(No Model.) 4 Sheets—Sheet 1.

S. MONTGOMERY.

MOLE DITCHING, TILE FORMING, AND WIRE LAYING MACHINE.

No. 330,724. Patented Nov. 17, 1885.

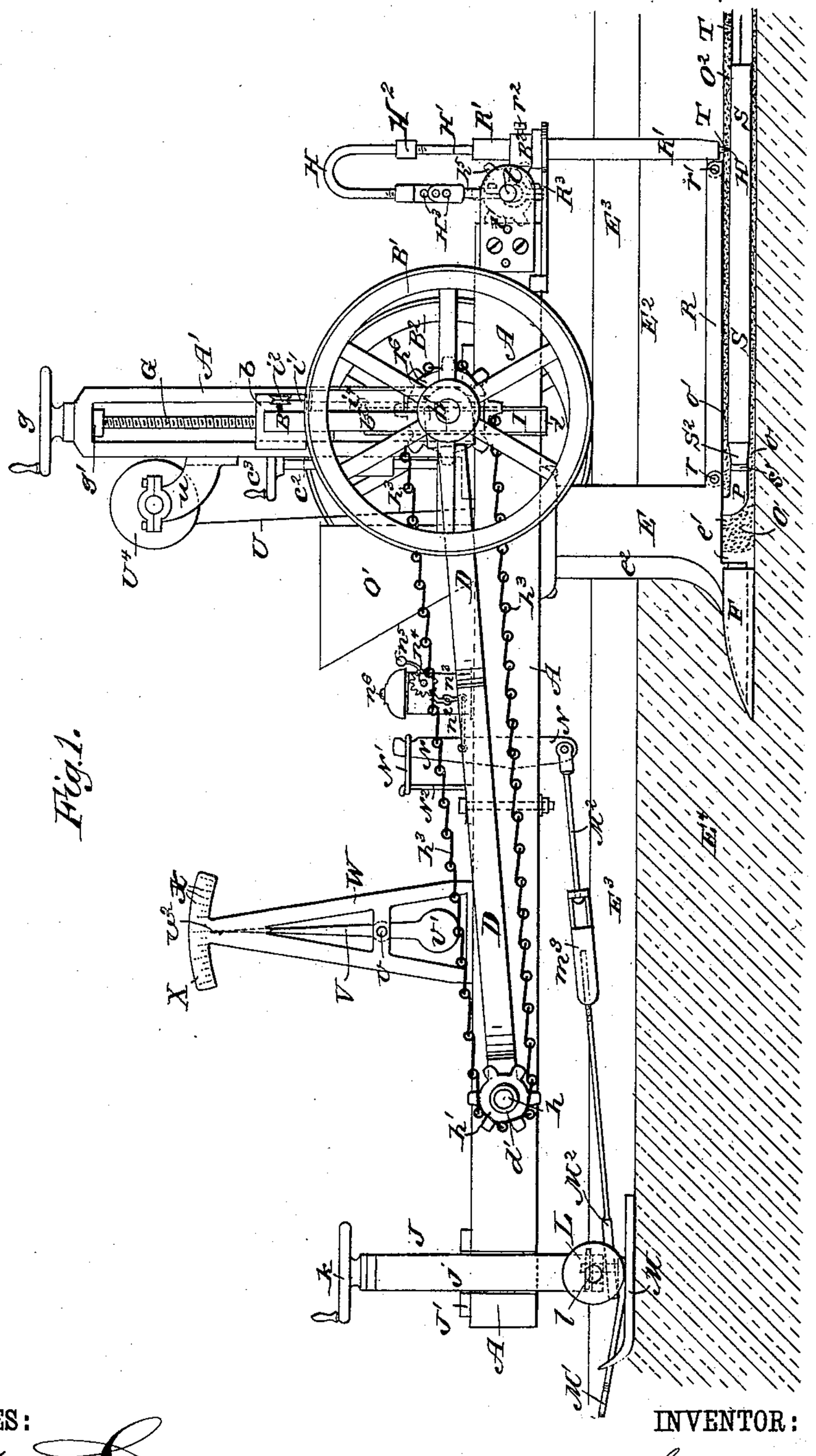


Fig. 1.

