage and adapted to turn bodily to its dumping position by slackening the strain on the haulage-cable which draws the bucket through the material.

When the apparatus is to be used for excavating deep trenches, the mast 20 is designed to have a vertical reciprocating play with the boom 30, which is pivotally attached thereto. To lower the bucket in proper relation to the bed of the excavation, the cable 27 is slackened, thus allowing the mast 20 to slide downwardly on the mast 14, the casting 6, and the end timber of the foundation-frame, and as said mast is lowered the boom 30 and the bucket and its carriage travel with said mast. As the mast and bucket are lowered into the excavation the cable 49 is paid out until the bucket reaches the bed of the excavation, at which time the engine is operated to arrest the descent of the mast and its associated parts. The bucket may now be drawn through the material to load the same automatically and to engage with the latch or trigger. The mast, boom, and bucket are now raised to substantially the line of the ground, the boom raised to its inclined position, and the mast 14 is turned horizontally to bring the bucket to the desired dumping position, after which the bucket is dumped and the parts are returned to their operative positions.

It may not be necessary in every instance to turn the mast 14 in order to carry the bucket around to one side of the line of the excavation, as in some cases I design to load the material on tram-cars.

In some cases the haulage-cable 27 for the slidable mast and boom may be attached to a fixed cleat or bracket to sustain the mast in a relatively stationary position, while allowing the boom to swing in vertical or horizontal planes, as is usual in the art; but in case of deep trenches where the sides of the bank or cut would interfere with the swinging of the boom the haulage-cable 27 is led to the drum or the engine, thus enabling the sliding mast to be raised and lowered in a perpendicular direction with the boom, while at the same time the boom is free to swing vertically on its pivotal connection with the mast.

My apparatus may be employed as an ordinary hoisting-derrick by removing the bucket, and it is serviceable when it is desired to remove rock where blasting is necessary. In this relation the boiler of the engine is adapted to supply the steam necessary for operating the rock-drills, and when the apparatus is used for removing rock and broken stone the material can be loaded into dump-cars or conveyers. The covering for the blasting necessary when blasting rock can be handled very readily by the apparatus, and by suitable rigging and anchored cable the machine may be propelled back and forth by the engine mounted thereon.

The apparatus may also be used for railway-excavation work, and in this connection it may be built on an ordinary flat-car. When mounted on a flat-car, the horizontal turning movement of the boom may be attained by the employment of an ordinary circular track at the bottom of the mast and operated by a reversible drum controlled by the engine.

For excavating trenches, such as sewers, the frame 1 is designed to be mounted on wheels or casters and operated in the manner

described. In this class of work it is desirable to "back-fill," as it is termed—that is to say, to carry the material excavated from one part of the trench to another part of the trench in which the sewer-pipe has been laid. To adapt the apparatus for service in excavations of this nature, one of the upright fixed braces 16 is removed from the machine to allow the boom to swing clear back over the trench and dump the contents of the bucket into a tram-car to be used as a conveyer running on a track resting on cross-ties which span the trench, or, if desired, the track for the tram-car can be placed on one side of the trench and the car arranged to dump sidewise into the trench, as desired. This tram-car for refilling the excavation may be operated by a cable and reversible drum operated by the engine.

I am aware that slight changes in the form and proportion of parts and in the details of construction may be made without departing from the spirit or sacrificing the advantages of the invention, and I therefore reserve the right to make such changes and alterations as properly come within the scope of the invention.

Having thus described the invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a mainmast, of a vertically-slidable mast, a boom carried thereby, an excavator-bucket mounted on the boom, means for adjusting said slidable mast in a vertical direction, and operating means for the boom and the traveling bucket, substantially as and for the purposes described.

2. The combination of a mainmast mounted to turn in a horizontal plane, a vertically-slidable mast connected thereto to turn horizontally therewith, a swinging boom having a hinged connection with the foot of said slidable mast to swing independently in a vertical plane and to travel in perpendicular and horizontal planes with said slidable mast, and suitable operating mechanism for the masts and boom, substantially as described.

3. The combination with a mainmast, of a slidable mast connected thereto, a boom pivoted to the foot of the slidable mast, a traveling excavator bucket or shovel mounted on said boom, a latch or trigger to confine the bucket or shovel against traveling movement on the boom, and operating means for the slidable mast, the boom and said bucket or shovel, substantially as and for the purposes described.

4. The combination with a suitable framework and a mainmast mounted to rock thereon, of a slidable mast attached to said mainmast and adapted to turn therewith and to slide endwise thereon, a boom connected to the slidable mast, a traveling bucket or shovel mounted on the boom, and means for rocking the mainmast, adjusting the slidable mast in a vertical direction, raising and lowering the boom, and hauling the shovel or bucket, substantially as and for the purposes described.

