(No Model.) 3 Sheets—Sheet 1.

# H. R. KEITHLEY.

## EXCAVATING MACHINE.

No. 567,274. Patented Sept. 8, 1896.

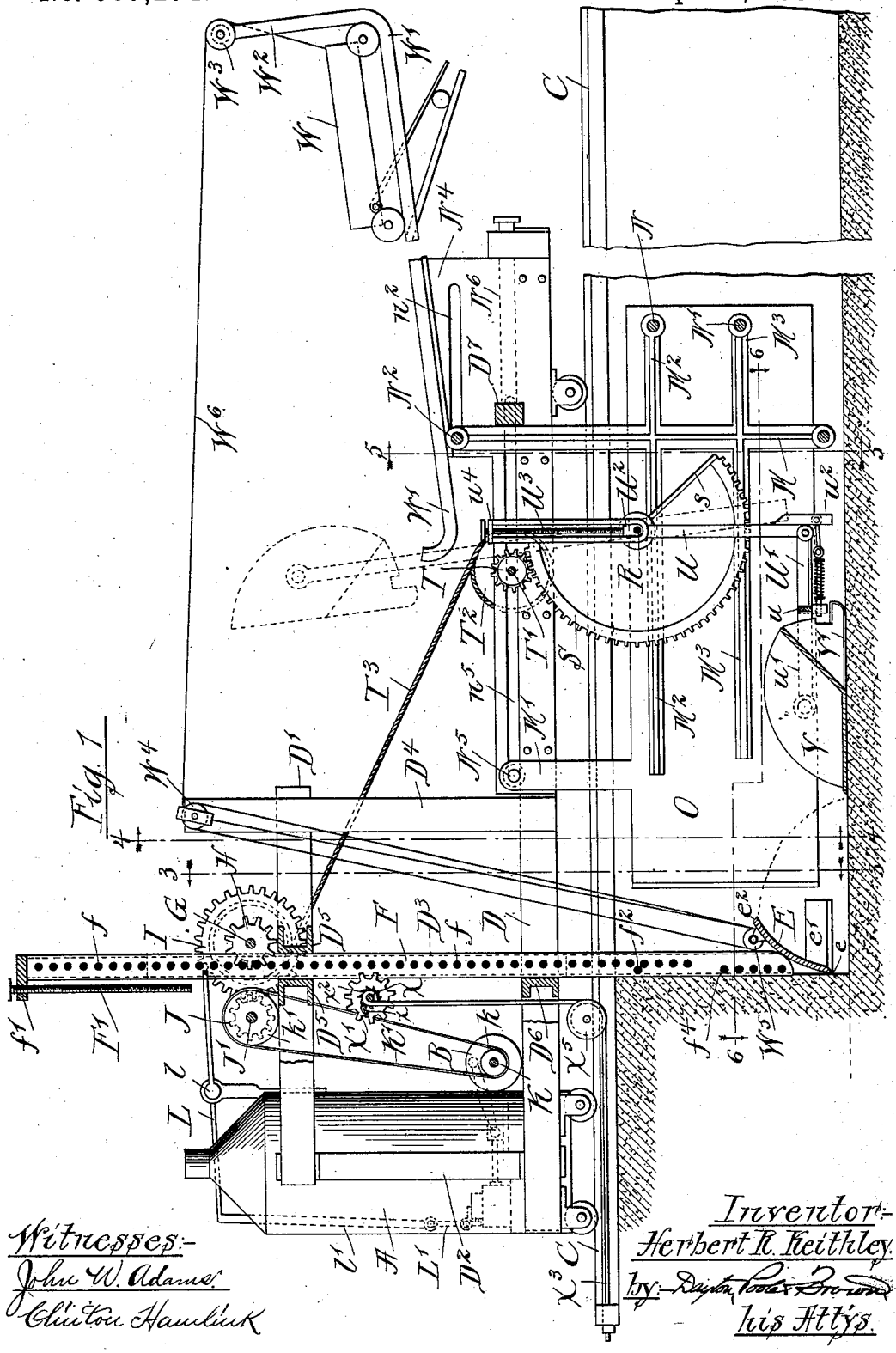

Fig. 1

Witnesses:-
John W. Adams.
Clinton Hamlink

Inventor:-
Herbert R. Keithley.
by: Dayton, Poole & Brown
his Att'ys.

(No Model.) 3 Sheets—Sheet 2.

