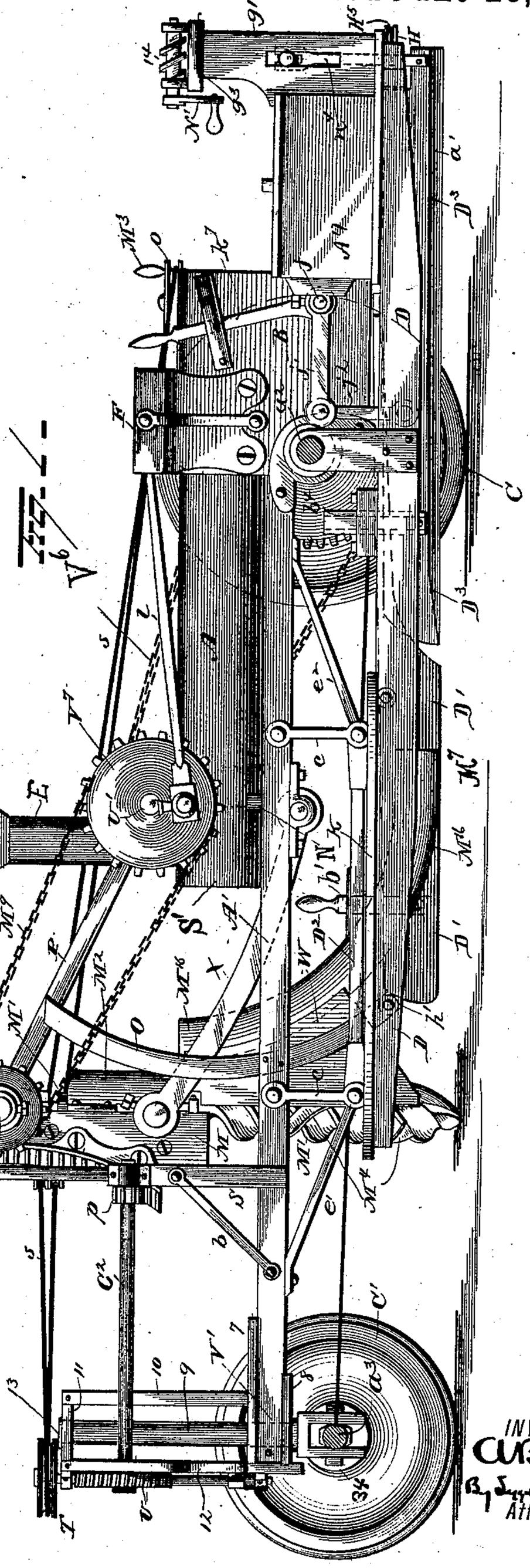
(No Model.)

6 Sheets—Sheet 1.

A. BOUCHER.

DRAIN TILE LAYING MACHINE.

No. 365,428. Patented June 28, 1887.



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6 Sheets—Sheet 2.

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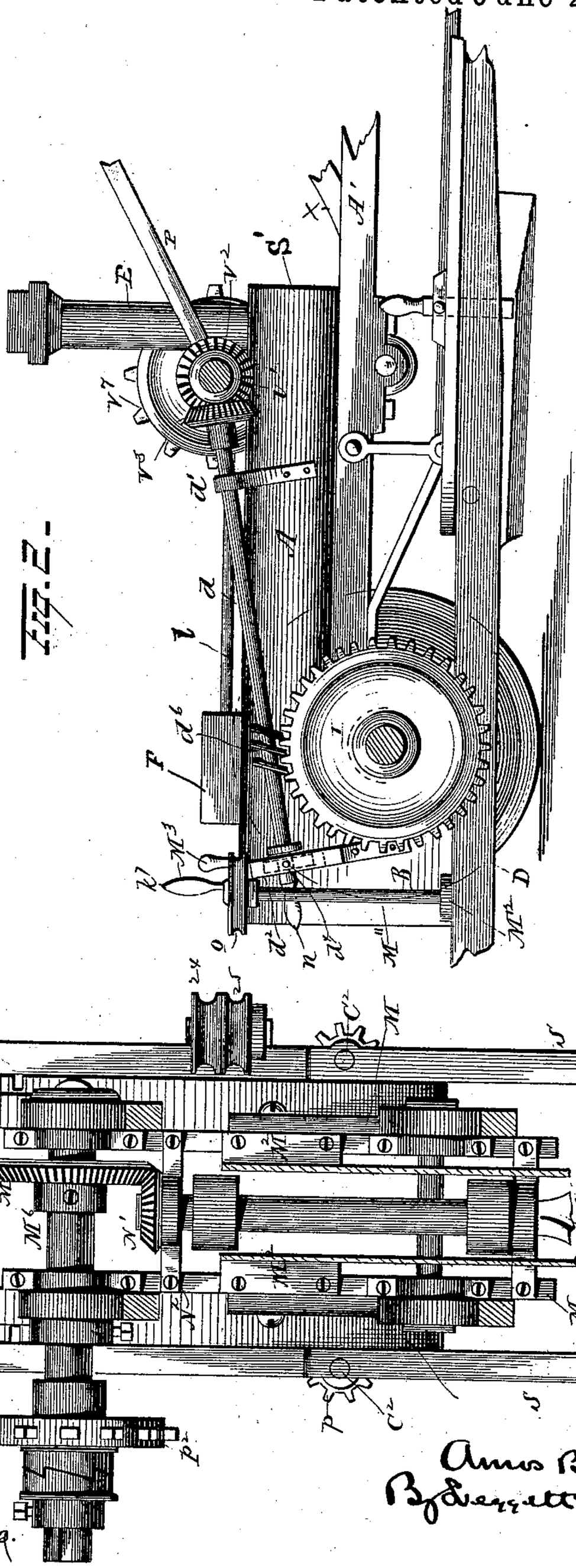
DRAIN TILE LAYING MACHINE.

No. 365,428. Patented June 28, 1887.



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(No Model.) 6 Sheets—Sheet 3.