WITNESSES:

Otto Beyer

C. Sedgwick

INVENTOR:

S. Montgomery

BY Munn & Co

ATTORNEYS.

4 Sheets—Sheet 2.

(No Model.)

S. MONTGOMERY.

MOLE DITCHING, TILE FORMING, AND WIRE LAYING MACHINE.

No. 330,724. Patented Nov. 17, 1885.

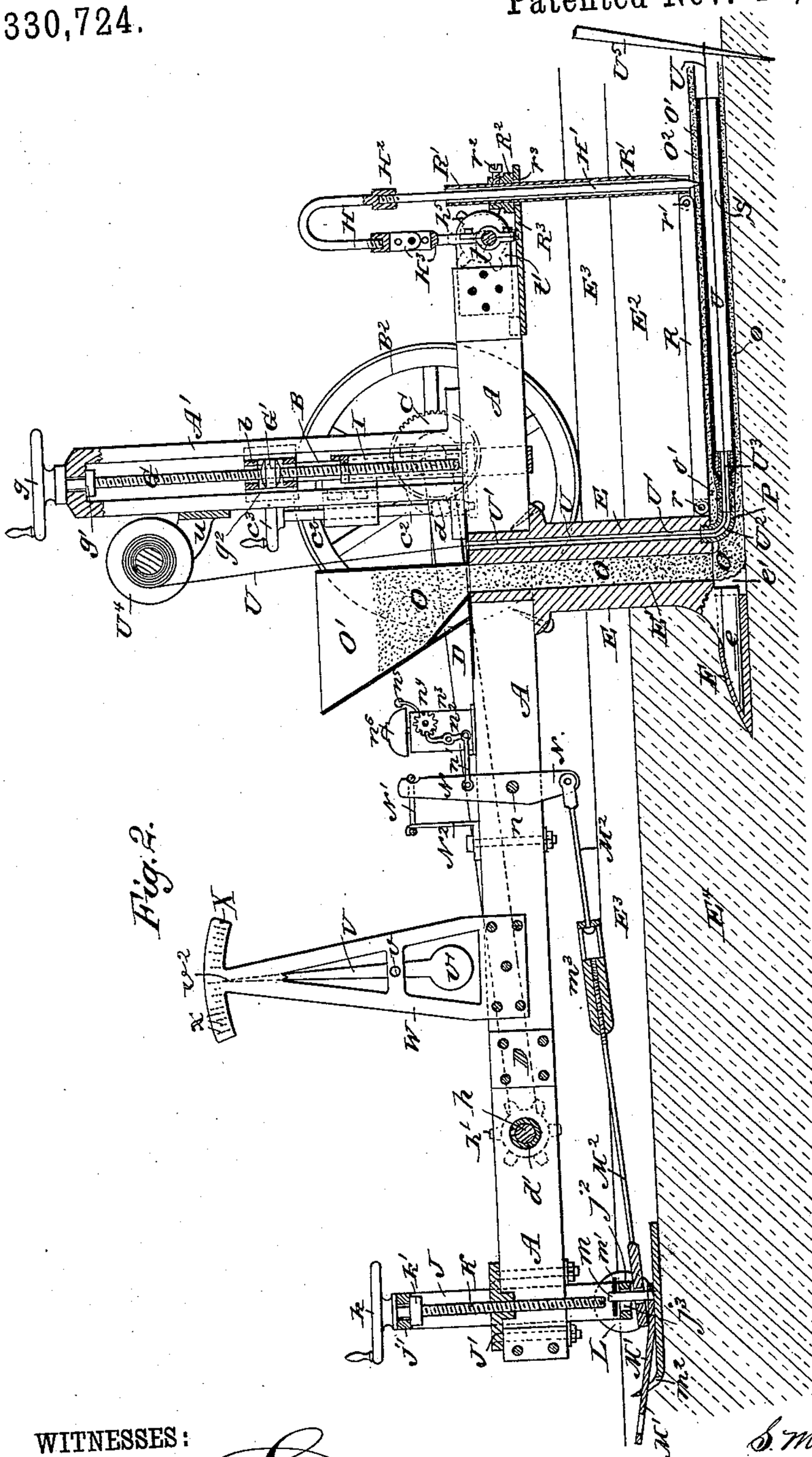


Fig. 2.

