(No Model.) 5 Sheets—Sheet 1.

W. WATSON.

EXCAVATING AND PIPE LAYING MACHINE.

No. 385,435. Patented July 3, 1888.

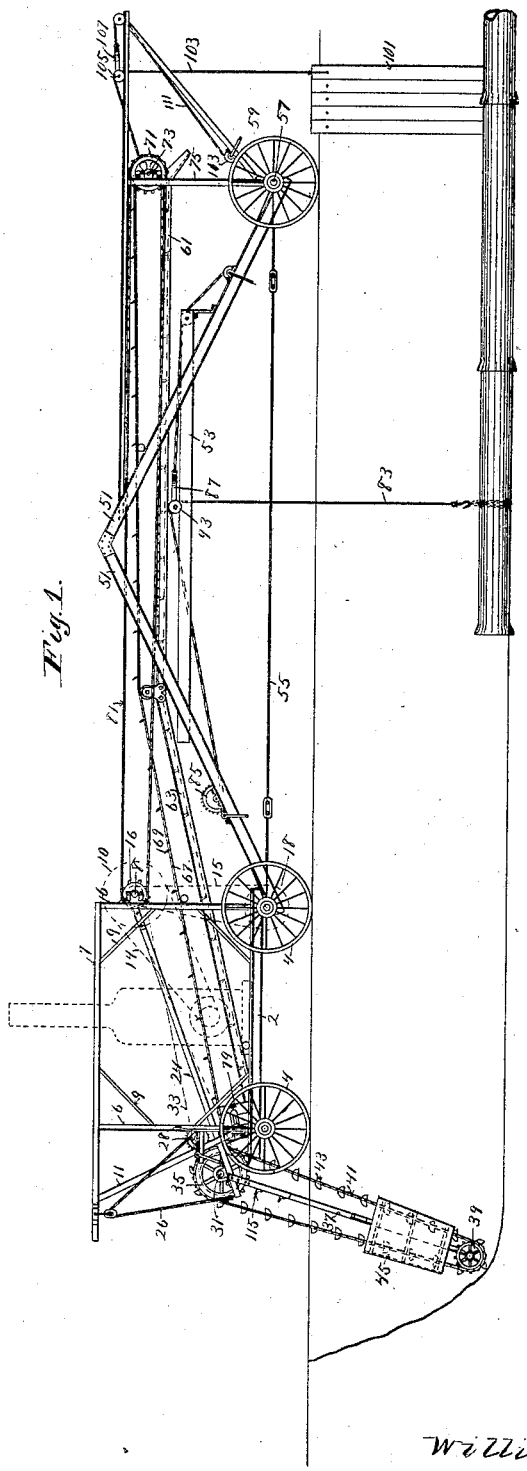

Fig. 1.

Witnesses.
S. J. Beardslee.
J. Jessen.

Inventor.
William Watson.
By Paul, Sanford & Merwin Attys.

(No Model.) 5 Sheets—Sheet 2.

W. WATSON.

EXCAVATING AND PIPE LAYING MACHINE.

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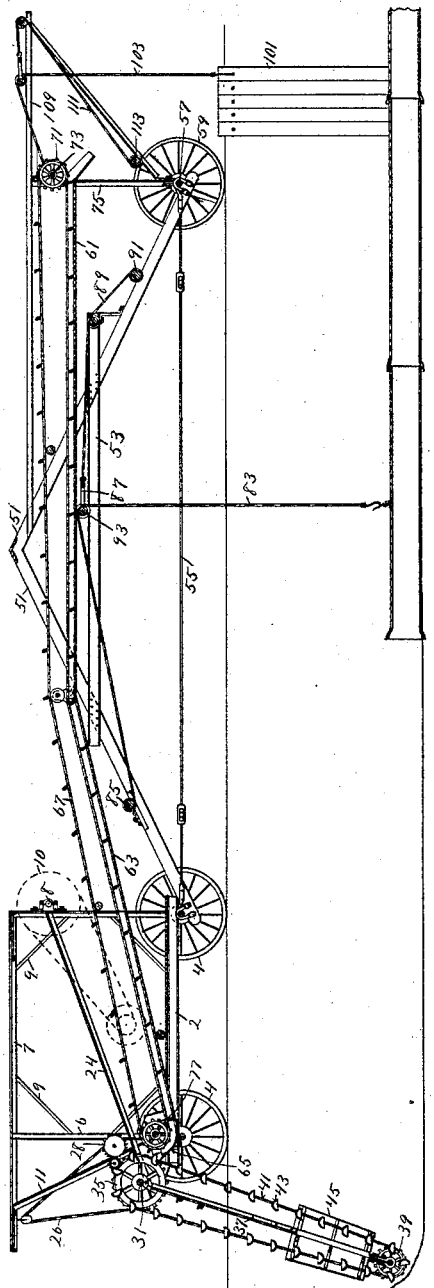
Fig. 2.



