(No Model.) 3 Sheets—Sheet 1.

H. R. KEITHLEY.

EXCAVATOR.

No. 564,695. Patented July 28, 1896.

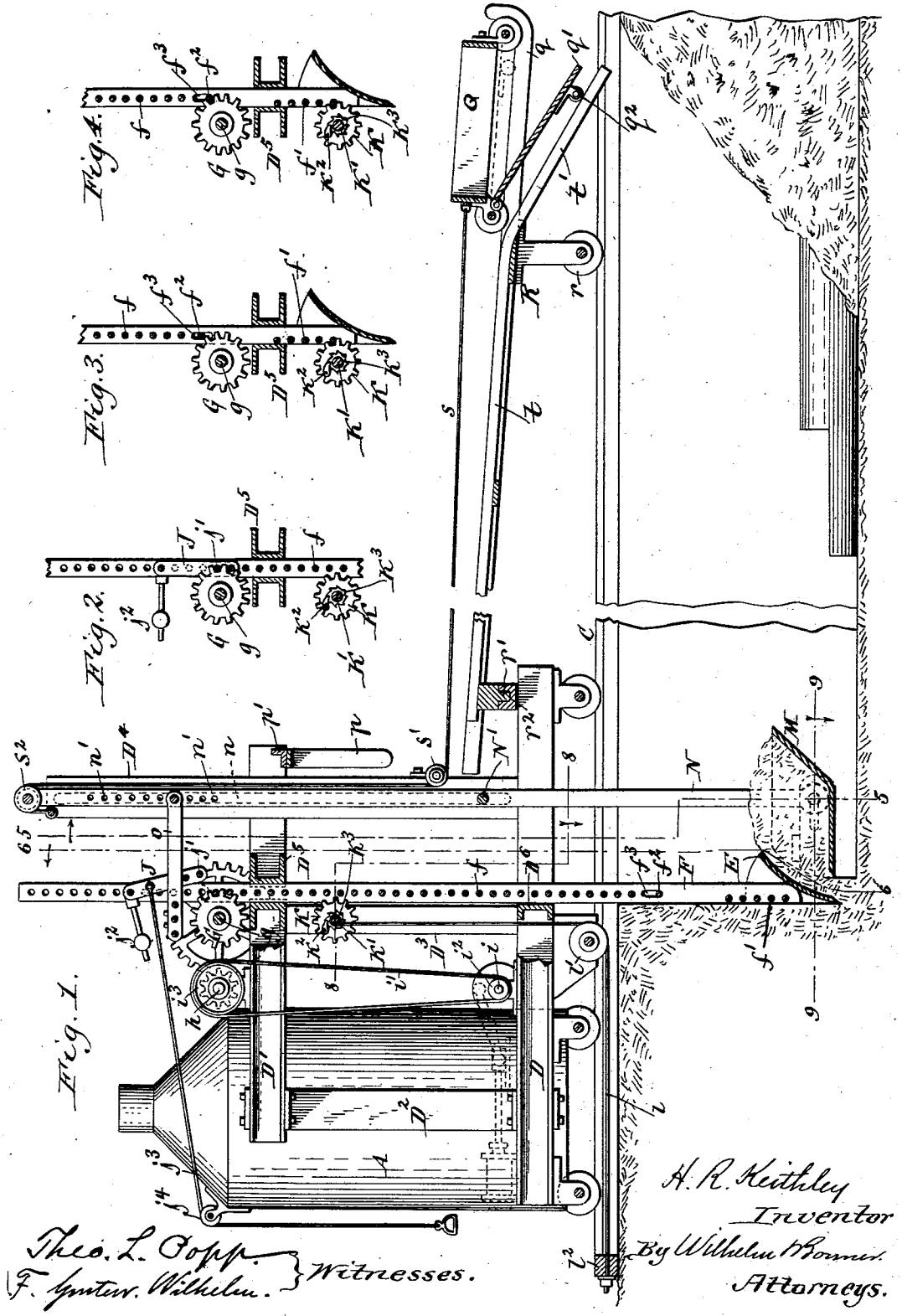

Fig. 4.

Fig. 3.

Fig. 2.

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

H. R. KEITHLEY.

EXCAVATOR.