WITNESSES:

F. W. Beyer

C. Sedgwick

INVENTOR:

S. Montgomery

BY Munn & Co

ATTORNEYS.

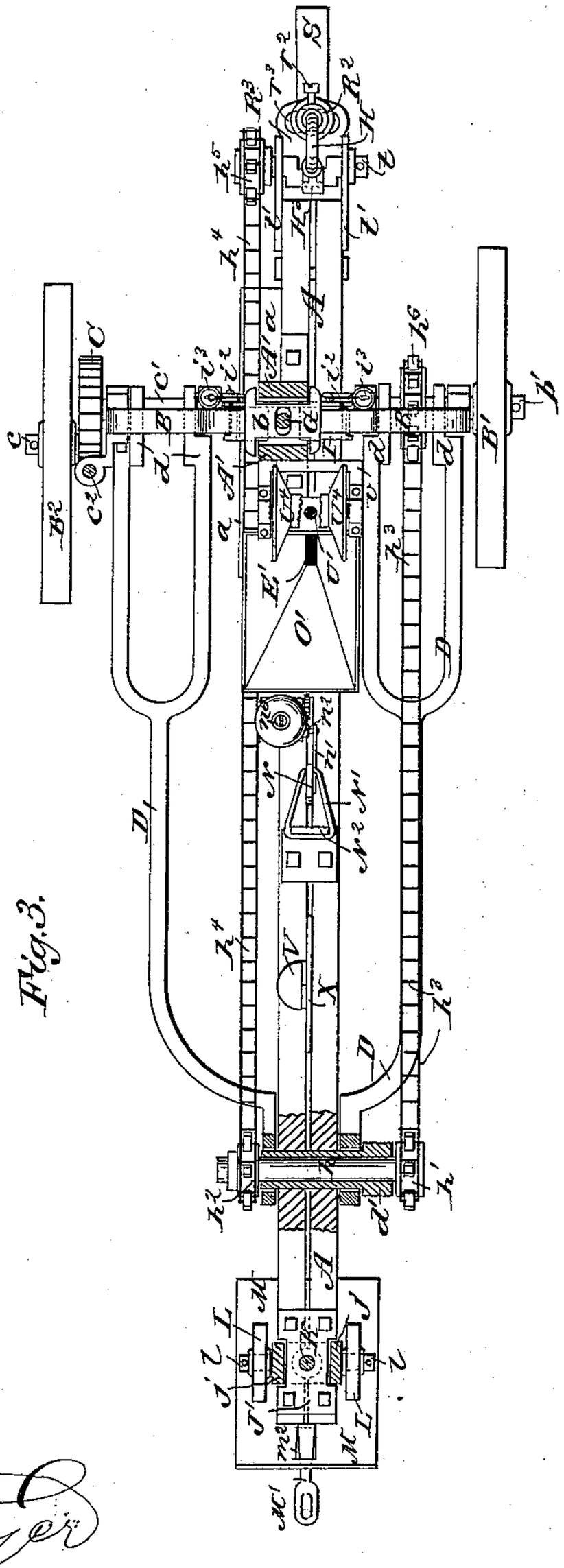
(No Model.) 4 Sheets—Sheet 3.

S. MONTGOMERY.

MOLE DITCHING, TILE FORMING, AND WIRE LAYING MACHINE.

No. 330,724. Patented Nov. 17, 1885.

Fig. 3.



WITNESSES:

Geo. Beyer

C. Sedgwick

INVENTOR:

S. Montgomery

BY Munn & Co

ATTORNEYS.

(No Model.) 4 Sheets—Sheet 4.

S. MONTGOMERY.

MOLE DITCHING, TILE FORMING, AND WIRE LAYING MACHINE.

No. 330,724. Patented Nov. 17, 1885.

Fig. 5.