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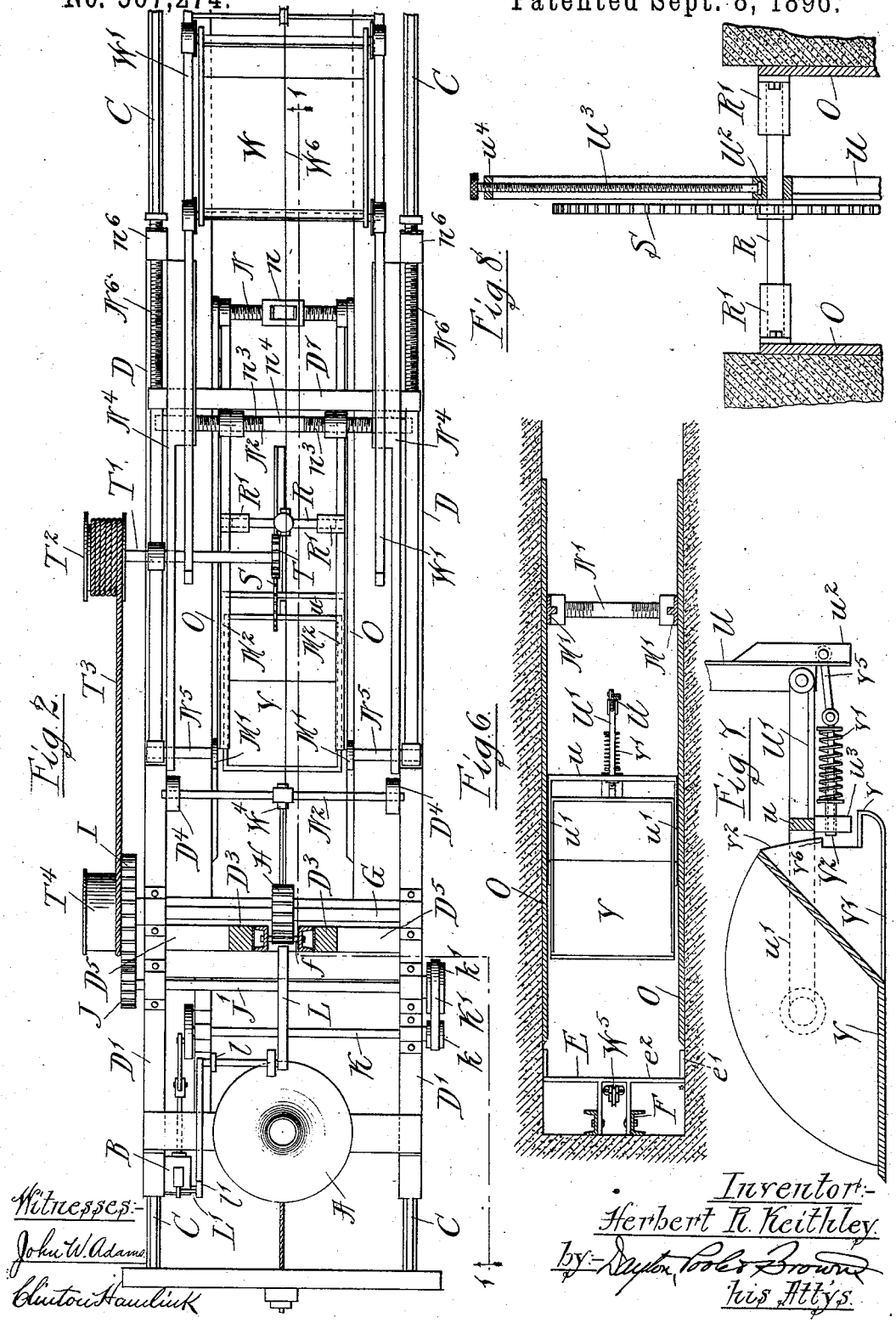

Fig. 2.



Fig. 8.



Fig. 6.



Fig. 7.

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(No Model.) 3 Sheets—Sheet 3.

# H. R. KEITHLEY.

## EXCAVATING MACHINE.

No. 567,274. Patented Sept. 8, 1896.

Fig. 5.

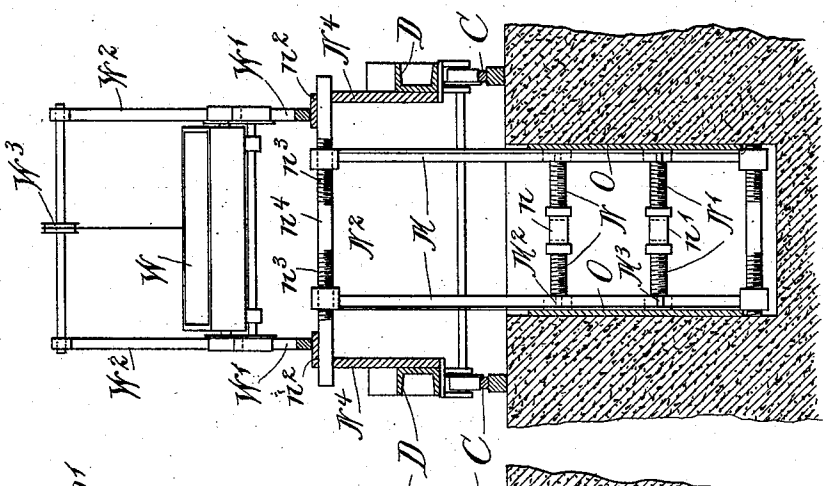


Fig. 4.