Witnesses.
L. J. Beardsley
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Inventor.
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By Paul, Sanford & Merwin. Attys.

(No Model.) 5 Sheets—Sheet 3.

W. WATSON.

EXCAVATING AND PIPE LAYING MACHINE.

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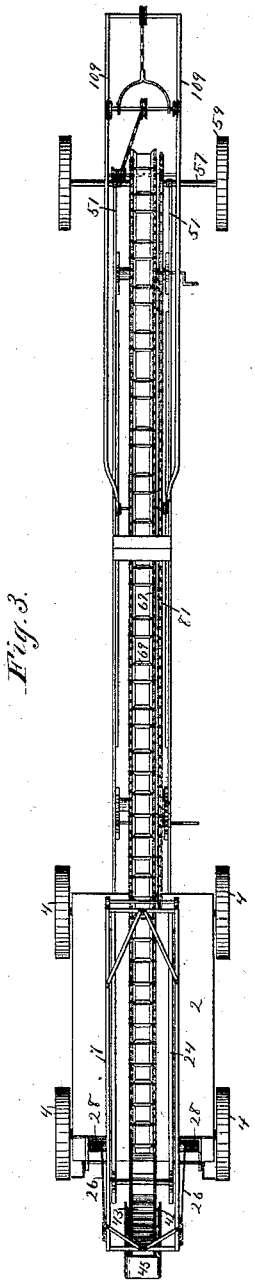

Fig. 3.

Witnesses.
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(No Model.) 5 Sheets—Sheet 4.

W. WATSON.

EXCAVATING AND PIPE LAYING MACHINE.

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Fig. 5.

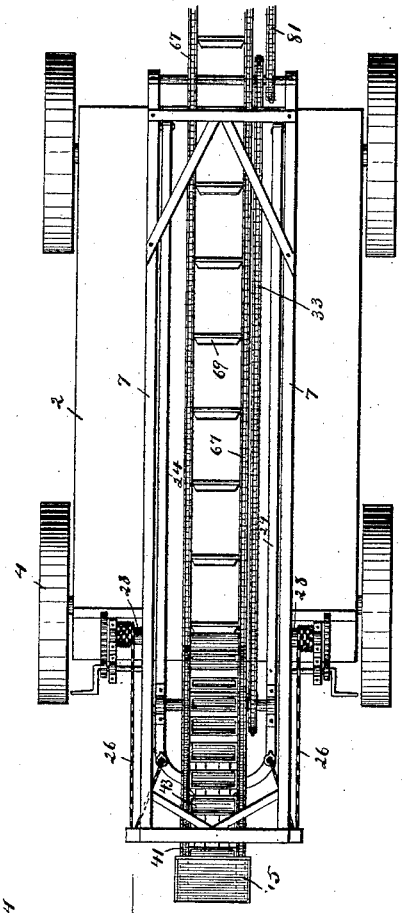
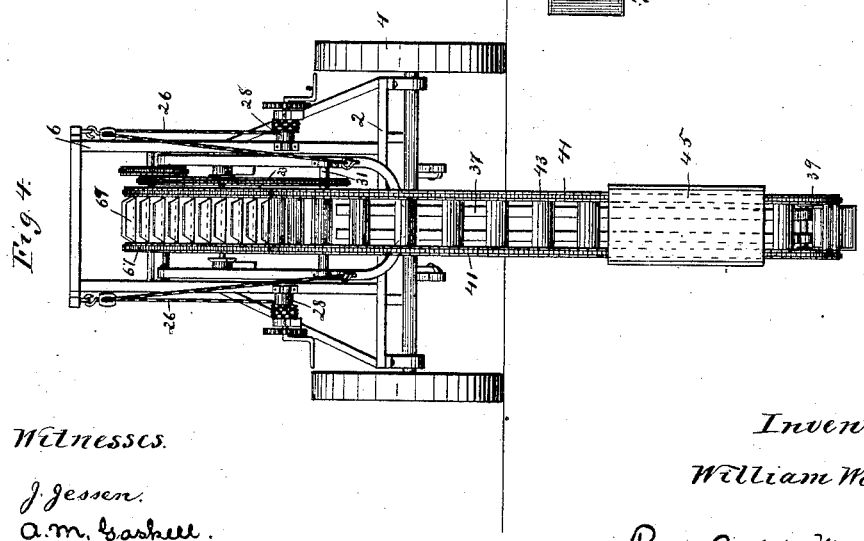