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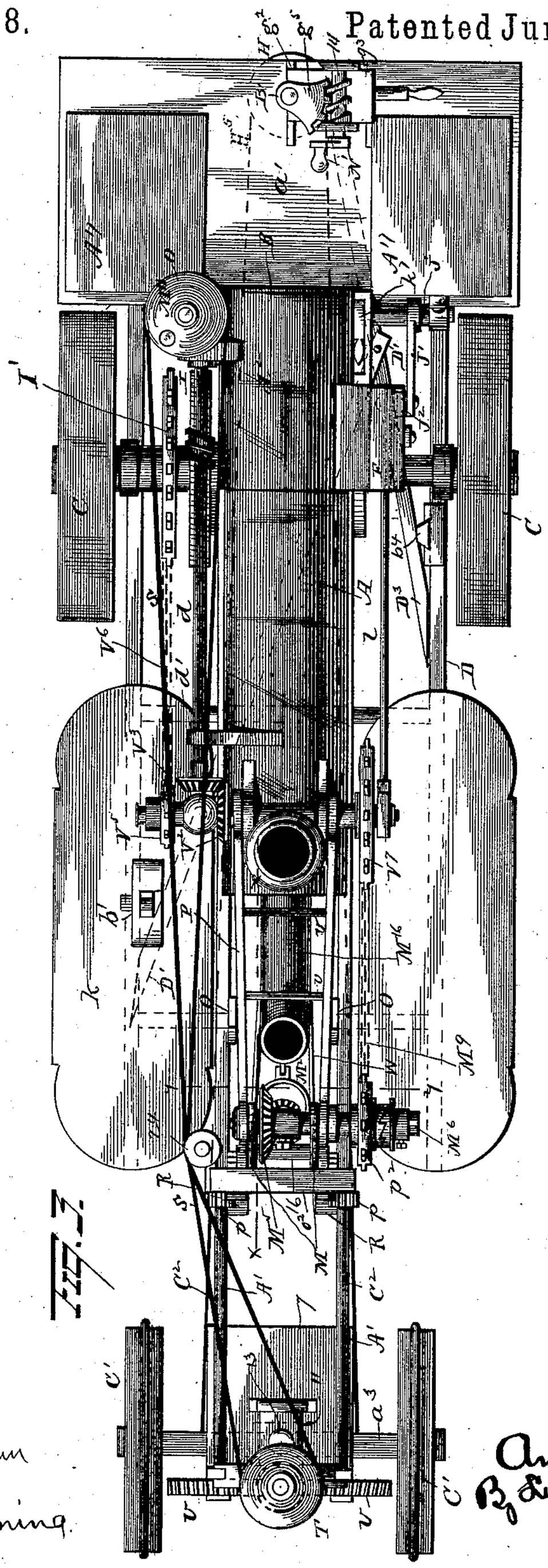
DRAIN TILE LAYING MACHINE.

No. 365,428. Patented June 28, 1887.



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(No Model.) 6 Sheets—Sheet 4.

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DRAIN TILE LAYING MACHINE.

No. 365,428. Patented June 28, 1887.

Fig. 4.

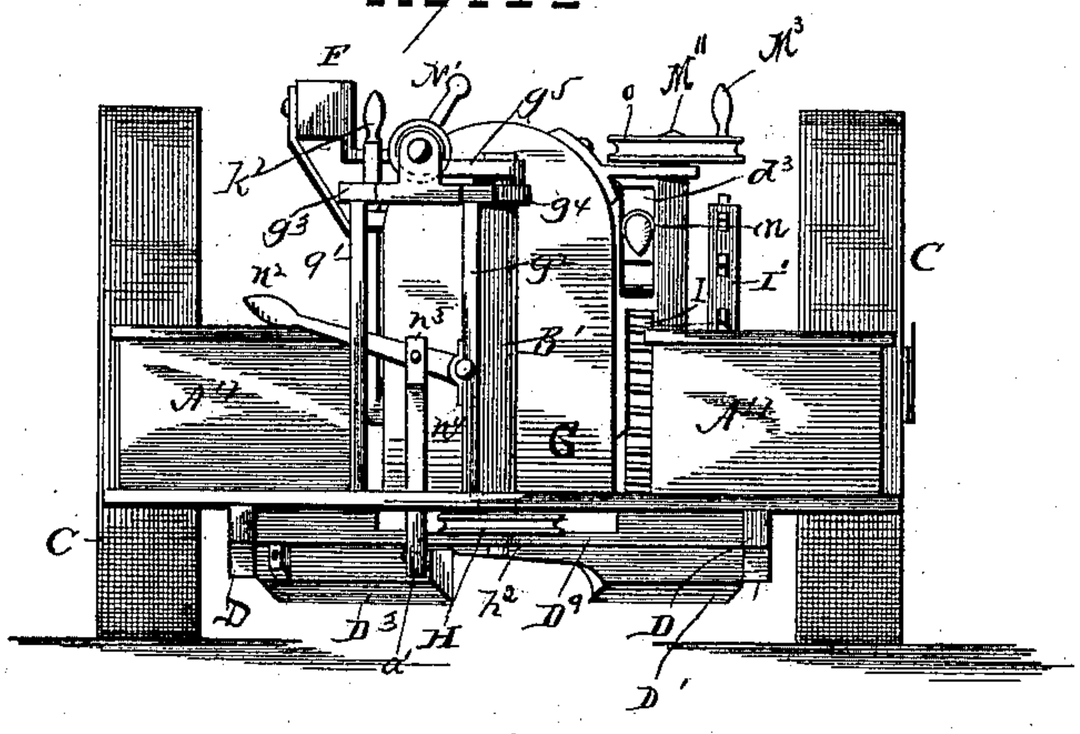
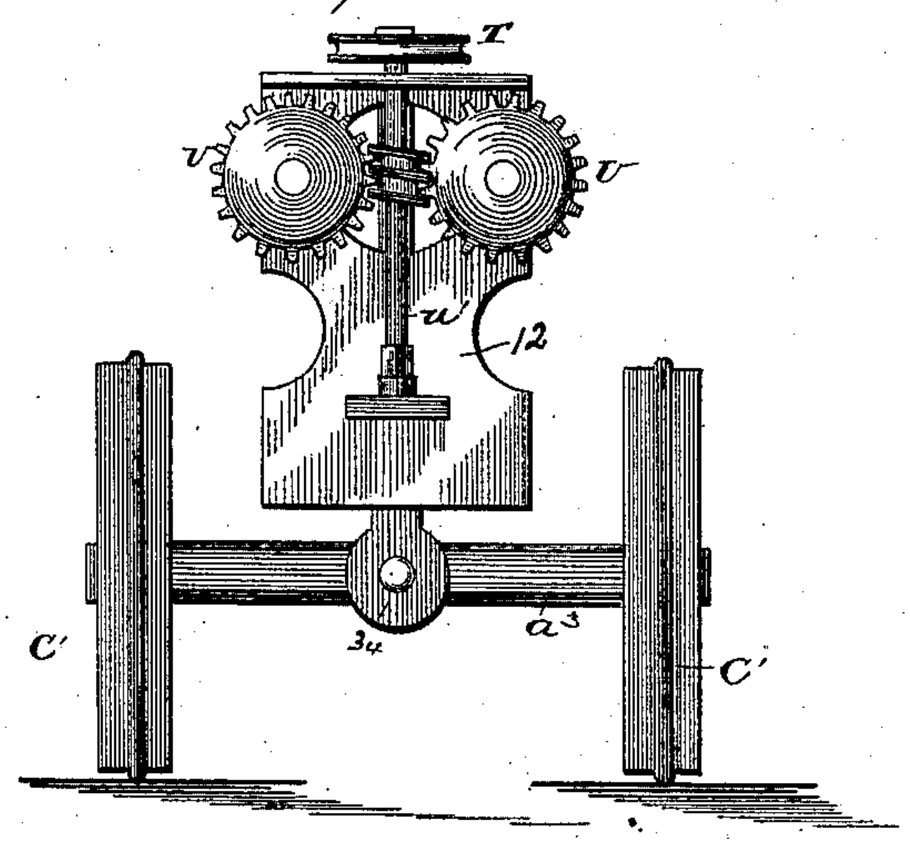