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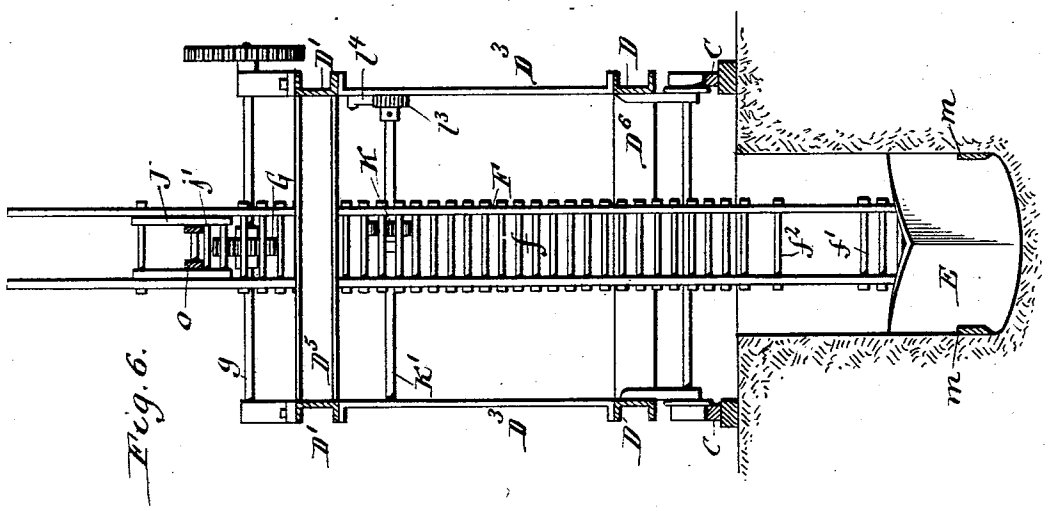

Fig. 6.

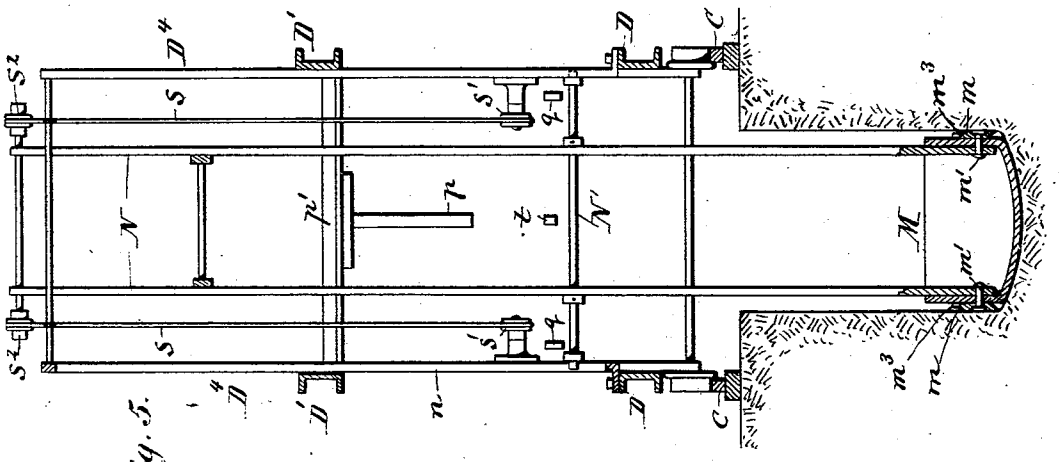

Fig. 5.

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(No Model.) 3 Sheets—Sheet 3.

H. R. KEITHLEY

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Fig. 7.

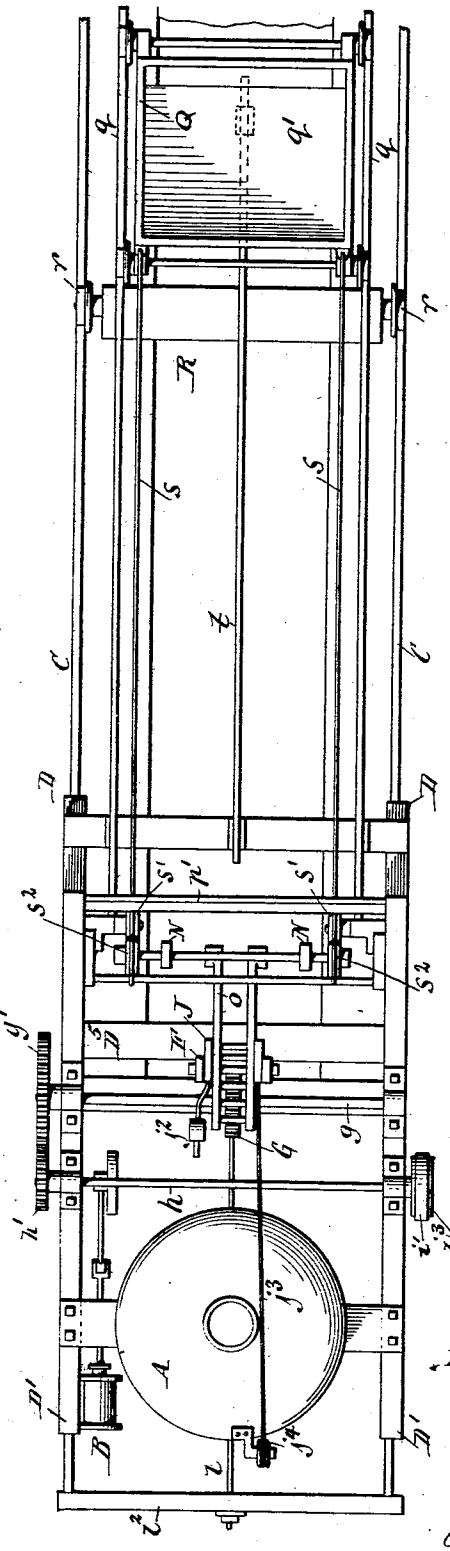


Fig. 9.