Fig. 4.



Witnesses.

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(No Model.) 5 Sheets—Sheet 5.

W. WATSON.

EXCAVATING AND PIPE LAYING MACHINE.

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Fig. 6.

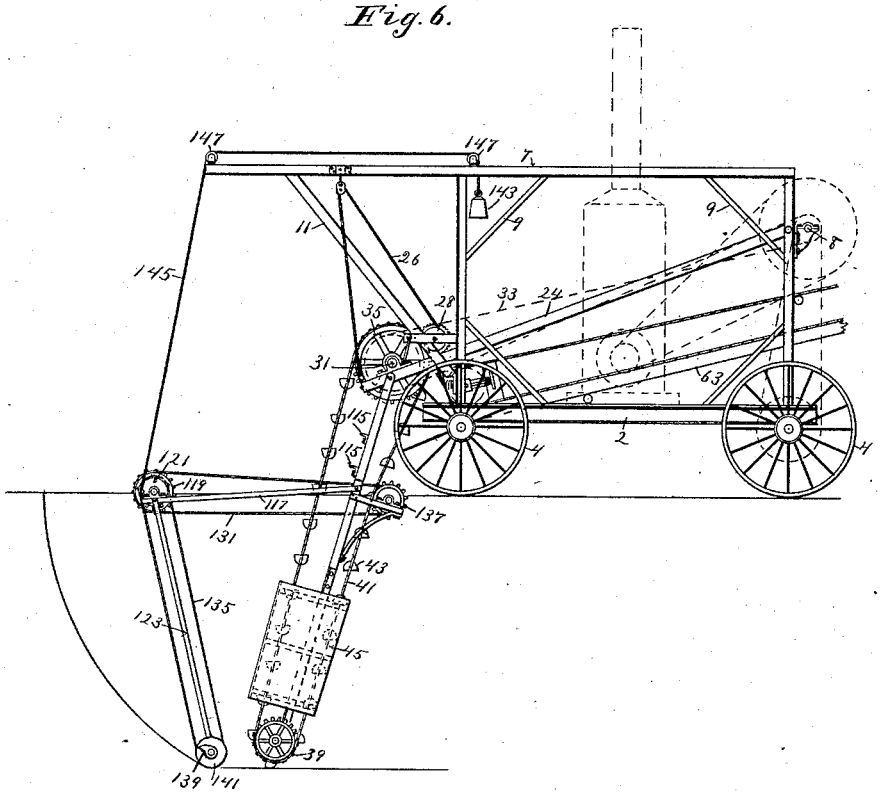


Fig. 7.

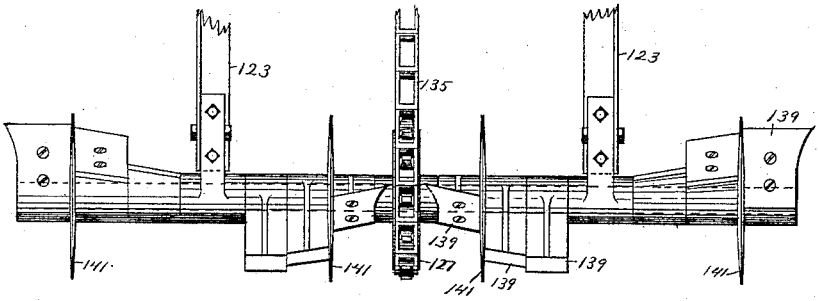
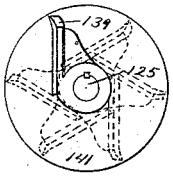


Fig. 8.



Witnesses.
S. J. Beardsley.
J. Jessen.

Inventor,
William Watson.
By his Attorneys.
Paul, Sanford & Merwin.