Fig. 5.



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(No Model.) 6 Sheets—Sheet 5.

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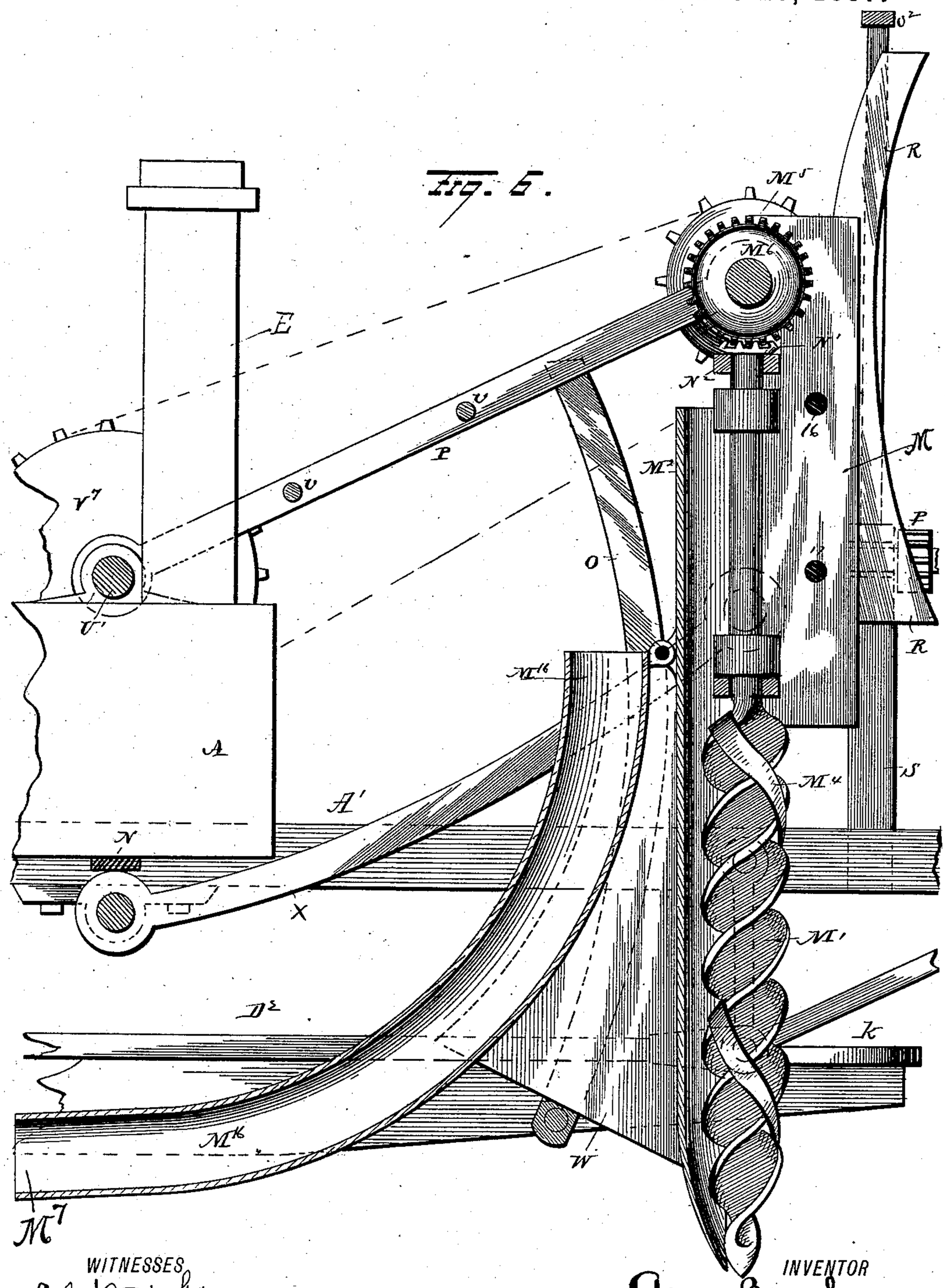
DRAIN TILE LAYING MACHINE.

No. 365,428. Patented June 28, 1887.

FIG. 6.



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(No Model.) 6 Sheets—Sheet 6.