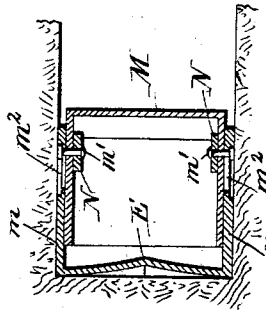
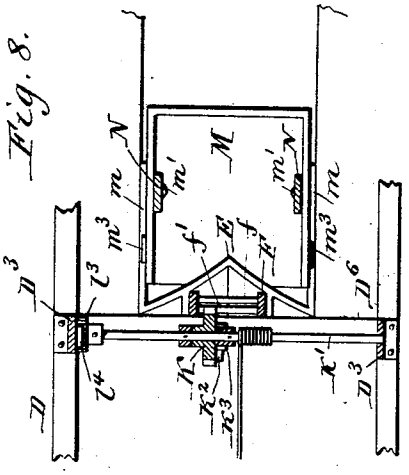


Fig. 8.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

HERBERT R. KEITHLEY, OF BUFFALO, NEW YORK.

EXCAVATOR.

SPECIFICATION forming part of Letters Patent No. 564,695, dated July 28, 1896.

Application filed January 24, 1895. Serial No. 536,007. (No model.)

To all whom it may concern:

Be it known that I, HERBERT R. KEITHLEY, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Excavators, of which the following is a specification.

This invention relates to that class of excavating-machines in which a vertically-reciprocating cutter, spade, or plow is employed, whereby perpendicular sections of earth are successively cut from the upright end or side walls of a trench or ditch.

The object of the invention is to improve the construction of such machines in several particulars; and it consists in the matters hereinafter described, and pointed out in the appended claims.

In the accompanying drawings, consisting of three sheets, Figure 1 is a longitudinal sectional elevation of my improved excavating apparatus, showing the same in connection with a sewer-excavation. Fig. 2 is a fragmentary sectional elevation of the cutter-bar and its actuating mechanism, showing the supplemental rack-bar in engagement with the actuating-wheel. Fig. 3 is a similar view showing the cutter-bar raised and its movable tooth out of gear with the actuating-wheel. Fig. 4 is a similar view showing said tooth in gear with the actuating-wheel. Fig. 5 is a transverse vertical section of the apparatus in line 5 5, Fig. 1, looking toward the right. Fig. 6 is a similar section in line 6 6, Fig. 1, looking toward the left. Fig. 7 is a top plan view of the apparatus. Fig. 8 is a fragmentary horizontal section in line 8 8, Fig. 1. Fig. 9 is a horizontal section of the cutter and bucket in line 9 9, Fig. 1.

Like letters of reference refer to like parts in the several figures.

A represents a boiler, and B an engine, both of ordinary construction, which are mounted upon a portable frame or truck, the wheels of which run upon longitudinal tracks C, laid along opposite sides of the trench or ditch to be excavated. In the construction shown in the drawings, the frame of the truck consists of lower side beams D, upper side beams D′, upright beams D^2, D^3, and D^4, upper transverse connecting-bars D^5, and a lower transverse connecting-bar D^6.

E is the vertically-reciprocating cutter, spade, or plow, and F an upright rack-bar, which carries the cutter at its lower end. The cutter is preferably V-shaped in cross-section and its walls recede downward and rearward from its salient ridge, so as to turn the earth rearward as it penetrates the ground. The reciprocating rack or cutter bar E is guided with its upper portion between the upper transverse connecting-bars D^5 and bears with its lower front portion against the lower connecting-bar D^6. The rack-bar preferably consists of a pair of upright parallel side bars and a series of horizontal rounds or bolts f, which connect the side bars and form the teeth of the rack-bar.

G is a gear-wheel which meshes with the teeth of the cutter-bar and whereby the latter is raised and lowered for reciprocating the cutter. This gear-wheel is secured to a horizontal shaft g, which is driven from a counter-shaft h by a pinion h', secured to the latter and meshing with a gear-wheel g', secured to the shaft g. Motion is transmitted to the counter-shaft h from the main driving-shaft i by a belt i', running around pulleys i^2 and i^3, mounted on said shafts, respectively.

When the actuating-wheel turns forwardly, or in the proper direction to lower the cutter-bar, the latter continues to descend until the uppermost of its series of teeth has cleared the teeth of the actuating-wheel, as shown in Fig. 2, when the bar is arrested, while the actuating-wheel continues to rotate.