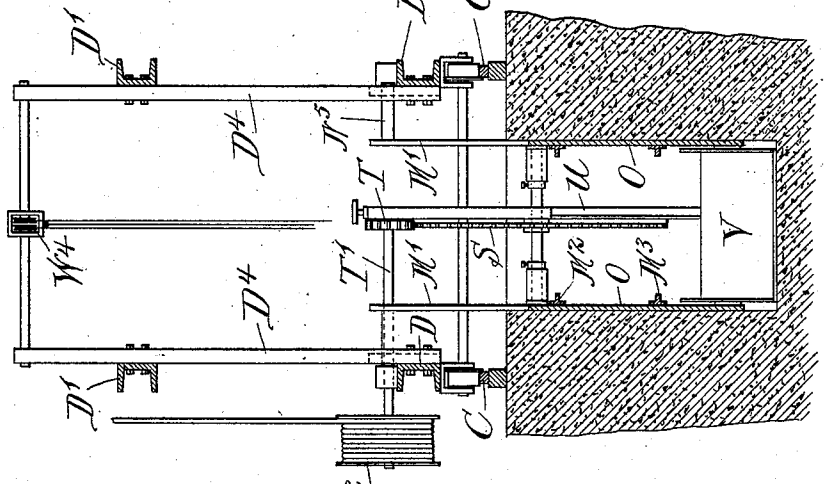
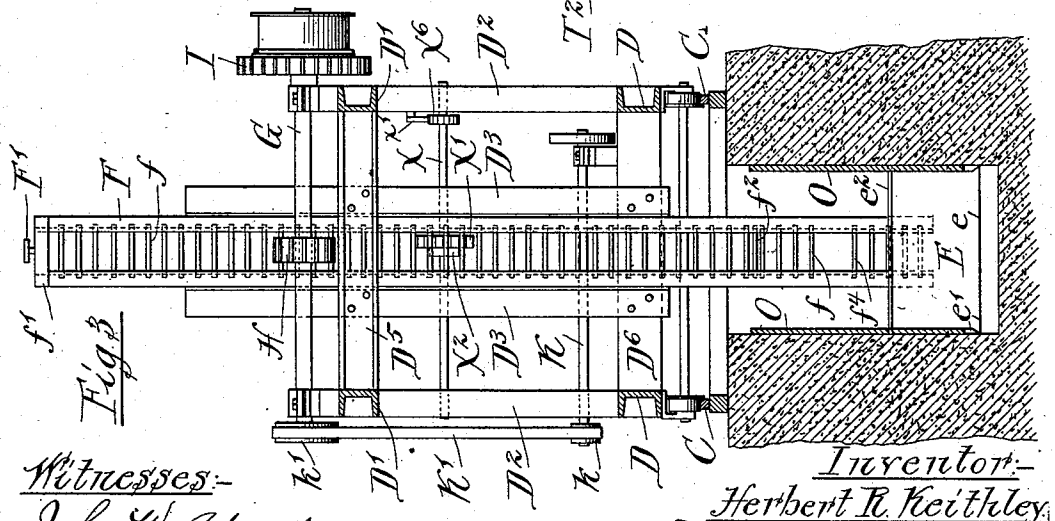


Fig. 3.



Witnesses:-
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Clinton Hamilton

Inventor:-
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# UNITED STATES PATENT OFFICE.

HERBERT R. KEITHLEY, OF BUFFALO, NEW YORK.

## EXCAVATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 567,274, dated September 8, 1896.

Application filed April 11, 1895. Renewed July 1, 1896. Serial No. 597,785. (No model.)

*To all whom it may concern:*

Be it known that I, HERBERT R. KEITHLEY, of Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Excavating-Machines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this 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 the earth are successively cut or sliced from the end or side walls of a trench or ditch and elevated from the same.

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

The invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a longitudinal sectional elevation taken on line 1 1 of Fig. 2. Fig. 2 is a plan view, with parts in section, of the machine shown in Fig. 1. Fig. 3 is a vertical section taken on line 3 3 of Fig. 1, looking toward the front. Fig. 4 is a vertical section taken on line 4 4 of Fig. 1, looking toward the rear. Fig. 5 is a vertical section taken on line 5 5 of Fig. 1, looking toward the rear. Fig. 6 is a longitudinal sectional view taken on line 6 6 of Fig. 1, showing the cutter-shovel and the lower toggle-arm in top plan. Fig. 7 is a sectional detail of the shovel and connected parts. Fig. 8 is a sectional detail of the adjusting device of the toggle.

Referring to said figures, A designates a boiler, and B an engine, both of ordinary construction and mounted upon a portable frame or truck, the wheels of which run upon longitudinal track-rails C, laid along opposite sides of the trench or ditch to be excavated. In the preferred construction shown in the drawings the frame of the truck comprises lower side beams D D, upper side beams D′ D′, upright beams $D^2$, $D^3$, $D^4$, and $D^8$, upper transverse connecting-bars $D^5$, and lower transverse connecting-bars $D^6$ and $D^7$.

