No. 677,522. Patented July 2, 1901.

J. H. W. LIBBE.

TRENCH DIGGING MACHINE.

(Application filed Feb. 4, 1901.)

(No Model.) 3 Sheets—Sheet 1.

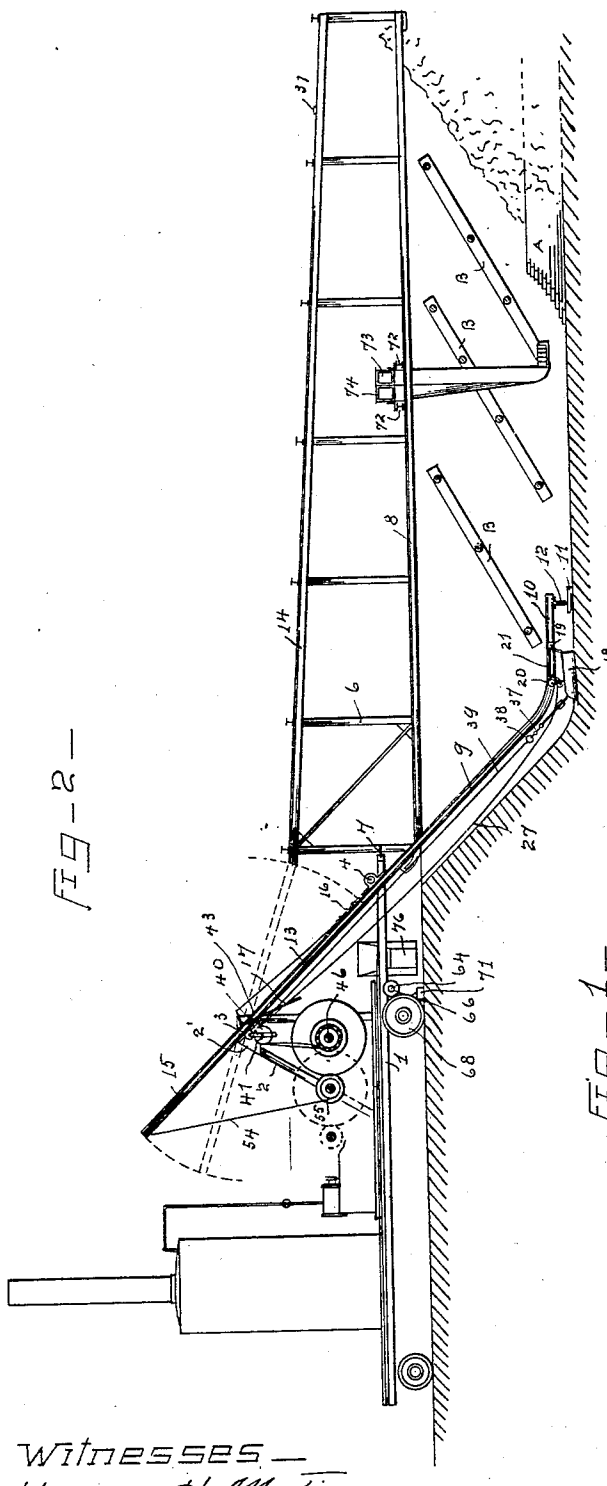


FIG. 2.