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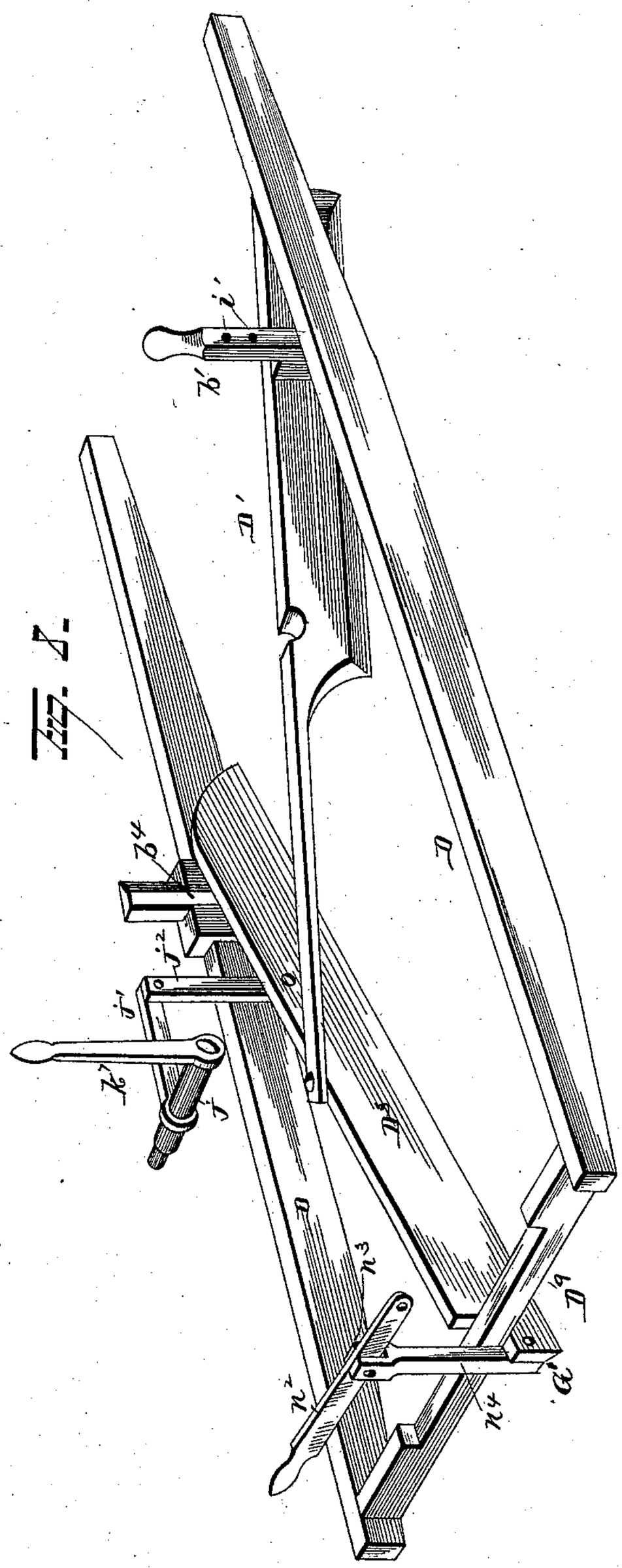
DRAIN TILE LAYING MACHINE.

No. 365,428. Patented June 28, 1887.



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UNITED STATES PATENT OFFICE.

AMOS BOUCHER, OF WHITE HOUSE, OHIO.

DRAIN-TILE-LAYING MACHINE.

SPECIFICATION forming part of Letters Patent No. 365,428, dated June 28, 1887.

Application filed October 26, 1886. Serial No. 217,248. (No model.)

To all whom it may concern:

Be it known that I, AMOS BOUCHER, of White House, in the county of Lucas and State of Ohio, have invented certain new and useful Improvements in Drain-Tile-Laying Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to drain-tile-laying machines.

The object of the invention is to produce a self propelling and operating device that will cut a ditch of a suitable desired width and depth to receive different sizes of drain-tile, place the tile properly in the ditch, and, if wanted, then cover the tile, the several operations being performed continuously and at one time; also, if necessary, to permit tile laying or the covering of same to be deferred and simply a ditch be produced and the laying and covering operations be conducted subsequently, either together or separately, as may be desired.

With these ends in view my invention consists in certain features of construction and combinations of parts, as will be hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 represents a side elevation of the machine. Fig. 2 is a side elevation of the opposite side of the device with the one driving-wheel removed. Fig. 3 is a plan view of the apparatus. Fig. 4 is a rear end elevation of the machine. Fig. 5 is a front end elevation in perspective. Fig. 6 is an elevation in longitudinal section, taken on the line *x x*, Fig. 3, to show the ditching mechanism. Fig. 7 is a vertical transverse section of the ditching and tile-conveying mechanism, taken on center line *y y*, Fig. 3. Fig. 8 is a detached view of the scraper-blades and immediately-attached frame-work and operating mechanism.

Referring to the drawings by letter, A represents a horizontal steam-generator of a class known as the "locomotive fire-box boiler." This is made of proper dimensions to provide an adequate supply of steam; and to facilitate draft, and thus quicken generation of steam, without the use of a high smoke or draft stack, a blower or steam-pipe of proper size is introduced into the smoke-box S′, that is formed in the front end of boiler A. A water-gage, steam-gage, try-cocks, and other necessary fittings to afford safety and facilitate the use of the boiler are provided; and as these are well-known adjuncts to all properly-constructed boilers, a more detailed description is not necessary.

The boiler A is mounted upon a frame, A′, composed of two parallel string-pieces of iron or other suitable material. These are placed a sufficient distance apart to permit the cylindrical portion of the boiler A to be properly supported thereon, a saddle-piece, N, made to conform to the curvature of the cylindrical sheet of said boiler, being rigidly affixed in position on the frame at the front end of the boiler, as shown in Fig. 1. The rear ends of the squared bars of the frame A′ are rigidly secured to the front end of the fire-box B by bolts or rivets; and it will be observed that this method of securing the frame and boiler at but one end will permit expansion and contraction of both the shell and frame without hinderance, as such longitudinal limited movement is permitted by the sliding contact had by the boiler in the supporting cradle-bar N. The frame-pieces A′ are extended a proper distance forwardly. (See Fig. 1.) Immediately in front of the throat-wall or front plate of the fire-box B, and parallel to it, the axle a^2 is placed in suitable boxes that are secured to the supporting-frame A′. The wheels C are rigidly attached to the ends of axle a^2, said axle being made of sufficient length to project beyond the outside of the frame-pieces A′ a limited distance, for a purpose that will hereinafter be shown.