E is the vertically-reciprocating cutter, spade, or plow, and F an upright rack-bar, which carries the cutter E at its lower end. The cutter E has a chisel edge and is preferably wedge shape in cross-section, having a straight transverse cutting edge *e*, side dressing edges *e′ e′*, and a rearwardly and upwardly curved blade or share $e^2$, adapted to turn the earth rearwardly as the cutter penetrates the ground. The reciprocating rack or cutter bar F is guided at its upper portion between the upper transverse connecting-bars $D^5$ and bears against and is guided at its lower front portion by the lower connecting-bar $D^6$. As preferably constructed, the said rack-bar comprises a pair of upright parallel side bars and a series of horizontal trundles or cross-bolts *f*, which connect the side bars and form the teeth of the rack-bar.

G is a shaft suitably mounted upon the upper side beams D′ and provided with a pinion H, which meshes with the teeth of the rack-bar F and serves to elevate or depress the latter and its connected cutter E.

I is a second and larger gear-wheel secured upon the shaft G, which intermeshes with and is driven by a gear J, mounted upon a counter-shaft J′. Motion is transmitted to the counter-shaft J′ from a driving-shaft K by means of a belt K′, running around pulleys *k k′*, respectively.

L is a lever pivotally mounted at *l*, projecting at its rear end adjacent to the path of the reciprocating rack F and connected at its opposite end by means of a suitable link *l′* with the reversing-lever L′ of the engine.

F′ is a vertically-arranged adjusting-screw mounted in a bracket *f′*, carried by the upper end of the rack-bar F.

$f^2$ is a cross bolt or stop mounted at the lower portion of the rack-bar F and adapted when the latter is raised to engage and lift the end of the lever L.

When the actuating-wheel is driven forwardly or in the proper direction to lower the cutter-bar, the latter continues to descend until the lower end of the adjusting-screw F′ strikes the upper end of the lever L and by depressing the latter reverses the engine,

whereupon the actuating-wheel is driven in the opposite direction. The rack-bar is elevated until the stop $f^2$ raises the end of the lever L, and thus arrests the movement of the engine in that direction. Preferably the stop $f^2$ will be arranged to simply stop the engine but not to entirely reverse it, and when it is desired to again lower the cutter the reversal of the engine will be accomplished by an attendant. Obviously by adjusting the screw F′ up or down the depth to which the cutter is driven may be regulated at will.

Next describing the mechanism by which the loosened earth is scooped up and elevated from the trench, this is constructed and arranged as follows:

The lower side bars D D are extended rearwardly and form the side members of an extension of the wheeled truck-frame, upon which is mounted an auxiliary movable frame which depends within the trench and forms the support upon which the elevating devices are mounted. Said frame is shown in the present instance as comprising vertical bars M M M′ M′, which depend from each side of the truck-frame, and parallel longitudinally-arranged side bars $M^2$ $M^3$, rigidly connected with the bars M M′ of the respective sides. The two sides of the frame thus formed are adjustably held parallel with each other and at a fixed distance apart by means of two pairs of right and left threaded studs or braces N N and N′ N′ entering inwardly from the ends of the horizontal bars $M^2$ $M^3$, respectively, and connected by turnbuckles $n$ $n'$.

$N^2$ designates a transverse supporting bar or shaft extending through the upper ends of the bars M M and engaging at its ends with horizontal slots $n^2$ $n^2$, formed in inner frame-timbers $N^4$ $N^4$, which are secured against the inner sides of the timbers D D. The bar $N^2$ is provided with right and left threaded portions $n^3$ $n^3$ where it extends through the ends of the bars M, and also with a squared portion $n^4$, by means of which it may be turned.

$N^5$ $N^5$ designate short supporting-bars secured one to each of the upper ends of the vertical bars M′ M′, extending outwardly therefrom and through horizontal slots $n^5$, also formed in the frame-pieces $N^4$ $N^4$.

$N^6$ $N^6$ designate longitudinally-arranged adjusting-screws suitably mounted upon the side timber D by means of screw-threaded bearings $n^6$ $n^6$ and having swiveled connection with the end bearings of the shafts $N^5$ $N^5$, whereby the latter and the shaft $N^2$ may be adjusted within their respective slots $n^5$ $n^2$ and the entire frame supported by said shafts correspondingly adjusted longitudinally upon the truck-frame.

O O designate shields or earth-supporting plates secured to the outer sides of the two depending auxiliary frames and adapted to prevent the loose earth and the sides of the trench from falling into the latter.

Next describing the bucket or shovel and the mechanism for actuating the same, R designates a shaft mounted transversely between the sides of the auxiliary frame by means of suitable bearings R′ R′, secured to the latter. Upon the shaft R is mounted a gear-segment S, with which intermeshes a driving-pinion T, secured to a second shaft T′, mounted upon the supporting frame-piece D.

$T^2$ designates a drum secured upon the opposite or outer end of said shaft T′, about which drum is coiled a driving-cable $T^3$, secured at its opposite ends to a second drum $T^4$, mounted upon the corresponding end of the shaft G.