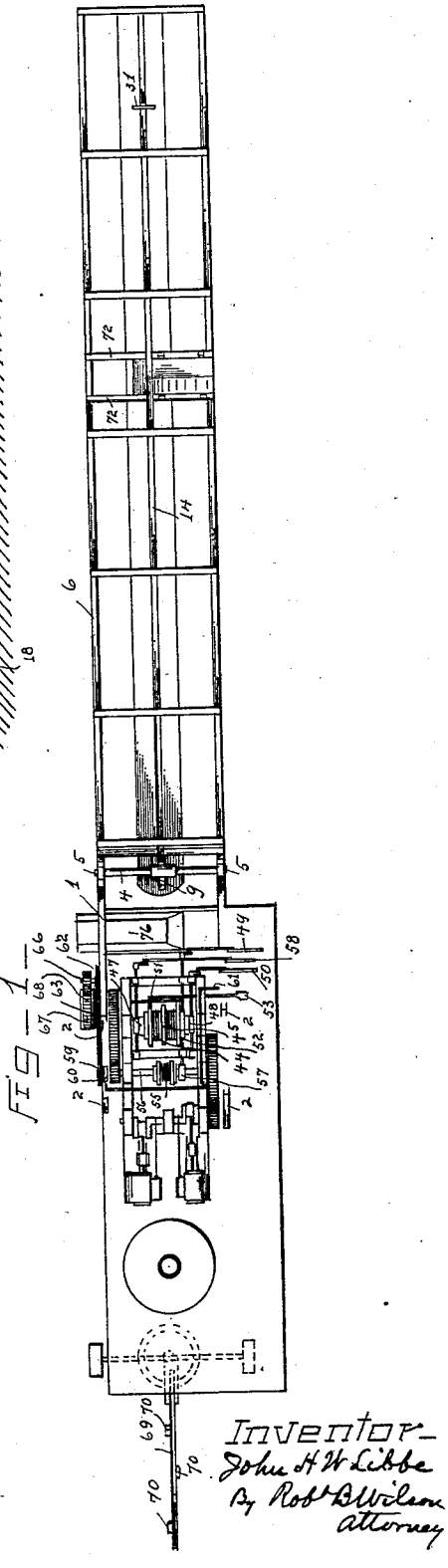


FIG. 1.

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

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(No Model.) 3 Sheets—Sheet 2.