UNITED STATES PATENT OFFICE.

WILLIAM WATSON, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR TO THE NATIONAL STEAM EXCAVATING COMPANY, OF MINNESOTA.

EXCAVATING AND PIPE-LAYING MACHINE.

SPECIFICATION forming part of Letters Patent No. 385,435, dated July 3, 1888.

Application filed December 21, 1887. Serial No. 258,588. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM WATSON, of Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain Improvements in Machines for Making Excavations, Laying Pipe, &c., of which the following is a specification.

The object of my invention is to provide an improved machine for forming excavations and conveying the material removed and depositing it at any convenient point. This machine is especially adapted for forming excavations for sewers and laying water and other pipes, and when thus used it is preferably provided with means for lowering the water-pipe into position, with means for drawing out the sheathing-plank after the pipe has been laid, and also means for receiving the material raised by the excavator, conveying it to the point where the pipe has been laid, and dumping it back into the excavation, thereby filling the excavation as fast as the pipe is laid, and thus obviating the necessity of handling the material removed from the excavation a second time.

To these ends the invention consists, generally, in the construction and combination hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, forming a part of this specification, Figure 1 is a side elevation of my improved machine, showing the manner of using it for laying water-pipe. Fig. 2 is a longitudinal vertical section of the same. Fig. 3 is a plan view. Fig. 4 is an end view of the machine on a larger scale than the other figures; Fig. 5, a plan view of the machine on a similar scale. Figs. 6, 7, and 8 are details showing the cutters.

In the drawings, 2 represents the main frame of the machine, which is preferably in the form of a carriage and suitably supported upon wheels 4. Upon the carriage 2 is a suitable frame-work, consisting, preferably, of the upright standards 6, which are connected at their upper ends by the horizontal bars 7, with which the standards are rigidly connected. Suitable braces, 9, may also be provided to insure a rigid connection between the standards 6 and the horizontal bars 7. The bars 7 preferably extend beyond the standard 6 at the front end of the machine and overhang the front end of the carriage. The forward ends of the bars 7 are preferably provided with additional supports by means of the inclined braces 11, arranged at each side of the carriage. A strong frame supported upon the body of the carriage is thus provided, and upon this the various parts of the mechanism are supported in the manner hereinafter described. I prefer to mount upon the carriage a suitable steam-engine, by means of which the mechanism hereinafter described may be driven, and also a boiler to furnish steam for said engine. The engine and boiler will usually be arranged upon opposite sides of the carriage, so as to make the weight as nearly equal as possible upon all sides of the carriage. Both the boiler and the engine used may be of any ordinary construction, and I do not deem it necessary to show or describe either of them with particularity herein.

In Fig. 1 I have indicated the position of the boiler in dotted lines, and also in dotted lines the position of the main shaft of the engine, from which power is applied, through the mechanism hereinafter described, to the operative parts of the machine.

A suitable shaft, 8, is mounted in bearings upon the standard 6, and is provided with driving-pulleys 10, to which power is applied from the engine through a suitable belt, 14. A sprocket-wheel, 16, is preferably mounted upon the shaft 8, and an endless chain or belt, 15, passes over the teeth and around the sprocket 18 upon the axle of the carriage. By this means power may be applied as well to the axle for the purpose of propelling the machine, either when it is to be advanced to its work or when it is to be transported from place to place. The shaft 8 will preferably be provided with an ordinary clutch device, so that the chain 15 will be driven only when it is desired to propel the carriage. A swing frame or sweep, 24, is preferably pivoted to the standards 6, substantially in a horizontal line with the shaft 8, and as near the center of the said shaft as may be convenient. The opposite end of this sweep is raised and lowered by means of suitable cables or ropes, 26, attached