J is a supplemental rack-bar carried by the cutter-bar and adapted to be moved into engagement with the teeth of the actuating-wheel G for starting the bar on its upward stroke when the movement of the actuating-wheel is reversed. This rack-bar consists of a pair of depending bars pivoted at their upper ends to the cutter-bar, above the actuating-wheel G, and having one or more teeth or rounds j', which, when brought into vertical alinement with the series of rounds of the cutter-bar, form a continuation or extension thereof, whereby the cutter-bar is elevated by the backward rotation of the actuating-wheel. The supplemental rack-bar is normally swung aside for holding its teeth out of gear with the actuating-wheel by means of a weight j^2, secured to the pivot of

the said rack-bar. The latter is moved into engagement with the actuating-wheel by a cord f^3, secured thereto, passing over a guide-pulley f^4 and terminating in convenient reach of the engineer or other attendant.

k is a detent-wheel whereby the cutter-bar is held in its elevated position and which, in the elevated position of the cutter-bar, engages with a short series of teeth or rounds f', arranged on the bar below the main series of teeth f, as shown in Fig. 3. The detent-teeth f' are arranged in a vertical plane slightly in advance of the plane of the main series of teeth, and the detent-wheel is so arranged relatively to the two series of teeth that it always clears the upper or main series, but meshes with the lower or detent series when the cutter-bar is elevated to its highest limit.

The detent-wheel k is loosely mounted on a transverse shaft k', journaled in the uprights D^3, and carries a pawl k^2, which engages with a ratchet-wheel k^3, secured to the shaft k', and which permits the detent-wheel to turn backward freely when engaged by the short series of teeth f', but prevents the detent-wheel from turning on the shaft in the opposite direction.

l is a propelling rope or cable secured to and wound upon the shaft k' and passing downward from said shaft around a guide-roller l', journaled on the lower portion of the truck, and thence forward to a fixed cross bar or anchor l^2, to which it is secured. This rope or cable holds the shaft k' against forward rotation. When the lower series of teeth of the cutter-bar are in engagement with the detent-wheel, the pawl of the latter engages against the abrupt face of a tooth of the ratchet-wheel, and as the shaft is prevented from turning forward by the anchored rope l the detent-wheel is also held against forward rotation, thereby supporting the cutter-bar in its elevated position.

l^3 is a ratchet-wheel secured to the shaft k' and engaging with a detent-pawl l^4, pivoted to the adjacent upright D^3. This pawl is arranged to prevent retrograde movement of the shaft k', whereby the propelling cable or rope is prevented from unwinding from the shaft during the backward rotation of the detent-wheel.

When the engine is reversed for elevating the cutter-bar, the actuating-wheel raises the bar until the lowermost tooth f^2 of its main series clears the actuating-wheel. In order to bring this last tooth into operative engagement with the actuating-wheel for again lowering the cutter-bar, said tooth is arranged to slide freely in vertical slots f^3, formed in the side pieces of the cutter-bar, as more clearly shown in Figs. 3 and 4. This movable tooth tends to rest in the lower ends of the slots by gravity, and when, during the upward stroke of the cutter-bar, it comes into gear with the actuating-wheel it is moved by a tooth of the latter against the upper ends of its slots, thus acting as a fixed tooth. As soon as this tooth reaches a position in which it is not forced against the upper ends of its slots by the teeth of the actuating-wheel, it drops by gravity into the path of the teeth of the actuating-wheel, as shown in Fig. 3, when it is again raised or deflected, the tooth reciprocating in its slots somewhat in the manner of a pawl and ratchet, and allowing the actuating-wheel to continue its backward movement without affecting the cutter-bar.

When the motion of the actuating-wheel is reversed for lowering the cutter-bar, the tooth of the actuating-wheel immediately above the movable tooth of the cutter-bar bears against the upper side of the movable tooth f^2 and causes it to abut against the lower ends of its slots, as shown in Fig. 4. The tooth now acts as a rigid tooth and transmits the movement of the actuating-wheel to the cutter-bar, thereby starting the latter on its downward stroke

The detent-wheel is in mesh with the lower series of the cutter-bar teeth during the initial portion of the downward stroke of the cutter-bar, and it is, therefore, compelled to turn forward until the uppermost of such teeth has cleared it. This forward rotation of the detent-wheel is imparted to the shaft k', causing the propelling rope or cable to be wound upon said shaft, and as the opposite end of the cable is anchored its bight impinges against the truck-roller l' and shifts the machine forward a greater or less distance, the extent of which is determined by the diameter of the shaft k' and the length of the series of detent-teeth on the cutter-bar. The detent device thus serves not only as a stop for arresting the downward movement of the cutter-bar, but also effects the automatic propulsion of the machine preparatory to making a new cut. The relative arrangement of the parts is such that the automatic advancement of the machine is effected and completed before the cutter enters the ground.