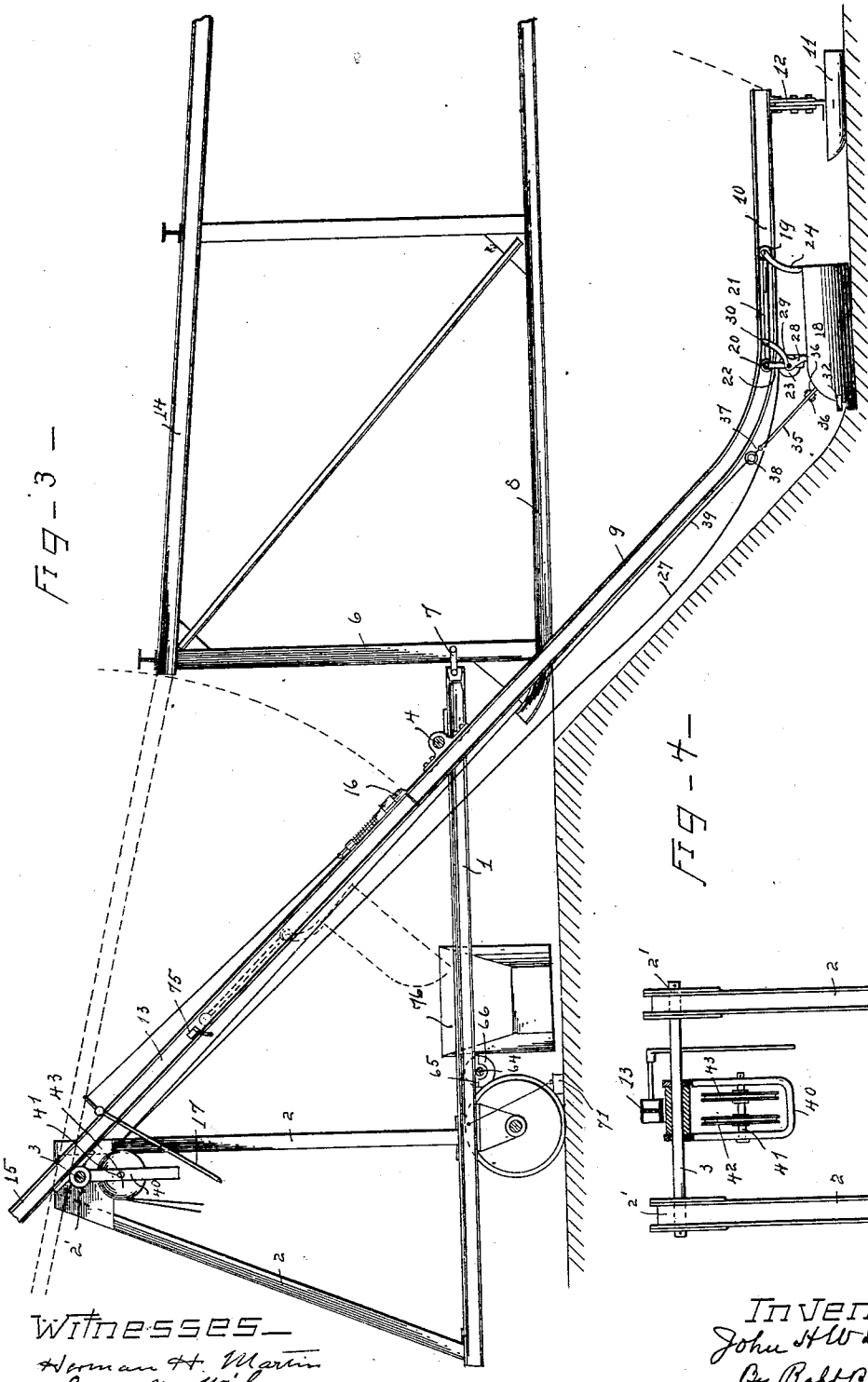


FIG-3-

FIG-4-

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(No Model.) 3 Sheets—Sheet 3.

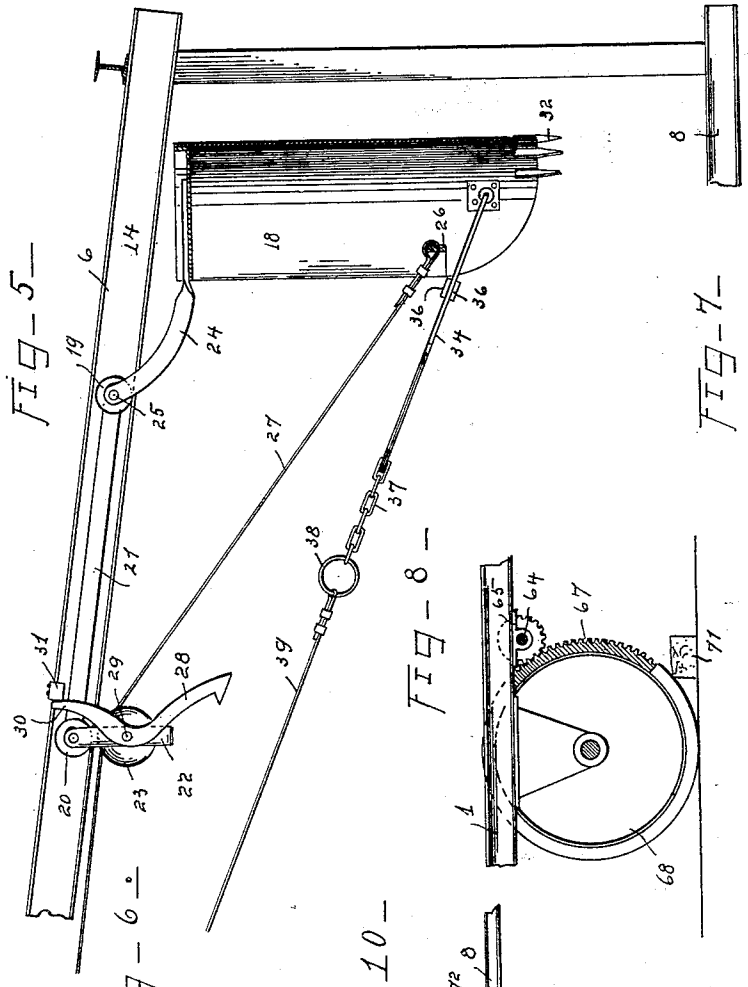


FIG. 5.

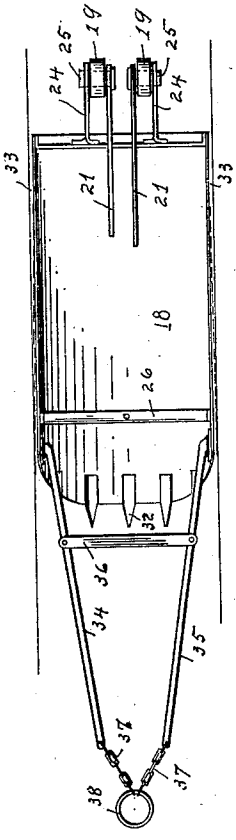


FIG. 7.

FIG. 8.

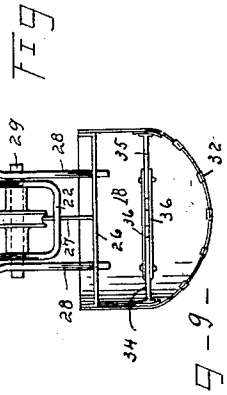


FIG. 6.