At a point near the front extremity of the frame A′ a cap-plate, 7, is secured thereon, of suitable thickness and of a material to insure proper stability. Beneath this plate 7 another plate, 8, of same thickness, but of less width, is placed, to bear upon the under face of the frame A′, and these two plates are secured together by bolts or other suitable means, or may be integral with the frame A′.

Centrally beneath the plates 7 and 8 is placed a suitably-formed and perforated plate of brass or other proper metal. This is secured in place,

and is designed to receive as a supporting-box the swivel-post 9. (See Fig. 1.) This is a bolt of proper length, of cylindrical form in the body, that is made to fit neatly the orifice in the plate just mentioned, so that it can be revolved in it and, passing through the top plate, 7, be extended vertically. A cap-plate, 11, securely affixed to the top of the vertical parallel pieces 10 12, forms therewith a top bearing for the swivel-post 9, which centrally perforates it, and is held in position by a cap-nut, 13, that rests on plate 11. The lower end of the post 9 is enlarged, and a central vertical slot formed in the body of the boss, so as to produce a fork having double parallel walls that are rounded on the edges, the space intervening between the jaws of the bifurcated head being of such relative width to the thickness of the front axle as to neatly fit onto it. The shape of the front axle of the ditcher is shown in Fig. 5, and it will be noticed that a bolt, 34, extends through the center of the bifurcated lower end of the swivel-post 9, and also a corresponding point in the side wall of axle a^3, when it is in proper position. By the method of construction just described a limited universal movement of the axle a^3 and the wheels C′ is effected. The frame A′ is stiffened longitudinally by the truss-braces D^2, that are attached by their ends c' e^2 to the under side of the frame A′. The parallel links c c are jointed to the bent truss-rods D^2 at proper supporting-points to brace the frame A′, to which these links are bolted by their upper ends.

At a short distance below the plane of the horizontal portion of the truss-braces D^3 two parallel string-pieces, D, are secured in place by the curved vertical bars O, and also by perforated enlargements that are placed on the rear driving-axle, a^2. The bars O are also utilized for another purpose, that will be explained in its proper connection. The string-pieces or bars D are located at equal distances outside the vertical plane of the upper frame, A′, and as the curved bars O are attached to the inside surface of said frame, the continuation of bars O that project below the frame have bosses extending laterally and outwardly at their lower extremities to attach to the sides of horizontal bars D at points h'. (See Fig. 1.)

Upon the top face of the bars D, on each side of the machine, are securely attached the platforms k. These are horizontal on their top faces and of such a length in relation to the space that intervenes between the front and rear wheels of the apparatus as to form a clearance at their front ends to permit a proper swing movement of the front pair of wheels upon the pivotal center of the axle, that is necessary to turn the machine in any desired direction when in use.

The pieces D are projected to the rear of the fire-box of the boiler A a sufficient distance to afford support to a platform, a', that is placed thereon and properly secured thereto. This is for the accommodation of the engineer, who controls the movement and operation of the mechanism, both as a locomotive and a ditching-machine.

Upon the platform a' are placed the boxes A^{17}. They are located on each side of the platform, and are designed to contain water and fuel for the boiler-supply. At the rear end of the water-tank, located upon the left side of the platform a' and securely affixed in a vertical position thereto, the supporting-frame for the steering-gear is placed. This is composed of two upright pieces, g' g^2, and a cap-piece, g^3, firmly bolted or otherwise secured in position thereon. An upright shaft, B′, at its lower end is boxed onto the frame D, so as to be properly supported in a manner to permit rotative movement of same. Its upper extremity is similarly secured to the cap-piece g^3, and the end that is made to project above the supporting-box g^4 is made to fit a perforation made in the toothed sector g^5. Into the latter a short cylinder, 14, cut with a coarse thread, so as to form a worm-gear, is meshed, the worm-barrel being journaled at the ends to be held in position by properly-formed lugs that project upwardly from the cap-plate g^3.

In a slot or opening cut through the cross-piece D^9 of the frame D the V-grooved pulley-wheel H is located. This wheel is firmly secured in place upon the upright shaft B′ at a point just above the box h^2, that supports the lower end of shaft.

A belt, chain, or wire rope, H^5, preferably the latter, is placed on the V-channeled pulley, and rests therein at a point about the center of the length of the belt. The free ends of the latter are extended forwardly and horizontally till they meet the front axle of the machine, to which they are affixed, the belt or wire rope being made sufficiently taut to transmit motion of pulley H to the axle a^3 with precision. It is evident that the operation of the crank N′ will communicate the rotary movement of the worm-barrel 14 to the sector g^5, and thus, through the pulley H, give directive or steering movement to the front axle and wheels mounted thereon.

At a point in the rear of the front wheels of the apparatus two upright metallic pieces, S, are erected vertical to the frame A′, upon which they are rigidly bolted or otherwise secured. Stout braces b are placed as a side support at the front faces of the uprights. These braces are bolted or riveted by their ends to the uprights S and horizontal frame A′. The pieces S are connected at their upper terminations by the cross-bar o^2, that secures them in parallel position and in the same vertical plane. These uprights are designed to maintain in proper place the ditch-excavating mechanism.

It is necessary for the proper action of the excavating machinery that a vertical and longitudinal adjustment for same be provided, that should be under the control of the operator on the platform at the rear of the boiler. To accomplish this a guide-frame is provided.

This frame is composed of two similarly-formed plates, M, that are rigidly held a proper distance apart by shouldered cross-braces 16 17, so as to have their inner faces parallel. Upon the outer side surfaces of the plates M are attached the segmental racks R. These are cut with teeth of a proper pitch to mesh with strongly-proportioned pinions *p*, that are mounted on the parallel horizontal shafts C^2. These extend forward and are of a suitable length to enter boxes that are located on the upright wall 12 of the frame 10 11 12. The front ends of the two parallel shafts C^2 are extended through the upright standard 12, so as to receive the worm-wheels U U. These wheels are made of same diameter, and the shafts on which they are mounted are a sufficient distance apart to permit the vertical shaft *u'* to be located between said wheels, together with the screw-threaded barrel that is rigidly affixed thereon, the threaded part being so situated in relation to the axial centers of the wheels U U as to mesh into the teeth cut in the peripheries of both, and thus actuate them.