M is a bucket or receptacle which receives and elevates the earth detached by the cutter or plow. This bucket is arranged immediately behind the cutter and is connected therewith by horizontal arms or brackets m, which are secured at their front ends to opposite edges of the cutter. The bucket is provided on opposite sides with horizontal pivots m', which are arranged in horizontal slots m^2, formed in the supporting-arms m, whereby the bucket is allowed to oscillate on said arms for dumping its contents, and also permitted to move toward and from the cutter for severing the slice of earth transversely opposite the lower edge of the cutter. The front edge of the bucket-bottom is preferably sharpened to facilitate this action of the bucket. The bucket-pivots are arranged somewhat in rear of the middle of the bucket, so that the front portion of the latter overbalances its rear portion, the bucket being normally held in its horizontal position by

lugs or stops m^3, arranged on opposite sides thereof, in front of its pivots, and bearing upon the upper edges of the connecting-arms m. The bucket is vibrated by means of an oscillatory frame or lever which, in the construction shown in the drawings, consists of a pair of upright members N, which are mounted near their middle upon a transverse rock-shaft or pivot N'. The latter is arranged with its ends in vertical slots n, formed in the uprights D^4. These slots permit the oscillating frame to reciprocate vertically with the bucket and the cutter. The members of the oscillating frame are provided at their lower ends with eyes or bearings which receive the pivots of the buckets, as shown in the drawings. The lower edges of the arms m are preferably sharpened, as shown, to more readily penetrate the ground.

o is a horizontal rack-bar, whereby the oscillating frame N is thrown into gear with the actuating gear-wheel G at the same time that the cutter reaches the extremity of its downward stroke, and whereby the bucket is swung forward sufficiently to sever the detached section of earth. This rack-bar is secured at its rear end to the oscillating frame, above the pivot of the latter, and is adapted to mesh with the upper side of the actuating-wheel G during the forward rotation of the latter, whereby said rack-bar is caused to move rearward until its teeth clear the actuating-wheel, thereby swinging the upper arm of the oscillating frame backward and its lower arm forward, and causing the front edge of the bucket-bottom to penetrate the section of earth.

The horizontal rack-bar o is so arranged on the oscillating frame relatively to the actuating-wheel G that in the descent of the oscillating frame and the cutter-bar the rack-bar comes into engagement with the actuating-wheel at about the same time that the teeth of the cutter-bar leave the actuating-wheel.

p is a stop which is arranged in the path of the bucket and against which the rear portion of the bucket strikes in ascending, thereby dumping the same automatically. This stop consists of a rigid arm depending from a cross-bar p', which connects the upper side beams of the portable main frame.

Q is a conveying-car into which the elevated earth is dumped, and whereby the same is carried to the desired place of deposit. This car runs upon inclined tracks q, which are preferably laid upon a portable trestle or platform R, connected at its front portion to the truck-frame and supported at its rear portion upon wheels r, which may run upon the main tracks C when the earth is to be delivered at the rear end of the trench, as is desirable in sewer-work.

In order to permit the conveyer-car to run in different directions from the machine, the trestle is swiveled at its head to the truck-frame by means of a vertical pivot r', turning in a socket r^2, as shown in Fig. 1, or by any other suitable means.

The conveyer-car is preferably operated automatically in conjunction with the vertically-movable bucket. In the construction shown in the drawings, this is effected by draft ropes or cables s, secured to the car and passing forwardly around guide-wheels s', journaled on the uprights D^4, thence upward around guide-wheels s^3, journaled at the upper end of the oscillating frame, and thence to a cross-rod, which is secured to the uprights D^4 and to which the cables are fastened. By this arrangement, when the oscillating frame ascends with the cutter-bar, the cables s are doubled on opposite sides of the oscillating frame, owing to their attachment to the uprights D^4, thereby drawing the horizontal portions of the cables forward and upward around the fixed guide-wheels s', and pulling the conveyer-car toward the head of the trestle. The parts are so proportioned that the conveyer-car reaches the head of the trestle in the proper position to receive the contents of the elevated bucket before the bucket strikes the dumping-stop p. When the bucket again descends, the cables are slackened, allowing the loaded conveyer-car to run by gravity to the rear end of the trestle for discharging its contents.

The bottom q' of the conveyer-car is preferably hinged at one end, as shown in Fig. 1, so that it may swing downward for dumping the contents of the car. The hinged bottom is held in its closed position by a roller q^2, journaled on the under side of the bottom, at or near its free end, and running upon a longitudinal track t, arranged on the trestle between the tracks of the conveyer-car. The rear or terminal portion of this intermediate track is inclined abruptly at a greater pitch than its main portion, as shown at t' in Fig. 1, whereby the hinged bottom is allowed to open or swing downward under the weight of the car contents when its supporting-roller runs down the receding or depressed terminal portion of said track, as shown in the last-mentioned figure. When the car is drawn toward the head of the trestle, the free end of its hinged bottom is raised by the abrupt incline t' until the supporting-roller of the bottom reaches the main portion of the intermediate track, by which time the bottom is fully closed. The supporting-roller is of the requisite diameter to raise the bottom to its closed position when running upon the main portion of the intermediate track.