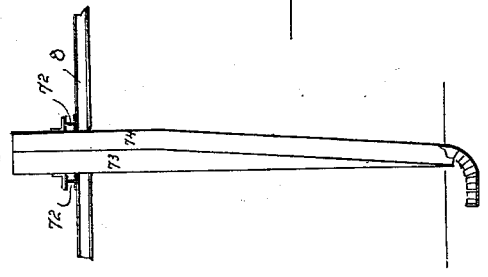


FIG. 10.

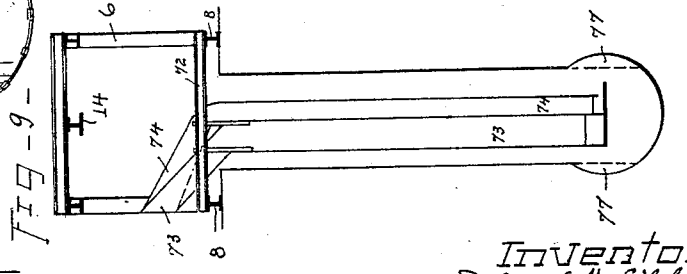


FIG. 9.

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UNITED STATES PATENT OFFICE.

JOHN H. W. LIBBE, OF TOLEDO, OHIO.

TRENCH-DIGGING MACHINE.

SPECIFICATION forming part of Letters Patent No. 677,522, dated July 2, 1901.

Application filed February 4, 1901. Serial No. 45,926. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. W. LIBBE, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented a new and useful Improvement in Trench-Digging Machines, of which the following is a specification.

My invention relates to a trench-digging machine, and has for one object to provide an efficient machine for excavating sewer-trenches and the like.

A further object is to provide a machine of the kind that will extend a trench after it in the direction of its forward movement completed to its full depth and width ready for the laying of the pipe or brickwork; furthermore, to provide a machine of the kind which may be closely followed up by the brick or pipe work and having ready means of conveying the earth as excavated and refilling the trench therewith as the sewer-work is extended therein.

I accomplish these objects by the mechanism hereinafter described and illustrated in the drawings, in which—

Figure 1 is a plan view of a trench-machine constructed in accordance with my invention. Fig. 2 is a side elevation of the same. Fig. 3 is an enlarged side elevation showing the scoop in operative position in the bottom of the trench. Fig. 4 is a front view of sheave hanger and support for the pivoted track-section. Fig. 5 is a side elevation of the end of the framing, showing the scoop in a dumping position. Fig. 6 is a front view of the scoop and its truck. Fig. 7 is a top plan view thereof, showing the expanding bail. Fig. 8 is a side elevation of the driving-gear. Fig. 9 is a section through the trench and showing a diagram of brick and mortar spouts, and Fig. 10 is a like view showing the manner of supporting the spouts from the drag.

In carrying out my invention I employ a frame 1, which is so mounted upon wheels as to be readily dirigible when propelled by its own power during the operation of the machine or when drawn by horses to the point of operation. Upon this frame is mounted a boiler, engines, and hoisting-drums of a suitable design to operate the machine. To the frame 1 there are also secured trusses 2, which are disposed vertically upon opposite sides of the frame, forming bearing 2′ for an oscillating shaft 3. Near the rear end of the frame there is also located a like shaft 4, journaled in bearing 5, mounted upon the top of the frame.

6 designates a framed structure which is movably coupled to the frame 1 by links 7 and is dragged along the ground upon the bed-beams 8, adapted as runners therefor when the machine is advancing.

9 designates a track, preferably formed of an I-beam, which is rigidly connected to the center of the oscillating shaft 4. This beam extends rearward from the frame 1 and is adapted to enter the trench in a declined position, and in the trench the beam is curved to form a deflected portion 10 at the free end of the beam, which is supported upon the shoe 11 by the extension-standard 12. When the trench is intended for sewer construction, the base of shoe 11 may be made to conform to the arc of the circle of the sewer-conduit, and upon being dragged through the trench the shoe will operate to smooth the ground by reason of the imposed weight of the I-beam resting thereon. 13 designates a like I-beam, which is secured to the oscillating shaft 3 and is adapted to form a continuous track when alined with the section 9, or the I-beam 14, which is centrally and pendently supported in a rearwardly-declined position by the framed structure 6. The beam 13 is fulcrumed to the shaft 3 to form a lever 15 to elevate the opposite end to alinement with the track 14. A reverse movement of the oscillating section 13 of the track will bring the same into alinement with the decline 9 entering the trench.