At a point near the vertical center of the plates M, and on the rear edges of same, is rigidly attached the upright metallic semi-tubular shield M^2. This is made of suitable thickness to give the necessary stiffness and of a diameter proportioned to that of the ditch-excavator. The latter is constructed of suitable metal, and is given a regular auger-twist in the body of same, the impinging cutter end being screw-pointed. It is essential that this vertical screw-formed excavator M' be made of such material as to secure requisite strength to resist lateral or torsional strains that are incurred in its operation. The auger-bit portion is made so as to permit its removal at will and different sizes of same substituted. The semicircular metallic shield or case M^2 is made to conform to the diameter of the twisted excavator-blade M', so as to act as a rear support, and also assist the lifting of the excavated material, by forming a dirt chamber in the rear of the excavator-screw.

The screw M' should be made of hardened steel, preferably, and polished, so as to transport vertically the material excavated with as little frictional action as possible. In order to cut the clay or stiff earth in which the tiles are to be laid, a thin spiral blade, M^4, provided with parallel cutting-edges, is placed longitudinally on the twisted body of the excavator M' and rigidly secured to the same. The spiral turns of the blade M^4 are in reversed direction to those of the excavator M'. It will thus be seen that shear cutting-edges are thus formed on blade M^4, and the lifting action of the screw-blade M' will keep the same clear to do effective work, the forward cutting-edges of the shield assisting the operation.

The cylindrical short shaft, to which the auger excavator-blade M' is adjustably secured, is held rotatively in a journal-box, and there is also a shouldered support formed integrally in the wall of the shield M^2, at a point above the upper termination of the twisted body of the excavator M', through which the cylindrical portion just described is inserted and held in rotative position. It is prevented from vertical displacement by collars or shoulders formed on its body that impinge on the surface of the bearing formed for the purpose in the shield M^2. Onto the upper end of the excavator M' a miter gear-wheel, N', of suitable size, is keyed or otherwise fastened. This bevel-pinion N' meshes with a similar wheel, M^5, that is supported in place by a cross-shaft, M^6, being boxed removably onto the vertical wall-pieces M.

There is a collar plate or box, N^2, so secured transversely below the pinion to the side plates, M, as to permit the shoulder or abutting face of the pinion N' to bear and revolve upon its upper surface. The plates M are pivotally connected by stud-bolts to diagonal brace-bars P X. These bars have perforations formed at their extremities, and the lower pair have their free ends mounted on a transverse shaft that is held by its ends in journal-boxes secured beneath the frame-pieces A', the position of this shaft-connection being near the forward end of the boiler A, just below the smoke-box of same. The lower pair of parallel bars, X, are curved somewhat, edgewise, as shown in Figs. 1 and 2. The upper pair of bars, P, are connected firmly by the cross-braces *v v*, and have their inner ends attached to a cross-shaft, V', that is bracket-mounted upon the boiler A at a point immediately in the rear of the stack E.

Upon the extremity of the shaft V', that projects on the right side of the machine, a miter gear-wheel, V^2, is mounted, so as to mesh with a corresponding pinion, V^3, that is secured to the forward end of the shaft *d*. This round shaft extends toward the front of the fire-box B, and is supported in position by fixed brackets *d' d²*, that are riveted in place to the boiler-shell A and fire-box B. The forward bracket, *d'*, is extended down the perpendicular side of the fire-box, and is slotted to retain a vertically-movable journal-box, d^3, through which the shaft *d* passes.

The box d^3 can be held at any desired point by the adjustment of a set-screw, d^4, that is inserted in the edge of the bracket d^2. To have a bearing with its point upon the box d^3, the rod or shaft *d* terminates in a handle, *n*, at its free end above the platform *a'*. A threaded barrel, d^6, is keyed fast upon the shaft *d*, at a proper point above the center of the driving-axle a^2, and there is placed upon this axle a^2 a worm-wheel, I, that is of a proper diameter to give the requisite speed to the shaft *d*, to which it is, when necessary, connected by means of the adjustment of said shaft and its supporting-box d^3 in the bracket *d'*, so as to cause the screw-threaded barrel d^6 to mesh into said wheel I; and it is intended that said wheel should be keyed onto the shaft or axle a^2, so as to receive motion therefrom. The end of the shaft V' is projected beyond the

supporting-bracket a proper length to receive the sprocket-wheel V^5 outside of the bevel-pinion V^2, situated on same shaft. This wheel V^5 is connected by a strong endless square-linked chain, V^6, to a large sprocket-wheel, I′, that is placed on the axle a^2, between its inner face and the worm-wheel I on the same axle. The shaft V′ is also made to project on the opposite or left side of the machine a suitable distance beyond its supporting-bracket to permit the adjustment on same of the sprocket-wheel V^7. This in turn is connected to the smaller sprocket-wheel, P^2, on the cross-shaft M^6 by an endless chain, M^9; and it will be remembered that a direct connection of the shaft M^6 is effected with the vertical excavator M′. The sprocket-wheel V^7 is also made to act as a pitman-wheel for the direct attachment of the reciprocating steam-engine F by means of the connecting-rod *l*, that attaches by one of its ends to the engine, and the opposite end to a crank-pin affixed in the outer face of the sprocket-wheel V^7, so as to obtain proper throw or crank action.

From the foregoing description of the relative working parts it will be evident that the rotative movement of the wheel V^7 by the steam-engine F will cause the excavating-drill and cutter M′ to revolve with a speed proportional to the motion of the engine and the relative size of the gearing. The progressive movement of the apparatus on its wheels is effected by the chain-connection of the shaft V′ on the right side to the driving-axle a^2, and thus permit the reciprocating motion of the engine F to act on the driving-wheels. The engine F is preferably constructed with valve-gear that will allow a reverse motion to be given thereto, and so permit a retrograde movement of the entire device on its wheels.

In operating the machine for excavation of ditches in soils that are very compact and difficult to intrench, it is of advantage to give the cutter M′ a rapid rotation and to have the forward motion of the machine so reduced as to give a limited slow feed of the revolving tool against the vertical breast of the ditch. To accomplish this gradation of the joint rotary and progressive movements, the small sprocket-wheel V^5 on the right end of shaft V′ is loosened by removing its retaining-key or set-screw. The worm gear-wheel I and the spiral-thread barrel d^6 are then brought into operative connection by lowering the shaft *d*. This is secured in place by rigid adjustment of the box d^3. The driving-pinion V^2 will now rotate the shaft *d*, and consequently, by its connection with the worm-wheel on the axle a^2, cause a comparatively slow movement forward of the excavator.