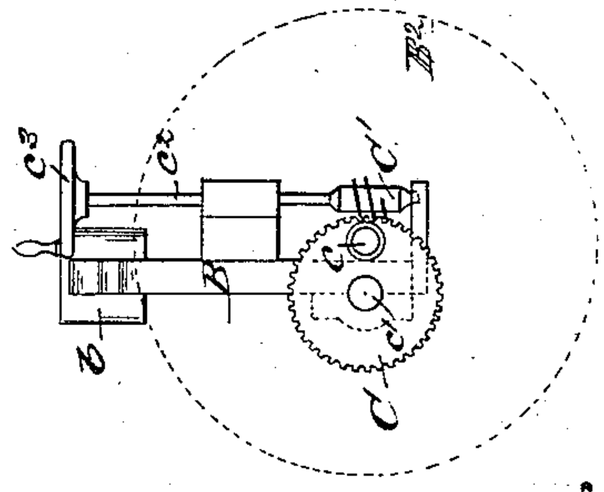


Fig. 6.

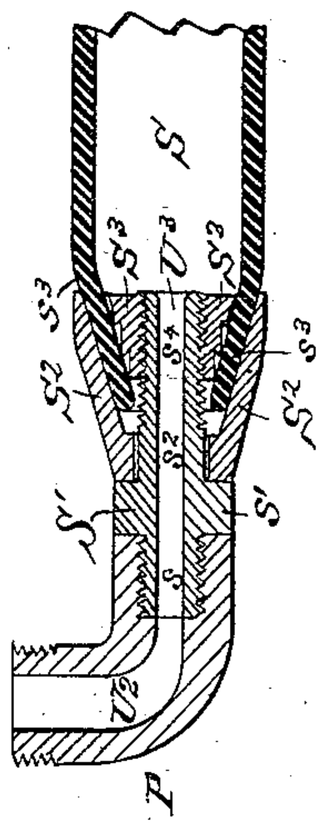
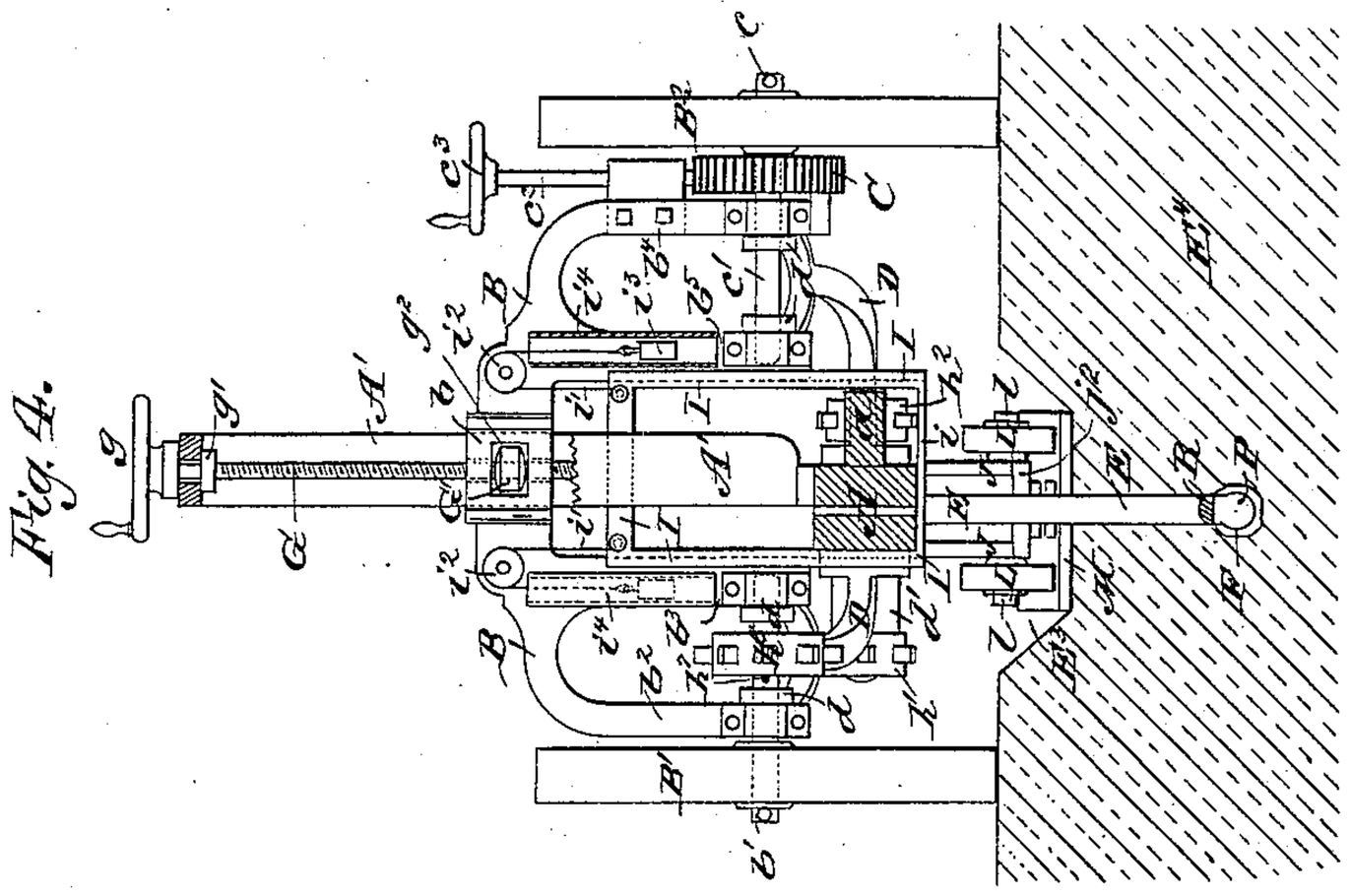