In order to lock the oscillating beam 13 to the different inclines, I have provided a spring-catch 16, adapted to limit the downward movement of the section when in alinement with the decline 9 and to automatically lock it to beam 14 when it is swung vertically into connection therewith. The catch is disengaged from the beam 14 by means of a lever 17, suitably secured to the swinging section 13 within convenient reach of the operator.

The excavator-scoop 18 is pendently supported from the I-beams 9, 13, or 14 and is carried by a truck, comprising rear wheels

19 and front wheels 20, coupled together upon opposite sides of the web of the I-beam by means of bars 21. The front wheels are held upon the bottom flanges of the beam by means of a yoke 22, between which is also journaled a sheave 23, in a position central below the beam. The rear wheels are held in position by the hangers 24, which are secured to the rear of the scoop, and to the axles 25, and thereby pivotally support the scoop.

26 designates a bar secured to the scoop, near the top and front thereof, to tie the sides of the scoop together and furnish a means for attaching thereto the supporting-cable 27. The tie-bar further operates to provide a shoulder for engagement with the gravity-hooks 28, which are disposed upon the outer sides of the yoke 22 and are pivotally mounted upon the shaft 29, which carries the sheave 23. The upper arms 30 of the hooks 28 are of a length to reach the top of the I-beams to adapt the hooks to disengagement with the tie-bar when the upward-projecting arms come in contact with a stop 31, secured to the declined beam 14, and thereby trip the scoop. The scoop is provided with a plurality of V-shaped teeth 32, which are fastened to the cutting edge of the scoop, the bottom of which is curved to conform to the diameter of the sewer-conduit. In order to expand the scoop at its mouth to cut a clearance-space 33 of a width to permit the free entrance of the scoop into the trench, I have provided an expanding-bail, which comprises the lever-arms 34 and 35, both of which are pivotally connected to the inner sides of the scoop, near the front, as shown in Fig. 6.

36 designates a fulcrum-bar pivotally secured to the arms 34 and 35 a little in advance of the scoop. The free ends of the arms are connected by means of chains 37 to a ring 38, to which the cable 39 is attached.

The operation of the expanding-bail is as follows: When the scoop is in the filling position, as shown in Figs. 2 and 3, with the teeth entering the earth, the resistance encountered causes a strain upon the working cable, which draws the long arms of the levers 34 and 35 inward and presses the sides of the scoop outward to a point, as will be seen by dotted lines, Fig. 7. The strain still continuing upon the cable forces the scoop through the earth, filling it as it travels along the beam 9. After the strain is off the bail the elasticity of the metal will contract the mouth of the scoop to its normal curvature, thus cutting the trench of a width to admit freely the scoop.

40 designates a yoke pendently supported from the shaft 3, and between the yoke-arms upon the arbor 41 are mounted sheaves 42 and 43, over which the cables 27 and 39 pass to their respective drums 44 and 45, upon which they are wound. The width of the yoke is such that the sheaves may travel lengthwise upon the arbor 41 the full width of the drums. The drums are loosely mounted upon the shaft 46, and motion is transmitted from the shaft to the drums by means of friction-clutches 47 and 48, which are also mounted upon the shaft. Both of the clutches are adapted to separate movement upon the shaft and are operated by hand-levers 49 and 50. The motion of both drums when running by gravity may be simultaneously controlled by means of friction band-brakes 51 and 52, operated by a foot-lever 53. The cable 54, which is attached to the lever-arm 15 of the oscillating switching-beam 13, is wound upon the drum 55, which is loosely mounted upon the intermediate shaft 56, and 57 designates a friction-clutch operated by hand-lever 58 to transmit motion from the shaft to the drum 55. Upon the same shaft there is also loosely mounted a sprocket-wheel 59, with a clutch 60 mounted in juxtaposition thereto to transmit motion from the shaft to the sprocket-wheel. The clutch 60 is shifted in or out of engagement with the sprocket-wheel by means of a hand-lever 61. From the sprocket-wheel motion is transmitted to a sprocket-wheel 62 by means of a sprocket-chain 63. The wheel 62 is mounted upon a shaft 64, which is attached by its bearings 65 to the frame 1, and upon both ends of the shaft are mounted pinions 66, of a width to engage the spur-face 67, formed centrally upon the face of the rear driver 68, by means of which the machine is propelled. The machine is guided by the tongue 69, which is held in the proper course by means of stakes 70, driven into the ground at intervals ahead of the machine. The backward movement of the machine is prevented by means of blocks 71, which are suitably supported from the frame behind the drivers and dragged along with the machine in its forward movement. The frame of the machine may be supported upon flanged wheels, if desired, and run upon a track, as environment may require, and which may be used without departing from the spirit of the invention.