It will be noticed that a vertical shaft, M^{11}, is located with its lower end stepped into a bracket-box, M^{12}, that is affixed to the frame D on the right side of the apparatus, at a point close to handle *n* of the rod *d*. This shaft has a V-grooved wheel, *o*, of proper diametrical size, mounted on its upper end. This wheel is furnished with a handle, M^3, to revolve the shaft M^{11}. An endless belt, *s s*, of proper strength, placed on the grooved wheel *o*, is extended forward to the grooved wheel T, that is mounted on the shaft *u*′ at the front end of the frame A′. Two supporting grooved pulleys, 24 25, that carry the belt *s s* and prevent swagging of same, are attached, so as to revolve on their centers, to the right edge of uprights S, the belt *s s* being made sufficiently taut to give effective movement to the pulley T when the handle on pulley *o* is rotated.

The parts to which the wheel T is connected move the segmental racks R, so as to elevate or depress them, and in this manner cause the drilling-excavator M′ to be raised or lowered to cut a ditch of more or less depth, as may be desired. The side bars, O, by bearing against the parallel bars P X, hold the same from side-play while the raising or lowering operation just described is in progress.

Directly in the rear of the cutter-shield M^2, between it and the boiler-front end, and in the same vertical plane with the said shield, the curved tile-conveyer M^{16} is placed. The upper end is of such a height as to be accessible from the platforms *k* on either side of the machine, and it is hinged at that point to the rear surface of the case M^2 to permit a limited vertical movement of the tubular conveyer M^{16}, so that it will adjust itself by gravity to the varying undulations of the bottom of the ditch in which it rests, its free end M^7 being extended a proper distance rearwardly, so as to afford a horizontal delivery-pipe, as shown in Fig. 1. The size of the caliber of this tube and its form and degree of curvature must be so proportioned as to afford an easy and assured descent of the drain-tile. This feed operation of the tiles is effected by an operator standing upon either platform *k* and placing the tile consecutively into the tube or conveyer M^{16}. This conveyer or guide-tube can be constructed having the section of the wall of same made to fit any desired sizes and shapes of the tile, so that they can be delivered into the ditch in regular successive order with their ends held in proper contact by the gravity of the descending column.

It will be noticed that there are vertical parallel guide-wings W made to project from each side of the shield M^2 rearward. These are made of sufficient strength to be stable, and are intended to hold the tile-conveyer M^{16} in position laterally, while at the same time free vertical play of the tube or trough is permitted by the hinged connection at its upper end.

After the tiles are properly deposited in the ditch the ditch-covering apparatus comes into use. This consists of two blades, made preferably of iron to insure strength and capability of durable service. The first shovel, D′, is adjustably secured to the frame D, or the platform *k* of same, that is located on the right side of the boiler A. A vertical lever with spaced holes *i*′ in its side permits this end of

the scraper to be elevated or depressed by adjustment of a handled bolt through a cross-hole in the side of the lever b', as shown in Fig. 1. The blade of the shovel D′ is made with parallel sides, the lower edges and front end being beveled to produce a wedge shape in cross-section and permit effective action as a scraper. The rear end is produced to form a bar that extends diagonally across the open ditch and connects pivotally to a boss on the top edge of the rear scraper, D^3. This latter piece is made similar to D′ in the shape of the blade, and is also adjustably held in place by a vertical slide-bar, b^4, that works in proper retaining-slides affixed to the inner side of the longitudinal frame-piece D, that is located on the left side of the ditching-machine. The rear end of the scraper D^3 extends in a diagonal line from the inside of the frame D on left side, as just stated, to a point immediately below the standard-frame of the steering-gear that is erected on the engineer's platform, as shown at G in Fig. 4 of the drawings. At this point it is pivotally connected to an upright link-bar, n^4. This has its upper end secured by a movable joint at n^3 to a vibrating lever, n^2, that passes through a slot in standard g' of the frame of the steering-gear, and is therein pivotally boxed to permit the lever n^2 to be vibrated vertically, and so move the connected end of the scraper G′ in a corresponding manner. A further means of adjustment of both the scrapers simultaneously is provided by the operation of the rock-shaft j and arm j', that is connected to the scraper D^3 at a point near its longitudinal center by a vertically-descending link or carrier, j^2. The rock-shaft j is oscillated so as to raise or lower both of the scrapers together by a lever, k^7, attached to its inner end, that is in a convenient position for the hand of the engineer.

It should be stated that this device is intended to propel itself over ordinary roads to places where it is to be used. For this reason the provision of two separate means of effecting progressive movement are provided, the quicker speed being preferably employed for travel, and the reduced speed for ditching and tile-laying work. It is obvious that the steering-gear hereinbefore described will give proper control of the movement of the machine and permit the subterrane drainage-pipe to be laid in any desired curvature, or diverging from a straight line, as occasion may require.

Should it be desirable to simply excavate the ditch without placing tile in same, the tubular conveyer can be disconnected at its hinged juncture by removal of the fulcrum-pin in same, and the scrapers so elevated as to clear the excavated earth at sides of the ditch. This will effect the object sought.

Evidently many minor changes may be made in the mechanical details herein described without departure from the spirit of my invention. I therefore reserve the right to make such slight modifications as will facilitate construction of the parts and be within the scope of my claims.

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

1. In a tile-laying machine, the combination, with a portable engine and an auger-shaped excavator for forming a trench or ditch, of an excavator cutting-blade, an excavator guide-frame connected with the engine by parallel bars, and mechanism for effecting vertical adjustment of the frame and supported excavator, substantially as set forth.

2. In a tile-laying machine, the combination, with a portable engine, of a vertically-adjustable auger-shaped excavator, an excavator cutting-blade extending spirally around the excavator, and an independent vertically-adjustable tile-conveyer, substantially as set forth.