U designates a toggle-arm mounted to oscillate upon the shaft R and pivotally connected at its lower end with the end of a second toggle-arm U′. The other end of the toggle-arm U′ is forked or provided with a cross-bar $u$ and two parallel side bars $u'$ $u'$, between the ends of which a shovel or bucket V is pivotally mounted. The pivot-studs of the bucket V are located slightly back of the transverse median line of the receptacle, so that when the latter is filled its front end will be the heavier. The bucket V is of scoop form, being provided with a metal bottom having a sharp cutting front edge, sides, and a rearwardly-inclined back end. Runners V′ V′ are also provided, which extend rearwardly in continuation of the bottom plate of the bucket.

The toggle-arm U is mounted upon the shaft R close to the side of the gear-segment S, and the latter is provided with a radially-arranged rib or flange $s$, located upon and extending at right angles outward from the side of said gear-segment and adapted as the latter is turned about its axis to engage and carry upward with it the toggle-arm U.

$u^2$ is a projection secured to the rear side of the toggle-arm U and adapted, as the latter is carried upward, to engage with and prevent the toggle-arm U′ from pivoting backwardly beyond a position in alinement with the arm U. In other words, when the arm U has been carried upward sufficiently to bring the toggle U′ in alinement therewith, the projection $u^2$ engages the rear lower side of the toggle-arm U′ and by preventing further flexure of the toggle lifts the latter and the shovel mounted thereon bodily upward in an arc described by a radius equal to the combined length of said toggle-arms.

In order that the scoop V may not tilt downwardly at its forward heavier end beyond a position with its bottom in alinement with the arm U′, a projection $v$ is provided thereon, which is adapted to engage with a lug $u^3$, projecting downwardly from the arm U′.

$V^2$ designates a latch-bolt mounted longitudinally upon the under side of the toggle-arm U′, comprising two telescopic sections, and is held normally extended by means of an expansion-spring $v'$, as clearly indicated in the detail Fig. 7.

$v^5$ indicates a toggle-link connected at one end to the projection $u^2$ and at its other end

to the adjacent member of the latch-bolt, by means of which the spring $v'$ is brought under tension, so as to tend to project the forward member of the pin $v^2$ and cause it to enter and engage a notch $v^6$, formed in the rear part of the shovel V, when the toggle is straightened in its oscillatory movement.

In order that the toggle-arm U may be lengthened, so as to excavate trenches deeper than that therein shown, said arm is extended above its point of pivotal connection with the shaft R and slotted longitudinally, as shown. Within this slot is arranged to slide a bearing-block $U^2$, by means of which the arm has pivotal connection with the shaft R. $U^3$ designates an adjusting-screw threaded through a cross-block $u^4$ at the end of the arm U and having swiveled connection at its inner end with the said bearing-block $U^2$.

W is a wheeled conveyer or car mounted to travel upon an elevated track structure W', supported from the main frame, the track-rails of which are inclined upwardly and rearwardly, so that a car will tend to run by gravity to the forward end of the structure. The forward or lower end of the track structure is so located as to bring a car standing thereon in suitable position to receive the earth carried upward and ejected from the shovel, as presently to be described, the ends of the track-rails W' being upturned, as shown, or other suitable stop provided to arrest the car when it arrives at the proper point.

In order that the car W may be automatically drawn to the rear end of said track structure, a standard $W^3$ is extended upward from this end, upon the upper end of which is mounted a guide-pulley $W^3$. A second pulley $W^4$, provided with a plurality of grooves, is mounted upon the upper part of the upright standard $D^4$, located in rear of the rack-bar F, and a third guide-pulley $W^5$ is mounted upon the cutter E or lower end of the rack-bar F. $W^6$ designates a cable secured to the rear end of the car W and trained from thence around the pulleys $W^3$ and $W^4$ a plurality of times, the number of which is determined by the length of travel which the car is designed to have.

The car or conveyer may obviously be of any preferred form adapted to dump or discharge the earth therefrom, that shown herein being similar to the mechanism illustrated and described in a prior pending application filed January 24, 1895, Serial No. 536,007.

In the case of ditching for tiles, for which purpose the present machine is particularly well adapted, the sections of tiling will be placed within the trench immediately behind the machine and the earth dumped back into the trench upon the pile, as indicated in the drawings.

Means are provided for automatically moving the entire machine forward a short distance upon each successive reciprocation of the cutter as follows: X is a winding-shaft suitably mounted transversely upon the upright frame of the machine near the front side of the rack-bar F. X' designates a gear-wheel loosely mounted upon said shaft X and adapted to intermesh with a series of trundles $f^4$, provided in the lower part of the said rack-bar. $X^2$ indicates a ratchet-wheel rigidly secured upon the shaft X adjacent to the gear X', which latter carries on its proximate side a pivoted pawl $x$, adapted to act in one direction upon the ratchet-wheel $X^2$. $X^3$ indicates a cable having one end secured to the winding-shaft X, trained from thence down and around a guide-pulley $X^5$, mounted in the lower part of the frame, and from thence carried forward beneath the truck and suitably anchored to the forward end of the track-rails or otherwise. As thus arranged, it will be obvious that upon each reciprocation of the rack-bar F the series of trundles $f^4$ will engage the teeth of the gear X' and turn the latter both in the upper and downward movement of the bar. In the upward movement of the bar the gear-wheel will simply turn idly upon the shaft X, but in the downward movement the pawl $x$ will engage the ratchet-wheel $X^2$ positively and drive the shaft in a direction to wind up the cable $X^3$. In order that the shaft X may not be turned back by the elasticity of the cable $X^3$ when the series of trundles of the rack-bar has passed the gear and the latter is released, a second ratchet-wheel $X^6$ is mounted upon the shaft X adjacent to one end thereof and a pawl $x$ mounted upon the upright $D^3$ and arranged to engage said ratchet and prevent the shaft from turning backward.