The machine being set at the front end of a trench-section previously prepared of the desired width and depth in the position shown in Fig. 2, the operation is as follows: The scoop is allowed to gravitate down the declined beam 9 into the trench until it arrives upon the deflected end section 10 of the beam. Cables 27 and 39 are slacked, which permits the mouth of the scoop to fall toward the bottom of the trench to bring the scoop into position to enter into the earth to a depth adjustable by the standard 12. The clutches 47 and 48 are now thrown into engagement with their respective drums. The strain upon cable 39 will operate to enlarge the mouth of the scoop by means of the pressure of the levers of the bail, whereby the scoop by traveling up on the beam will excavate a trench to a greater width than the scoop; and thereby provide clearance for the scoop to freely enter the trench when empty. After the scoop is filled cable 39 is slacked and the

continuous strain of the cable 27 will lift the mouth of the scoop until the tie-bar engages with the gravity-hooks. This being accomplished, the scoop is hoisted upon the oscillating switching-beam 13 and is held upon the beam by stopping movement of the drums by means of the friction-brakes. The clutch 57 is now brought into engagement with the drum 55, which results in lifting the loaded switch-beam to connection with declined beam 14 by winding the cable 54 upon the drum 55. As soon as the spring-catch locks the switching-beam to the declined beam 14, the brakes are released and the scoop gravitates rearward until the trip near the end of the beam 14 releases the hooks from the tie-bar and dumps the scoop. After this operation is accomplished the scoop is drawn back upon the switching-beam and held thereon by reason of the brakes stopping movement of the drums 47 and 48. The spring-catch is withdrawn to drop the switch-beam to connection with the beam 9, after which the brakes are released to gravitate the scoop into the trench and repeat the operation. As will be seen in the drawings, the angle of the declination of the switching-beam when elevated and connected to the delivery-track 14 is more acute than the latter and is adapted to overcome the inertia of the loaded scoop upon the switching-beam and give it momentum to gravitate toward the end of the declined track 14. It will also be apparent that the rocks or other obstruction in the path of the scoop may be readily removed, as no mechanism obstructs the trench other than the I-beam 9, which allows full access for the removal of the obstruction without backing the machine.

The machine is advanced and steered, as hereinbefore described, and, as will be seen in Fig. 2, the framed structure 6 may be made of a length that the earth excavated may be delivered at a point behind the advance of the completed sewer to refill the trench. The shoring B in the trench is also readily arranged and removed, and by reason of the construction of my mechanism the shoring-beams may be located close to the declined beam 9 and prevent caving of the banks at the point of operation without interfering therewith.

72 designates cross-beams which are secured to the top of the bed-beams 8 and are adapted to support a conduit 73 for the brick and a conduit 74 for the mortar, both being arranged to deliver the material side by side in the trench within convenient reach of the masons. One or more sets of conduits may be carried in like manner, if required, and as the machine advances the obstructing shoring-timbers may be removed out of the path of the conduits and replaced in the rear thereof.

In extending a trench for water-pipe the excavated earth must be discharged upon the side of the trench and remain there until the pipe-conduit is tested and inspected. For such trenches the traveling structure 6 is disconnected from the machine and the switching-beam 13 is suitably locked to the trench declined beam 9 to form a continuous declined track, upon which the scoop-truck may travel up and down and which travel is controlled in the above-described manner by the cables 27 and 39.

75 designates a trip detachably secured to the switching-beam 13 and is placed in a position to dump the scoop by disengaging the hooks from the tie-bar. The trip is curved to contact with the hooks under their pivotal connection to the pin. The scoop dumps its contents into a trough 76, suitably supported from the frame 1 and adapted to deliver the contents of the scoop to one side of the trench, as shown in Figs. 1, 2, and 3. The trough may be so secured to the frame 1 as to be readily removable when the machine is to be used for filling the trench after the progressing sewer-work.