thereto and passing over the sheaves upon the forward end of the overhanging bar 7, and downward to spools or crabs 28, on which the said ropes are wound. These spools are preferably provided with suitable pawls and ratchets to prevent them from turning backward under the strain exerted upon them by the weight of the sweep. These ropes or cables are preferably attached to the sweep on each side thereof, and are operated independently, so that the portion of the sweep to which they are attached may be kept substantially level, although the carriage may stand on an incline with one side higher than the other. Mounted upon the forward end of the sweep 24 is a shaft, 31, which is preferably driven by a belt, 33, from the shaft 8. This shaft also carries the sprocket-wheels 35 of the elevator, hereinafter described. The elevator-frame 37 is pivoted upon the front end of the swinging frame 24 and is free to swing thereon. In the lower end of this frame sprocket-wheels 39 are mounted, and an excavating and elevating belt, 14, provided with the buckets 43, passes around the sprockets 35 and around the sprockets 39. A suitable casing, 45, is secured upon the elevator-frame and extends outside the belt 41 for a portion of its length above the sprocket 39, leaving the lower end of the belt exposed, so that the buckets are free to come in contact with the material at the lower part of their travel and are protected by casing 45 after they have been filled, so that the material cannot fall against this portion of the belt and form an obstruction to the same. The elevator-frame is preferably arranged within the elevator-belt, as shown; but I make no claim herein to the construction of the same, as I claim it in a separate application for Letters Patent. By means of the elevator and the driving mechanism already described the material from the excavation will be raised and deposited in a suitable hopper, hereinafter described, arranged upon the carriage.

The manner in which the elevator works will be readily understood. The buckets descend empty and are filled with the dirt or material from the lower part of the excavation as they pass around the lower sprocket-wheel and begin their upward movement, and as they pass around the upper sprocket-wheels the material is dumped out into the hopper.

Where the machine is to be used for making excavations for water-pipes and laying the pipes therein, I prefer to provide a suitable truss-frame that extends to the rear of the carriage a sufficient distance to form a support for a carrier that takes the material as it is delivered from the elevator and dumps it back into the excavation at a point where the pipes have been laid. This frame forms a support for the mechanism that is used for drawing the sheathing-plank, and also forms a support for the device by which the water-pipes are lowered into position.

The truss-frame that I prefer to use consists of the inclined bars 51, connected at a point about midway of their length by the horizontal bars 53, also connected at their lower ends by the tie-rod 55. I do not confine myself to this construction, however, as any other suitable truss may be used with or without the tie-rod 55. The forward end of this truss is preferably pivoted upon the rear axle of the carriage 2, although it may be connected with the carriage in any other suitable way. The rear end of the truss-frame is preferably mounted upon a suitable axle, 57, provided with wheels 59. The truss thus supported forms, therefore, a continuation or extension of the carriage 2. A suitable conveyer-box, 61, is mounted upon this truss-frame and extends from a point near the rear end thereof nearly to its forward end, and a similar box, 63, is hinged to the forward end of the trough 61, and is adapted to rest at its forward end upon the carriage 2, and is provided with a hopper, 65, which is arranged at a point beneath the upper end of the elevator hereinbefore described and is adapted to receive material therefrom.

An endless conveyer-belt, 67, provided with a series of bars or flanges, 69, is arranged in the conveyer-box 61 and 63, and its rear end passes around suitable sprocket-wheels, 71, upon a shaft, 73, that is mounted in suitable bearings upon standards 75 at the rear of the truss-frame. The other end of the conveyer-belt passes around an adjustable idler-pulley, 77, arranged within the hopper 65. By means of adjusting-screws 79 the pulley 77 may be moved for the purpose of tightening the belt. The shaft 73 is driven by a suitable belt, 81, extending around a pulley on the shaft 8, whereby the shaft 73 is driven, and thereby drives the conveyer-belt 67. The conveyer-belt, traveling in the direction of the arrows shown in Fig. 1, draws the material along in the conveyer-trough, from which it is discharged at the rear of the truss frame. The forward end of the hinged portion of the conveyer-trusses 63 rests upon the platform of the carriage 2 and is free to be raised and lowered thereon, turning upon the hinge, by which it is connected to the rigid or fixed portion in the conveyer-trough 61.

It will be seen that when the machine is used for making excavations for water-pipe a portion of the excavation equal to substantially the length of the machine will be open, that the dirt will be taken out at the forward end of the machine, carried along over it and dumped at its rear end. The part of the excavation that is between the forward and the rear ends of the machine will therefore be open, and in this part the water or other pipes may be laid, to be covered by the dirt that is dumped back into the excavation at the rear end of the machine. In order that the water-pipe may be conveniently lowered into the excavation, I leave an open space along each side of the truss-frame, and prefer to provide a hoisting device, by which the pipe may be raised from the ground, swung over the excavation, and lowered into place. Any suitable device may