The operation of my improved machine is as follows: Assuming that the cutter has been raised to its highest position, after making a cut in the wall of the excavation, the bucket and its oscillating frame are also elevated and the conveyer-car is at the head of the trestle. The elevated parts are held in this position by the detent-wheel k meshing with the lower series of the cutter-bar teeth. The

shaft of the detent-wheel is held against turning by the cable *l*, and the weight of the portable truck and superposed parts predominate over that of the elevated cutter and bucket, so that the apparatus remains stationary. Upon now reversing the engine, so as to turn the actuating-wheel forward, the cutter-bar is lowered and the initial portion of this movement is transmitted by the detent-wheel to the shaft of the latter, thereby winding the cable *l* upon said shaft and propelling the machine forward preparatory to making the cut. The cutter-bar continuing its downward stroke causes the cutter to penetrate the ground and remove a section of earth from the wall of the trench, the bucket descending with the cutter and receiving the detached earth, which latter is deflected into it by the cutter. At the same time that the cutter reaches the limit of its downward stroke, caused by the main series of teeth leaving the actuating-wheel, the shifting rack-bar *o* of the oscillating frame N is brought into gear with the actuating-wheel G by the descent of the oscillating frame, thereby vibrating the latter and causing the bucket to swing toward the cutter, whereby the front edge of the bucket-bottom cuts the detached section of earth transversely. Practically all the earth removed from the wall of the excavation at each cut is by this means directed into the bucket, and the bottom of the trench is at the same time smoothly finished. The forward movement of the bucket ceases as soon as the rack-bar *o* clears the actuating-wheel G, when the bucket recedes by gravity to its former position, returning the oscillating frame to its perpendicular position. The engine is now reversed, whereby the actuating-wheel is caused to turn backward and elevate the cutter and the bucket connected therewith. As the bucket ascends, its rear portion encounters the stop *p*, which causes the bucket to tilt backward and dump its contents into the conveyer-car. During the dumping of the bucket the bucket and the parts connected with it are held in an elevated position by the detent-wheel *k*, which at that time is in engagement with the lower series of teeth of the cutter-bar. The engine is now again reversed and the cutter-bar is moved into gear with the actuating-wheel G by means of the supplemental rack-bar J, whereby the cutter is again lowered for removing another section of the excavation, as before described. As the oscillating frame N descends with the cutter, the draft-cables running around the guide-wheels at the upper end of the said frame are permitted to slacken or pay out, thus allowing the conveyer-car, which has been loaded with the earth of the preceding cut, to run down the inclined trestle to the place of deposit. The conveyer-car is thus automatically drawn to the head of the trestle to meet the loaded bucket during the ascent of the latter, and allowed to return to the rear end of the trench or other place of deposit during the time that the cutter descends to remove the next section of earth.

By combining the bucket with the plow or cutter in the manner shown the bucket remains in close proximity to the cutter throughout the stroke thereof, and it thus receives the loose earth as rapidly as it is detached from the cutter, thus saving the cost of hand-labor, which would otherwise be required for shoveling the earth into the bucket. The cutting action of the bucket, produced by vibrating the same transversely of the plane of movement of the vertically-reciprocating cutter, insures the discharge of nearly all of the loosened earth into the bucket, so that very little hand-labor is required for clearing or finishing the bottom of the trench.

The stroke of the vertically-movable cutter or spade may be increased or diminished by lengthening or shortening the series of teeth on the cutter-bar, the side members of the latter being for this purpose made sufficiently long and the openings which receive the teeth or rounds extending to the upper ends of the members, so that additional teeth or rounds may be inserted for increasing the stroke of the cutter or a greater or less number removed from the top of the series for diminishing its stroke. In order to permit a corresponding adjustment of the rack-bar *o* on the oscillating frame, the latter is provided with a vertical series of openings *n'*, which receive the removable carrying-rod of the rack-bar.

In the drawings a steam-engine is shown for operating the machine, but any other suitable motive power may obviously be substituted therefor.

I claim as my invention—

1. The combination with a vertically-reciprocating spade or cutter, of a vertically-reciprocating receptacle for the excavated material moving with the cutter and supported opposite the cutter with its side edge which is nearest the cutter located adjacent to the cutting edge of the same, whereby the said receptacle is adapted to receive the excavated material by gravity in the descent of the cutter, substantially as described.

2. The combination with a vertically-reciprocating spade or cutter, of a vertically-reciprocating bucket or receptacle for the excavated material supported opposite and adjacent to the spade or cutter and connected with the latter, by means preventing vertical movement of the bucket relatively to the cutter, whereby the bucket reciprocates in unison with the spade or cutter, substantially as set forth.

3. The combination with a vertically-reciprocating spade or cutter, of a vertically-reciprocating bucket or receptacle supported opposite and adjacent to the spade or cutter, said bucket or receptacle being movable at an angle to the plane of movement of the cut-

ter, and having a cutting edge for severing the detached section of earth transversely substantially as set forth.

4. The combination with a vertical reciprocating spade or cutter of a bucket or receptacle connected with the cutter by connecting means which maintains the receptacle rigidly opposite the cutter but affords movement of the receptacle horizontally toward and from the cutter, substantially as described.

5. The combination with a vertically-reciprocating spade or cutter and a bucket or receptacle, of a vertically-movable bar to the lower end of which the cutter is attached and which is provided with rigid arms sustaining the receptacle opposite the cutter, substantially as described.

6. The combination with a reciprocating spade or cutter of a vertically-reciprocating bucket or receptacle supported adjacent to the spade or cutter by means which maintain it rigidly opposite the cutter, but leave it free to move toward and from the latter and an oscillatory frame connected with said bucket or receptacle, for giving horizontal movement thereto, substantially as set forth.