5. The combination with a frame and a mainmast mounted thereon, of a slidable mast attached to said mainmast and adapted to be lowered below the frame, a boom carried by the slidable mast, a traveling bucket or scoop, and operating means for said slidable mast, the boom and the bucket or scoop, substantially as and for the purposes described.

6. The framework having diagonal timbers united together by a vertically-disposed casting having one of its faces adapted to serve as a guide, in combination with a mainmast, a slidable mast connected with said mainmast and adapted to ride against the guide-face of said casting, a boom, a traveling bucket or scoop, and means for operating said slidable mast, the boom and the bucket or scoop, substantially as and for the purposes described.

7. The combination with a frame and a mainmast, of a vertically-slidable mast, a keeper fixed to said slidable mast and loosely embracing the mainmast, another keeper fixed to the mainmast and slidably fitted to the slidable mast, a boom, a traveling bucket or scoop, and suitable operating means, substantially as and for the purposes described.

8. The combination of a mainmast provided with track-rails, a slidable mast fitted laterally against said mainmast, a keeper fixed to the slidable mast and carrying suitable rollers adapted to travel on the track-rails of the mainmast, another keeper fixed to the mainmast and embracing the slidable mast, means for raising and lowering said slidable mast, a boom, a traveling bucket or scoop, and suitable operating means for the boom and said bucket or scoop, substantially as and for the purposes described.

9. The combination with a suitable frame having a vertical guide-casting, of a mainmast stepped on the frame and provided on one side with track-rails which terminate above said guide-casting, a slidable mast having a movable keeper and rollers or wheels adapted to travel on the track-irons, a keeper fixed to the mainmast below the track-irons and above the guide-casting to embrace the foot of the slidable mast, a boom carried by the slidable mast, and a traveling bucket or scoop, substantially as and for the purposes described.

10. The combination with a boom, of the sheave-carrying plates fixed to the beam at its free end, an overbalanced trigger hung in said plates and having its nose normally in the path of the bucket-carriage, a bucket-carriage slidably fitted to the boom and arranged to engage with the trigger to be confined thereby at the outer end of the boom, a haulage-cable guided in the sheave-carrying plates and connected to a bucket on said bucket-carriage, and a trip-cord attached to the trigger, substantially as described.

11. The combination with a boom, of a buck

et-carriage fitted thereto and consisting of a hanger and a saddle, a bucket or scoop hinged to the hanger and a haulage-cable attached to said bucket or scoop and adapted to force the latter against the saddle, whereby said saddle limits the upward movement of the bucket or scoop with relation to the boom, substantially as and for the purposes described.

12. The combination with a boom, of a hanger slidably fitted thereto, a bucket or scoop hung eccentrically on said hanger, a saddle fitted on said boom to travel thereon with the hanger and arranged to bear upon the bucket or scoop in advance of its pivotal connection with the hanger, and a haulage-cable connected to said bucket or scoop below the bearing of the saddle thereon, substantially as and for the purposes described.

13. The combination of a boom provided on its upper and lower sides with track-irons, a bucket-carriage fitted loosely on said boom and provided with rollers adapted to travel on said track-irons above and below the boom, a bucket hinged to said carriage, a trigger mounted on the boom in the path of the bucket-carriage, and a haulage-cable connected to said bucket, substantially as and for the purposes described.

14. The combination of a swinging boom, a bucket-carriage consisting of a hanger and a saddle mounted on the boom to travel endwise thereon, a bucket hinged eccentrically to the hanger and adapted to press or bear against the saddle of said carriage, a haulage-cable connected to the bucket in advance of its pivotal connection with the hanger and below the bearing of the saddle on said bucket, a trigger or latch mounted on the boom in the path of the bucket-carriage and having an operating-line, and means for raising and lowering said boom, whereby the latch is adapted to confine the carriage and bucket, at or near the free end of the boom, while the latter is being raised and the bucket is adapted to tilt to a dumping position without hindrance from the saddle of the bucket-carriage, substantially as and for the purposes described.

15. The combination with a suitable framework, of a mainmast stepped thereon, a transverse bar or arm rigid with said mainmast and having suitable operating-lines to turn the mainmast in a horizontal direction, a vertically-slidable mast connected with said mainmast and adapted to be lowered below the frame and the mainmast, a swinging boom carried by the foot of the slidable mast, means for raising and lowering the slidable mast and said swinging boom, a traveling bucket or scoop mounted on the swinging boom, and a haulage-cable guided on the mainmast and the swinging boom and connected with said bucket or scoop, substantially as and for the purposes described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

GUSTOF J. MILLER.

Witnesses:

W. M. PRINDLE,

T. H. HAWKES, Jr.