3. In a tile-laying machine, the combination, with a portable engine, of a vertically-adjustable guide-frame, a rotary excavator journaled in said frame, and a spiral cutting-blade extending around the excavator, a shaft and gear-wheel mounted in the guide-frame for rotating the excavator, and means for transmitting motion from the engine to the gearing mounted in the guide-frame, substantially as set forth.

4. In a tile-laying machine, the combination of a vertically-adjustable excavator-shield with a rotary excavator and dirt-elevator provided with a spiral cutter, substantially as set forth.

5. In a tile-laying machine, the combination of a vertically-adjustable excavator-shield provided with two parallel cutting-edges with a rotary excavator and dirt-elevator having an adjustable spiral cutting-blade surrounding the excavator, substantially as set forth.

6. In a tile-laying machine, the combination of a vertically-adjustable excavator-shield with a rotary excavator and dirt-elevator having a reversed spiral cutter rigidly secured upon its twisted peripheral edge, substantially as set forth.

7. In a tile-laying machine, the combination, with a shield and a rotary excavator and its spiral cutter arranged to operate therein, of a tile-conveyer hinged or pivotally connected to said shield, or the frame to which it is secured, and extending rearwardly from said shield, substantially as set forth.

8. In a tile-laying machine, the combination, with a vertical shield and parallel rearwardly-extended guide-plates attached to same, of a tubular rearwardly-curved tile-conveyer that is laterally held from displacement by the guides and permitted a vertical adjustment by hinged or pivotal connection to the shield or its supporting-frame, substantially as set forth.

9. A ditch-cutting and tile laying and covering machine having a high-pressure fire-box boiler and steam-engine mounted thereon, in

combination with a vertical ditch-excavator, a tile conveyer and depositor, a vertically-adjustable two-bladed dirt-scraper, apparatus for elevating and depressing the same, and mechanism for steering the machine and operating the engine from the rear of the machine, and a steering-gear, substantially as set forth.

10. In a self-propelling drain-ditching and tile-laying machine, a steam-boiler and steam-engine having a supporting-frame, one rotative axle with fixed wheels, a non-rotative axle with rotary wheels, the front axle being centrally attached to the boiler-frame, so as to have limited vibratory movement vertically and horizontally on a center bolt, combined with a vertically-adjustable revolving excavator, a tile conveyer and depositor, and a ditch-coverer composed of one or more blades, substantially as set forth.

11. In a tile-laying machine, the combination, with a suitable motor, a transverse driving-shaft impelled by said motor and provided on either end with a sprocket-wheel, and a sprocket-chain connecting one of these wheels with a similar wheel on the main axle of the machine, and a second chain connecting the opposite wheel with a wheel on the excavator driving-shaft, of a rotary auger-shaped excavator and an excavator driving-shaft, a sprocket-wheel mounted thereon, and a clutch mechanism on the excavator driving-shaft, whereby the latter is thrown in and out of motion, substantially as set forth.

12. In a tile-laying machine, the combination, with a suitable motor, a driving-shaft, the latter carrying different-sized sprocket-wheels on opposite ends, the sprocket-wheel on the main axle of the machine, and a chain connecting the latter with one of the driving-shaft sprocket-wheels, of the auger-shaped excavator, the excavator driving-shaft, the clutch and sprocket-wheel thereon, a chain connecting said wheel with one of the wheels on the main driving-shaft and the segment-shaped rack-bars, the pinions for meshing with said rack-bars, and mechanism whereby the elevation and depression of said bars is regulated from the rear of the machine, substantially as set forth.

13. In a self-propelling drain-ditching and tile laying and covering machine, a steam-boiler, a steam-engine, a supporting-frame that permits the longitudinal expansion of the boiler, a crank-wheel that has sprockets on its periphery, two vertical excavator supporting standards, and a cross-shaft at the top of the standards, combined with a smaller sprocket gear-wheel, a sprocket-chain connecting these wheels, a miter-wheel on cross-shaft, a corresponding and meshing miter-wheel on vertical excavator, and said vertical excavator, substantially as set forth.

14. In a self-propelling drain-tile ditching and laying machine, a steam-engine, a steam-boiler, a boiler-supporting frame, a crank-disk with sprocketed edge, two vertical parallel standards, two vertical frame-plates with relatively-attached segmental racks, and a rotatively-supported cross-shaft located upon and near the top of the frame-plates, combined with a smaller sprocket-wheel, an endless chain on it and sprocketed edge of the crank-disk, a miter-wheel on cross-shaft, a similar meshing miter-wheel on vertical excavator, a semi-cylindrical excavator-shield, and the vertical auger-shaped excavator, substantially as set forth.

15. In a self-propelling drain-ditching and tile-covering machine, a steam-engine, a steam-boiler, a supporting-frame for the boiler, and crank-disk with sprocket-toothed edge, combined with a smaller sprocket-wheel affixed to a boxed and journaled cross-shaft that is placed on vertical and parallel frame-plates, said shaft being gear-connected to a vertical auger-twisted excavating-blade, the excavator-carrying frame-plates having stable but adjustable support on four end-pivoted parallel bars and two segmental racks, two pinions mounted on parallel shafts, two worm-wheels on opposite ends of said shafts, an upright shaft end-supported and provided with a worm-barrel that meshes into both of the equal-sized worm-wheels, a grooved pulley-wheel mounted on the upright shaft above these wheels, a corresponding-sized grooved pulley-wheel supported to revolve horizontally on shaft fixed on engineer's platform, and an endless connecting-belt placed taut on said pulleys, substantially as set forth.

16. In a self-propelling drain-ditching and tile-laying machine, a steam-engine, a steam-boiler, a supporting-frame for the boiler, and an engine crank-disk with a sprocket-toothed periphery, combined with a smaller sprocket-wheel, a journaled cross-shaft, a miter-geared excavator-blade and excavator-supporting frame, a shield or vertical dirt-chamber, and a hinged tile-conveyer having lateral guide-plates, substantially as set forth.

17. In a drain-ditching and tile placing and covering apparatus, the combination of a horizontal boiler, a horizontal engine, and supporting-frame that permits longitudinal expansion of the boiler, with a vertical auger-blade ditching-tool, its dirt-elevating shield, a curved tubular tile conveying and depositing trough, and the oppositely-set diagonal ditch-filling scrapers, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

AMOS BOUCHER.

Witnesses:
A. A. WALP,
JNO. D. EPLER.