7. The combination with a reciprocating spade or cutter and slotted arms or brackets secured thereto, of a bucket or receptacle movable toward and from the cutter and having pins or pivots which slide in the slots of said arms or brackets, substantially as described.

8. The combination with a vertically-reciprocating spade or cutter and an actuating device for giving vertical movement thereto, of a bucket or receptacle which moves vertically with, but is capable of moving horizontally toward and from said spade or cutter, a vibratory frame connected with said bucket for moving the same horizontally and a detachable actuating mechanism whereby said vibratory frame is actuated from said actuating device, substantially as set forth.

9. The combination with a reciprocating spade or cutter and a receptacle movable with the same, of a vertically-movable bar to which the cutter is attached and which is provided with rigid arms with which the receptacle has horizontally-sliding connection, means acting on the bar for moving the same vertically and means acting on the receptacle for giving horizontal movement to the same, substantially as described.

10. The combination with a vertically-movable cutter and a receptacle sustained opposite the cutter but movable horizontally toward and from the same, of a vertically-movable bar attached to the cutter, a vibrating frame for actuating the receptacle connected and moving vertically with the said bar, means acting on said bar for moving vertically the said receptacle and means acting on said vibrating frame for giving horizontal motion to the said receptacle, substantially as described.

11. The combination with a reciprocating cutter and a toothed actuating-wheel, of a bucket or receptable movable toward and from said cutter, a reciprocating vibratory frame connected with said bucket, and a rack-bar secured to said vibratory frame and adapted to engage with said actuating-wheel, substantially as set forth.

12. The combination with a reciprocating cutter, a rack-bar attached to the same, a toothed actuating-wheel engaging said rack-bar, a receptable movable toward and from said cutter, a vibratory frame connected with said receptacle, and a rack-bar connected with the vibratory frame and adapted to engage said actuating-wheel, substantially as described.

13. The combination with a main frame of a reciprocating cutter, a supporting-bar attached to the same, a receptacle connected with the supporting-bar by means which hold the receptacle rigidly opposite the cutter, but affords movement thereof horizontally toward and from the cutter and a vibrating frame for actuating the receptacle having both pivotal and vertically-sliding connection with the main frame, substantially as described.

14. The combination with a main frame, of a reciprocating cutter, a supporting-bar attached to the cutter, a receptacle connected with the supporting-bar by means holding the receptacle rigidly opposite the cutter, but affording horizontal movement of the receptacle toward and from the cutter, a pivoted vibrating frame for actuating the receptacle, vertical guides on the frame in which the pivot of the vibrating frame is adapted to slide, and means for actuating said supporting-bar and vibratory frame, substantially as described.

15. The combination with a pair of vertically-slotted uprights of the main frame, of a reciprocating cutter, an actuating-wheel, a reciprocating vibratory frame having a rock-shaft or pivot arranged in the slots of said uprights, a bucket or receptacle connected with the lower portion of said vibratory frame, and a rack-bar attached to said vibratory frame and adapted to engage with said actuating-wheel, substantially as set forth.

16. The combination with a vertically-reciprocating cutter, of a bucket or receptacle which is supported opposite to and moves vertically with the cutter, is movable horizontally toward and from the same, and is also pivotally supported to permit it to be dumped, substantially as described.

17. The combination with a cutter, a bar attached to the same and provided with supporting-arms, and a receptacle having both horizontally-sliding and pivotal connection with said arms, whereby it may be moved toward and from the cutter and also dumped, substantially as described.

18. The combination with a cutter, a vertically-movable supporting-bar attached to the same and means for moving said bar in

both directions, of means for supporting the bar in its elevated position comprising a gear-pinion provided with a pawl and ratchet, and a rack on the said bar adapted for engagement with said pinion, substantially as described.

19. The combination with a movable supporting-frame, a cutter and a vertically-movable bar attached to the cutter, of means for moving the said frame comprising a rotating pinion, mounted on the frame and having operative connection with a winding-drum, a cable connecting said drum with a stationary object, and a rack on said bar adapted for engagement with said pinion, substantially as described.

20. The combination with a movable supporting-frame, of a reciprocating cutter, a supporting-bar attached to the same, a shaft carrying a gear-pinion, a rack-bar on the supporting-bar for engagement with said pinion and a propelling-cable attached to a stationary object and adapted to be wound on the said shaft, substantially as described.

21. The combination with a movable supporting-frame, of a spade or cutter, a reciprocating rack-bar guided in said supporting-frame and carrying the cutter, a pinion engaging with said rack-bar having ratchet engagement with its own shaft, and a propelling-cable wound upon the shaft of said pinion and connected at its other end with a stationary object, substantially as set forth.

22. The combination with a movable supporting-frame having a guide-wheel, of a spade or cutter, a reciprocating supporting-bar having rack-teeth, said bar being guided in said supporting-frame and carrying the cutter, a pinion engaging with said rack-bar, and a propelling-cable secured at one end to the shaft of said pinion, passing around the guide-wheel of the movable frame, and having its opposite end anchored to a stationary part, substantially as set forth.