The operation of the apparatus thus constructed is as follows: Assuming the parts to be in the position shown in the drawings, with the cutter at the lowest limit of its movement and the engine reversed so as to elevate the same, the upward movement of the rack-bar, through its engagement with the gear H, operates to wind the cable $T^3$ upon the drum $T^4$, thus unwinding it from the drum $T^2$ and actuating the gear-segment S. As soon as the said segment S has been turned sufficiently to bring the flange $s$ thereof into engagement with the rear side of the toggle-arm U the latter will be carried around therewith, thus serving to force the shovel or scoop V along the bottom of the trench, so as to slide beneath the earth loosened by the last downward movement of the cutter. As the scoop V is thus forced forward the rear end of the toggle-arm U' will be carried upwardly by the arm U until the two have assumed a position in alinement with each other, whereupon the projection $u^2$ of the arm U will engage with the rear under side of the toggle-arm U', thus holding the latter in rigid alinement. The continued movement of the gear-segment S will lift the scoop bodily upward until it assumes the position indicated in dotted lines in the drawings, in which position its load will fall by gravity into the car W.

Further movement of this segment in this direction will be arrested at this point by the contact of the stop $f^2$ of the rack-bar with the lever L, thus stopping or shutting off the engine. At the same time when the toggle-arm U begins to lift the arm U′ the link $v^5$ begins to compress the spring $v'$ of the pin $v^2$, and would force the latter into the notch $v^6$ of the scoop V were it not for the fact that the arm U′ is simultaneously lifted upward, so that the end of the spring comes into contact with the segmental-shaped surface $v^2$ of the scoop and rides upwardly thereon. The further straightening of the toggle-arms therefore serves merely to increase the tension of the expansion-spring $v'$ upon the pin $V^2$. When, however, the toggle-arms have assumed a straight position, the scoop V, by reason of the fact that it is pivoted back of its center, will first be tilted upward at its rear end until it assumes a position in alinement with the arm U′, or in the same relation thereto as shown in the drawings, the end of the spring-pressed pin $V^2$ being caused to travel back over the segmental surface $v^2$ and finally snap into the notch $v^6$. The latch-pin $V^2$ serves to prevent the scoop from tilting over rearwardly when the latter is in its uppermost or dumping position. When the toggle-arms have reached a position in alinement with each other and the scoop has been tilted up into alinement with the arm U′, the heel or projection of the scoop comes into contact with the depending lug $u^3$ of the arm U′ and prevents further tilting of the scoop.

It is to be noted that while the arc-shaped path traversed by the scoop in its upward movement crosses or extends into the path of the reciprocating cutter E the latter will at such times be elevated sufficiently to avoid interference with the scoop.

The scoop having reached its uppermost position and been dumped, the engine is reversed and the cutter-bar started down. As the drum $T^4$ unwinds the cable $T^3$ the scoop will by gravity return to its normal lowermost position or that shown in the drawings.

During the first part of the downward movement of the rack-bar F the rack-teeth $f^4$, which are at this time in engagement with the gear X′, will actuate the latter, thus moving forward the entire apparatus before the cutter reaches the earth. The continued downward movement of the latter will therefore serve to slice off a fresh supply of the earth from the front end of the trench.

As the cutter E rises the cable $W^6$ is allowed to unwind, and the car W moves by gravity down to the forward end of the track in position to receive the earth from the scoop. Upon the return or downward movement of the cutter the pulley carried thereon, moving away from the pulley W, operates to take up the cable and thereby draw the car back to its rearmost position, where it is dumped in any suitable manner.

In case it is desired to adjust the apparatus for excavating a deeper trench the adjusting-screw F′ of the rack-bar is turned up sufficiently to allow the cutter to enter the earth the desired distance before the engine is reversed. The toggle-arm U is next lengthened by means of the adjusting-screw $U^3$, so as to carry the scoop down to the new lower level of the bottom of the trench. The lengthening of the toggle-arm U will obviously cause the scoop to swing upwardly upon a longer radius, and in order that it may not interfere with and strike the front end of the trench the entire elevating mechanism must be adjusted rearwardly. This is accomplished by means of the pair of adjusting-screws $N^6$ $N^6$, which act upon the ends of the supporting-shafts M′. By turning said adjusting-screws in the proper direction the supporting-shafts M and M′ are moved backwardly within the slots $n^2$ $n^5$, respectively, and the entire mechanism supported by said shafts adjusted correspondingly.