The length of the track-beam 9 is proportioned to the required depth of the trench and the size of the scoop to its required width.

By conforming the bottom of the scoop to the bottom of the sewer the trench will only have to be rounded out by handwork at the points 77, as shown in Figs. 9 and 10.

It is apparent that by setting the wheels of the frame 1 to move laterally the machine may be moved along a sloped bank to widen a trench by moving the machine the width of the scoop after each cut.

Having thus fully described my invention, what I claim is—

1. In a trench-digging machine, the combination with a frame mounted on wheels and provided with means of self-propulsion, of a declined track-beam supported by the frame, and having its lower end deflected by a curve and adapted to trail horizontally in a trench; a shoe adapted to support the lower end of the track-beam; a tripping scoop pendently mounted and adapted to travel on the track-beam, and having an expansible mouth provided with a cutting edge; a bail for the scoop, adapted to expand the mouth of the scoop under the strain of a pull on the bail sufficient to overcome the cutting resistance of the scoop; hoisting mechanism mounted on the frame and connected to the bail, adapted to pull the scoop up the track-beam, and means to trip and dump the scoop.

2. In a trench-digging machine, a frame mounted on wheels, a trailing track-beam, pivotally supported by the rear end of the frame and declined in a trench, and having a curved lower end portion, a tripping scoop mounted on the trailing track-beam, hoisting mechanism mounted upon the frame, cables attached to the scoop and connected with the hoisting mechanism, a shoe adapted to support the curved lower end of the track-beam and adjust the depth of the cut of the scoop, a trailing structure linked to the rear of the

frame, pendently supporting a rearwardly-declined dumping track-beam, vertically-projecting trusses secured to the frame, a switching track-beam fulcrumed on the trusses and adapted to switch the scoop from the trench track-beam to the dumping track-beam, and vice versa, means to oscillate the switching-beam and connect it with and disconnect it from either the trench or dumping track, and means secured to the rear end of the dumping track-beam to trip the scoop, and dump the contents into the trench.

3. In a trench-digging machine, a frame mounted on wheels, hoisting mechanism mounted upon the frame, a track-beam supported by the frame and declined to enter a trench and formed with a curved end portion, a tripping scoop pivotally pendent from a carrier mounted on the track-beam, cables connected to the hoisting mechanism and secured to the scoop by an expanding bail, comprising levers pivotally secured to the mouth of the scoop and fulcrumed to a spreading-bar to expand the mouth of the scoop under the strain of the cable, tripping-hooks secured to the carrier, adapted to engage the scoop, and a trip secured to the track-beam, adapted to trip the scoop by disengaging the hooks.

4. In a trench-digging machine, the combination of a scoop comprising a wheeled carrier mounted on a track, a scoop pendently pivoted from the rear of the carrier, a yoke pendently supporting the front of the carrier, an axle secured to the yoke, having a sheave mounted thereon, a tie-bar secured to the scoop, tripping-hooks pivotally mounted on the yoke-axle, adapted to engage the tie-bar to support the scoop, a bail comprising lever-arms pivotally secured to the sides of the scoop, a spreader adapted to fulcrum the lever-arms, links connected to the free ends of the arms and to a cable, adapted to contract the free arms of the levers and expand the mouth of the scoop, and a cable rove over the yoke-sheave, secured to the tie-bar at one end and to the hoisting mechanism at the other, adapted to hoist the mouth of the scoop to engagement with the trip-hooks.

5. In a trench-digging machine, a self-propelled vehicle provided with hoisting mechanism, a declined track extending into a trench and supported from the rear of the vehicle, an overhead-supported track trailed by the vehicle, a tripping scoop adapted to travel along the tracks in a pendent position, cable connections from the scoop to the hoisting mechanism, an oscillating track fulcrumed above the vehicle, adapted to switch the scoop from one track to the other, and means to oscillate the switching-track.

6. The combination, in a trench-digging machine, of an elastic metal scoop, U-shaped in cross-section, and provided with a cutting edge at its mouth, with a bail, pivoted to the upturned sides of the scoop and adapted to spread the mouth of the scoop and increase the width of its cut, when the scoop is drawn through earth by the bail.

In witness whereof I have hereunto subscribed my hand this 2d day of February, A. D. 1901.

JOHN H. W. LIBBE.

Witnesses:
IRVING E. MACOMBER,
HERMAN H. MARTIN.