23. The combination with a movable supporting-frame, of a cutter, a supporting-bar attached to said cutter having a set of main rack-teeth and a series of auxiliary rack-teeth out of line with the main teeth, an actuating-wheel engaging the main teeth, and a propelling device for the frame embracing a gear-pinion adapted to engage the auxiliary teeth, substantially as described.

24. The combination with a portable supporting-frame, of a cutter, a reciprocating supporting-bar carrying the cutter and having a series of main rack-teeth and a series of auxiliary rack-teeth arranged out of the plane of the main teeth, an actuating-wheel adapted to engage with the main teeth of said bar, a pinion adapted to engage with the auxiliary teeth of the bar, and a propelling-cable whereby the movement of the shaft of said pinion is transmitted to the portable frame, substantially as set forth.

25. The combination with a movable supporting-frame, of a cutter, a reciprocating supporting-bar carrying the cutter and having a series of main rack-teeth and a series of auxiliary rack-teeth arranged out of the plane of the main teeth, an actuating-wheel adapted to engage with the main teeth of said bar, a pinion adapted to engage with the auxiliary teeth of the bar, and mounted loosely on its supporting-shaft, a pawl and ratchet connecting said pinion with its shaft, and a propelling-cable connected with said pinion-shaft and operating upon the movable supporting-frame, substantially as set forth.

26. The combination with a cutter of a supporting-bar for actuating the same, provided with rack-teeth, an actuating-wheel engaged with said bar, and a supplemental rack-bar movably connected with said supporting-bar and adapted to form a continuation of the rack-teeth thereof, substantially as described.

27. The combination with a cutter and main supporting-bar carrying the same, provided with rack-teeth, of an actuating-wheel engaging with said rack-teeth, and a supplemental rack-bar mounted on said main bar and adapted to form a continuation of the rack-teeth thereof, substantially as set forth.

28. The combination with a cutter and the reciprocating supporting-bar carrying the same and provided with rack-teeth of an actuating-wheel engaging with said bar, a supplemental rack-bar pivoted to said reciprocating bar and forming a continuation of the teeth thereof, a device for holding said supplemental rack-bar out of its operative position, and a shifting device for moving said supplemental rack-bar into its operative position, substantially as set forth.

29. The combination with a cutter, of means for actuating the same, embracing a rack-bar, and an actuating-wheel engaging the same, said rack-bar having a reciprocating tooth, substantially as described.

30. The combination with a cutter, of a reciprocating rack-bar carrying said cutter and having a reciprocating tooth, and an actuating-wheel engaging with said rack-bar, substantially as set forth.

31. The combination with a cutter, of a reciprocating rack-bar having a series of stationary teeth and provided at one end of said series with longitudinal slots, a reciprocating tooth sliding in said slots, and an actuating-wheel engaging with said rack-bar, substantially as set forth.

32. The combination with a vertically-movable bucket or receptacle, of a vertically-movable frame carrying the same, a conveying-car, and a cable attached to the car and having operative connection with the said vertically-movable frame, substantially as described.

33. The combination with a vertically-movable bucket or receptacle, of a vertically-movable frame carrying the same, a conveying-car, and a cable attached to the car and having operative connection with the said vertically-movable frame through the medium of

one or more pulleys, whereby the movement of the car is made greater than that of the frame, substantially as described.

34. The combination with the main frame, of a bucket or receptacle, a reciprocating frame guided on the main frame, and connected with said bucket, a guide-wheel arranged on the main frame below the upper end of said reciprocating frame, a conveying-car, and a draft-cable connected with said car, passing around said guide-wheel and actuated by said reciprocating frame, substantially as set forth.

35. The combination with the main frame, of a bucket or receptacle, a reciprocating frame guided on the main frame connected with said bucket, and provided at its upper end with a guide-wheel, a guide-wheel arranged on the main frame below the upper end of said reciprocating frame and a draft-cable passing around said guide-wheels and secured at one end to the conveyer-car and at its other end to the main frame, substantially as set forth.

36. The combination with track-rails and a conveyer-car, of an auxiliary track having a depressed or downwardly-receding portion; the conveyer-car having a movable bottom provided with a roller which runs upon said auxiliary track, substantially as set forth.

37. The combination with track-rails and a conveyer-car, of an auxiliary track having a depressed or downwardly-receding portion, said conveyer-car having a hinged bottom detached at its free end, and a roller journaled in the under side of the hinged bottom and running upon said auxiliary track, substantially as set forth.

38. The combination with the main frame and a vertically-reciprocating frame guided thereon, of a bucket or receptacle pivoted to said reciprocating frame, a stop arranged on the main frame in the path of the bucket, and a track or trestle for a conveyer-car having its head arranged underneath said stop, substantially as set forth.

Witness my hand this 18th day of January, 1895.

HERBERT R. KEITHLEY.

Witnesses:

CARL F. GEYER,

KATHRYN ELMORE.