It will be obvious from the foregoing description that an apparatus constructed in accordance with my invention possesses many important features of improvement. By means of the mechanism described the scoop is given a most effective movement for properly dressing out the bottom of the trench and scooping up and elevating the loosened earth. Just at that part of the movement of the shovel when it is cutting loose the earth at the bottom of the trench, which cannot be fully loosened by the vertically-reciprocating cutter, it is given a most powerful thrusting action by the arrangement of the toggles. The dumping of the scoop is also effected in a most simple and direct manner.

It will be understood that various of the details described herein are not essential. For instance, in the drawings a steam-engine is shown for operating the machine, but obviously an electric motor or other motive power might be substituted therefor.

I claim as my invention—

1. The combination with a vertically-reciprocating spade or cutter, of a vertically-movable bar, to the lower end of which the cutter is attached, a motor for actuating said bar, embracing a reversing-gear and means for actuating said reversing-gear, comprising vertically-separated stops on the bar, and a movable part which is located in position to be acted on by the stops, and which is connected with and actuates said reversing-gear, substantially as described.

2. The combination with a vertically-reciprocating spade or cutter, of a vertically-movable bar supporting the same, a motor for actuating said bar, provided with a reversing-gear, vertically-separated stops on the bar, of which the upper one is vertically adjustable to variably limit the descent of the cutter and a movable part located in position for contact with said stops, and connected with said reversing-gear, substantially as described.

3. The combination with a spade or cutter of a rack-bar, supporting the same, a gear-wheel engaging the rack-bar, a motor actuating the gear-wheel, said motor having a reversing-gear, vertically-separated stops on the bar, and a movable part located in position for contact with said stops and connected with the said reversing-gear, substantially as described.

4. An excavating apparatus comprising a movable frame, a motor mounted thereon and provided with a reversing-gear, a vertically-movable cutter, a rack-bar for supporting the same, mounted to slide vertically in the frame, a gear-wheel engaging the rack-bar, said wheel being driven by the motor, vertically-separated stops on the rack-bar, the upper one of which is vertically adjustable, and a movable part located in the frame in position for contact with said stops and having operative connection with the said reversing-gear, substantially as described.

5. An excavating apparatus embracing a bucket, an oscillatory jointed arm, the outer part of which is adapted to be flexed on the main part in one direction only from its position when extended in prolongation of said main part, said bucket being pivoted to the outer part of the arm and a spring-actuating locking device for holding the bucket from turning on the outer part of the arm, said locking device comprising members which are connected with the main and outer part of the arm at either side of the joint in the same, whereby the locking device will be automatically actuated by flexure of the arm, substantially as described.

6. An excavating apparatus embracing a bucket, an oscillatory jointed arm adapted to be flexed in one direction only, said bucket being pivoted to the arm, and a locking device for the bucket comprising a bolt mounted on the outer part of the arm and connected with the inner part of the arm by a spring connection and a notched plate on the bucket adapted for engagement with said bolt substantially as described.

7. An excavating apparatus embracing a bucket, an oscillatory jointed arm to which the bucket is pivoted and a locking device for the bucket, embracing a bolt mounted to slide on the outer part of the arm, said bolt consisting of two endwise-movable parts connected by a spring, a link connecting the bolt with the inner part of the arm, and a notched plate on the bucket adapted to engage the bolt, substantially as described.

8. An excavating apparatus embracing a bucket, and an oscillatory jointed arm to which the bucket is pivoted, said bucket being provided with a rearwardly-projecting runner, substantially as described.

9. An excavating apparatus embracing a bucket, an oscillatory jointed arm to which the bucket is pivoted, and a locking device for holding the bucket from turning on the arm: said bucket being provided with a rearwardly-projecting runner, substantially as described.

10. An excavating apparatus embracing a bucket, an oscillatory jointed arm, carrying the bucket, and a rock-shaft, on which the arm is mounted, said arm being connected with the shaft by a bearing-block which is adjustable endwise on the arm to vary the length of the latter, substantially as described.

11. An excavating apparatus, embracing a bucket, an oscillatory jointed arm, carrying the bucket, a rock-shaft on which the arm is mounted, said arm being provided with a longitudinal guide-slot a bearing-block engaging the shaft and adapted to slide in said guide-slot, and an adjusting-screw engaging the arm and block for adjustably holding said block in place, substantially as described.

12. An excavating apparatus embracing a bucket, an oscillatory jointed arm carrying the bucket, a rock-shaft on which the arm is loosely mounted, a gear-segment attached to the shaft and provided with a stop or projection engaging the arm to move the same, and a gear-pinion actuating the said gear-segment, substantially as described.

13. An excavating apparatus embracing a bucket, an oscillatory jointed arm to which the bucket is pivoted, a locking device for holding the bucket from rotation on the arm, a rock-shaft on which the arm is loosely mounted, a gear-segment attached to the shaft and provided with a stop or projection engaging the arm to move the same in lifting the bucket, substantially as described.