be used for this purpose. I prefer to provide a cable or chain, 83, that is adapted to be wound upon a windlass, 85, mounted upon the truss-frame and adapted to be operated by hand, or to be connected with the driving mechanism and operated by power. A small carriage or trolley, 87, is preferably arranged upon the horizontal bars 53 on the truss-frame, and is adapted to move back and forth thereon. The trolley 87 is connected by rope or chain 89 with the windlass 91, by means of which the position of the trolley on the bars which support it may be determined. By turning up the windlass and winding the rope 89 thereon the trolley 87 may be drawn toward the windlass. By unwinding the rope the trolley may be allowed to move in the other direction. The trolley 87 is provided with a roll or sheave, 93, over which the cable 83 passes. By moving the trolley as the pipe is being lowered the point at which the pipe may be placed in the excavation may be determined.

In order to prevent the dirt at the sides of the excavation from caving in, it is customary to drive sheathing-plank, 101, down just inside of the wall of the excavation and to remove these after the pipe is laid. I prefer to provide my machine with means by which these plank may be pulled up when it is desired to remove them. This consists, preferably, of a cable, 103, provided with means for fastening to the upper end of the plank 101 and adapted to be wound upon a suitable spool upon the shaft 73. This spool is arranged to be engaged by a clutch on the shaft when it is desired to wind up the cable, and to be disengaged and turned freely on the shaft when it is desired to draw down the cable and hook it onto a plank. The cable 103 passes over a sheave or roll, 105, upon a trolley-frame, 107, that is adapted to move back and forth upon the beams 109 and overhangs the rear end of the machine.

The frame 107 is connected by a rope or chain, 111, with a windlass, 113, by means of which the position of the trolley may be varied to suit the position of the plank which is to be removed, thus enabling me to remove quite a number of the plank without changing the position of the machine.

The details of the machine may be varied without departing from my invention, and some of the auxiliary devices—such as the device for pulling out the sheathing-planks and the device for lowering the water-pipe into place—may be variously arranged, or omitted altogether, without departing from the principle of my invention.

The elevator-frame may be raised and lowered by means of the ropes 26, which are connected with the swing-frame or sweep 24, and the elevator-frame itself may be provided with a suitable staple or equivalent device, 115, and when it is desired to raise the elevator higher than can be done by raising the sweep the rope 26 may be unhooked from the sweep and hooked to the staple 115, thereby permitting the elevator-frame to be raised, so as to bring the lower end of the elevator above the ground. This will be convenient, especially when it is desired to move the machine from place to place. It will be understood that in using the machine it stands across the excavation that is made by it, and that as the dirt is removed at the forward end of the machine and carried up and back and dumped into the excavation again the machine is moved forward, preferably by driving the carriage by the means hereinbefore described.

In some instances I prefer to provide the machine with a series of cutters that will be arranged in front of the frame of the excavator for the purpose of cutting or loosening down the material in front of the excavator. The construction that I prefer for this purpose is shown in detail in Figs. 6, 7, and 8. A supporting-frame, 117, is pivoted upon the frame of the excavator and is provided with a shaft at its forward end, upon which are secured suitable sprockets, 119 and 121. A frame, 123, is pivoted to the forward end of the frame 117, and at its lower end is provided with bearings for a shaft, 125. This shaft is driven by suitable means or sprocket-chains, 131 and 135, connecting with a sprocket-wheel, 137, that is driven directly from the excavator-chain, as shown in Fig. 6. Secured upon the shaft 125 are a series of cutters, 139, preferably arranged substantially in spiral rows upon the shaft 125. I prefer, also, to provide a series of disks, 141, which are also arranged upon the shaft 125 between the cutters and extending slightly beyond the edges of the cutters. These disks, by extending beyond the edges of the cutters, first come in contact with bowlders or other obstructions in the soil which is being loosened and ward off the cutters from them. The counter-weight 143 is suspended over the excavator by the chain or cord 145, running from the frame of the cutting-machine over the sheaves 147, and serves to counterbalance the weight of the cutting-machine and permit it to be readily raised or lowered.

I claim as my invention—

1. The combination, in a machine of the class described, of a suitable carriage, an excavating-elevator adapted to raise the material from the excavation, an independent frame connected with said carriage and extending from the rear thereof, a conveyer-trough extending from the opposite end of said carriage, supported upon said frame and adapted to receive material from said elevator, and a conveyer arranged to draw said material along in said trough and to dump it back into the excavation, substantially as described.