14. The combination with a vertically-reciprocating spade or cutter, of a bucket, an oscillatory jointed arm, carrying the bucket, a rock-shaft on which said arm is mounted, and operative connection between the spade and rock-shaft, by which said rock-shaft is turned when the spade is moved vertically, substantially as described.

15. The combination with a vertically-reciprocating spade or cutter, of a bucket, an oscillatory jointed arm, to the free end of which the bucket is pivoted, a locking device to hold the bucket from turning on the arm, a rock-shaft on which the arm is mounted, and operative connection between the said spade and the rock-shaft, substantially as described.

16. The combination with a vertically-reciprocating spade or cutter of a vertically-movable rack-bar, a gear-wheel engaging the rack-bar, for actuating the latter, a bucket, an oscillatory jointed arm to the free end of which the bucket is pivoted, a rock-shaft on which the arm is mounted, and actuating connections between said gear-wheel and the rock-shaft for actuating the said arm, substantially as described.

17. The combination with a vertically-reciprocating spade or cutter, of a vertically-movable rack-bar, a gear-wheel which engages the rack-bar, a bucket, an oscillatory

jointed arm carrying the bucket, a rock-shaft on which the arm is mounted, a gear-segment attached to the rock-shaft, a gear-pinion engaging said segment, winding-drums attached to the shafts of said gear-wheel and gear-pinion, and a cable wound about said drums, substantially as described.

18. The combination with a vertically-reciprocating spade or cutter, of a vertically-movable rack-bar, a gear-wheel which engages the rack-bar, a bucket, an oscillatory jointed arm carrying the bucket, a rock-shaft on which said arm is loosely mounted, a gear-segment rigidly attached to the rock-shaft, and provided with a projection adapted to engage the arm, a gear-pinion in mesh with the gear-segment, winding-drums on the shafts of the gear-wheel and gear-pinion, and a cable wound about said drums, substantially as described.

19. The combination with a bucket, of an oscillatory jointed arm, to which the bucket is pivoted, a locking device detachably engaging the bucket, an elevated track, extending to a point above the pivoted axis of the arm and a conveying-car resting on the track, substantially as described.

20. The combination with a bucket, of an oscillatory jointed arm to which the bucket is pivotally connected, a locking device detachably engaging the bucket to hold it from turning, a track extending to a point over the pivotal axis of the arm, said bucket having an inclined rear wall, and a rearwardly-projecting runner, substantially as described.

21. The combination with a vertically-reciprocating spade or cutter, of an earth-elevating device, track-rails extending from the elevating device away from the same at an upward inclination, a conveyer-car on the track-rails, a guide-pulley at the outer end of the rails, guide-pulleys on the cutter and machine-frame, and a rope attached to the car and passing over said pulleys, substantially as described.

22. An excavating apparatus embracing a movable frame, a vertically-reciprocating cutter, a vertically-movable bar supporting the cutter and mounted on the frame, an earth-elevating bucket and an oscillatory jointed arm carrying the bucket and an auxiliary frame, in which said arm is mounted, said auxiliary frame being movable on the main frame toward and from the cutter, substantially as described.

23. An excavating apparatus embracing a movable frame, a vertically-reciprocating cutter, an earth-elevating device, earth-supporting plates, attached to the frame and located at either side of the elevating device, said plates being bodily movable laterally on the frame and adjustable braces between the plates, substantially as described.

24. An excavating apparatus embracing a movable frame, a vertically-reciprocating cutter, a vertically-movable bar supporting the same, an earth-elevating device, an auxiliary frame adjustably attached to the main frame for supporting said elevating device, and earth-supporting plates located at the outer sides of said auxiliary frame, substantially as described.

25. An excavating apparatus embracing a movable frame, a vertically-reciprocating cutter, a vertically-movable bar supporting the same, an earth-elevating bucket, an oscillatory jointed arm carrying said bucket, a rock-shaft on which said arm is mounted, an auxiliary frame in which said rock-shaft is mounted, said auxiliary frame being adjustably attached to the main frame and earth-supporting plates located at the outer faces of said auxiliary frame, said plates being adjustable toward and from each other, substantially as described.

26. The combination with a vertically-movable cutter and an earth-elevating device adjacent thereto, of earth-supporting plates located at opposite sides of the elevating device, horizontally-arranged frame-bars located at the inner faces of the plates to stiffen the same, and cross-braces located at the rear of the elevating device, and acting on each of the bars at two horizontally distant points, substantially as described.

27. The combination with a main frame of a vertically-movable cutter mounted thereon, an earth-elevating device adjacent thereto, embracing a bucket, and an oscillatory jointed arm carrying the same, earth-supporting plates located at opposite sides of the elevating device, horizontal frame-bars at the inner faces of the plates, a vertical frame-bar engaging both horizontal bars near their rear ends, said bars being supported at their upper ends by attachment to the main frame, and cross-braces extending between the vertical frame-bars and between the rear ends of the horizontal frame-bars, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 8th day of April, A. D. 1895.

HERBERT R. KEITHLEY.

Witnesses:
JNO. J. BONNER,
ELLA R. DEAN.