2. The combination, in a machine of the class described, of a suitable carriage, a sweep pivoted upon said carriage, an elevating-excavator pivotally supported upon said sweep and arranged at one end of said carriage and adapted to raise material, and a frame extending from the opposite end of said carriage, a conveyer-trough supported upon said frame

and extending to a point beneath the upper end of said elevator, and a conveyer-belt arranged in said trough and adapted to convey material from said elevator to a point distant from the carriage, substantially as described.

3. The combination, in a machine of the class described, of a suitable carriage, a sweep pivoted upon said carriage, an excavating-elevator pivotally supported upon said sweep and arranged at one end of said carriage, a supporting-frame extending from the opposite end of said carriage, a conveyer extending from said carriage over said frame, and an apparatus for raising and lowering pipe arranged upon said frame between said carriage and the discharging end of said conveyer, substantially as described.

4. The combination, in a machine of the class described, of a suitable carriage, 2, the sweep 24, pivoted to standards 6 upon said carriage, the elevator-frame 37, pivoted upon the free end of said sweep, the elevator-belt 41, arranged upon said frame, and the hoisting-ropes 26 26, connected with said sweep and adapted to be wound upon windlasses, substantially as described.

5. The combination, in a machine of the class described, of a suitable carriage, the pivoted sweep 24, mounted upon said carriage, the excavating-elevator pivotally mounted upon the free end of said sweep, a hopper arranged beneath the upper end of said elevator and adapted to receive material therefrom, and a conveyer extending from said hopper to a point distant from said carriage, substantially as described.

6. The combination, in a machine of the class described, with the carriage 2 and the elevator mounted thereon, of the truss-frame connected with the opposite end of said carriage, the stationary conveyer-trough 61, supported upon said frame, the conveyer-trough 63, hinged to said trough 61 and adapted to receive material from said elevator, the conveyer belt 67, arranged to run in said troughs, and the pipe raising and lowering apparatus arranged upon said truss-frame, between said carriage and the discharging end of said conveyer, substantially as described.

7. The combination, with the carriage 2, the excavating-elevator mounted thereon, and the driving mechanism arranged upon said carriage, of the truss-frame connected with the rear end of said carriage and consisting of the inclined bars 51, the horizontal bars 53, the conveyer extending from a point beneath the discharging end of said elevator to the rear end of said truss-frame, the trolley 87, supported upon said truss-frame and adapted to be moved longitudinally thereon, the windlass 85, and the rope or cable 83, connected with said windlass and passing over said trolley-frame, substantially as described.

8. The combination, with the carriage 2 and the excavating-elevator mounted thereon and arranged at one end of said carriage, of the truss-frame connected with the opposite end of said carriage and having its rear end supported on suitable wheels, 59, and provided with the standard 75, the shaft 73, mounted in bearings in said standards, the stationary conveyer-trough 61, supported upon said truss-frame and extending to the rear end thereof, the conveyer-trough 63, hinged to the forward end of the said trough 61, and having its forward end resting upon said carriage and adapted to receive material from the said elevator, the idler-pulleys 77 77, the pulleys 71 on the shaft 73, and the endless conveyer-belt 67, arranged in said trough and passing around said pulleys 71 and 77, for the purpose set forth.

9. The combination, with the carriage 2, of the excavating-elevator mounted thereon, driving mechanism mounted on said carriage, the shaft 8, mounted in bearings on standards fixed upon said carriage, a frame connected with said carriage and extending to the rear thereof, a driving-shaft at the rear end of said frame, a conveyer extending from said carriage to the shafts at the rear end of said frame, and driving-belts extending from said shaft 8 to the shaft at the rear of the frame and to said elevator, substantially as described.

10. The combination, with the carriage provided with the elevator, of the frame connected with the rear end of said carriage, the conveyer extending from said carriage to the rear end of said frame, the pipe hoisting and lowering apparatus mounted upon said frame, between said carriage and the discharging end of said conveyer, and the plank-hoisting apparatus mounted upon the rear end of said frame, substantially as described.

11. In a machine of the class described, the combination, with the excavator, of the swinging frame provided with the shaft 125, the series of cutters 139, arranged upon said shaft, and the disks 141, arranged upon said shaft, substantially as described.

In testimony whereof I have hereunto set my hand this 17th day of December, 1887.

WILLIAM WATSON.

In presence of—

A. C. PAUL,

A. M. GASKELL.