Fig. 4.



WITNESSES:

A. Bonsberger

C. Sedgwick

INVENTOR:

S. Montgomery

BY Munn & Co

ATTORNEYS.

UNITED STATES PATENT OFFICE.

SAMUEL MONTGOMERY, OF WEST TOLEDO, OHIO.

MOLE-DITCHING, TILE-FORMING, AND WIRE-LAYING MACHINE.

SPECIFICATION forming part of Letters Patent No. 330,724, dated November 17, 1885.

Application filed March 23, 1885. Serial No. 159,778. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL MONTGOMERY, of West Toledo, in the county of Lucas and State of Ohio, have invented a new and Improved Mole-Ditching, Tile-Forming, and Wire-Laying Machine, of which the following is a full, clear, and exact description.

The object of my invention is to improve the construction of mole-ditching machines, to adapt them for forming a continuous cement tile or lining to the mole-ditch, and also for laying telegraph or telephone wires either directly in the mole-ditch or within the cement tile formed therein.

A further object of the invention is to provide for perforating the top wall or roof of the continuous tile or leaving it imperforate, at will, so that the tile may be used as a drainage-tile to carry off surface-water, or as a conduit for irrigating land.

The invention consists, also, in various constructions and combinations of parts of the mole-ditching, tile-forming, and wire-laying machine, all as hereinafter fully described and claimed.

Reference is to be had to the accompanying drawings, forming part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a side elevation of my improved mole-ditching, tile-forming, and wire-laying machine as at work. Fig. 2 is a longitudinal sectional elevation of the machine. Fig. 3 is a plan view of the machine, partly in horizontal section. Fig. 4 is a rear view of the machine, partly broken away and in section. Fig. 5 is a detail view of the frame-leveling mechanism, and Fig. 6 is an enlarged longitudinal sectional elevation of the tile-forming head and its connected tile-supporting pipe or tube.

The letter A indicates the beam of the machine, and to which is fixed the slotted standard A′, in and on which slides the head-piece *b* of the frame B, which supports the main wheels B′ B² of the machine. The wheel B′ is fast on its axle *b′*, which is journaled in the parts b^2 b^3 of the frame B at one side of beam A, and the opposite wheel, B², is journaled loosely on a stud or gudgeon, *c*, which is fixed in the face of the worm gear-wheel C at one side of the shaft *c′*, to which wheel C is fixed, and said shaft *c′* is journaled in the parts b^4 b^5 of the frame B. A worm, C′, on a shaft, c^2, journaled to bearings on the frame B, and meshing with wheel C, may be turned by means of its hand-wheel c^3 to raise or lower the wheel B² for leveling the machine transversely, as may be required.

On the opposite shafts, *b′ c′*, are fitted the rear bifurcated or yoke ends, *d*, of arms D D—one at each side of the beam A—and the forward ends of the arms are pivoted at *d′* to the beam near its forward end, the pivot *d′* serving as a fulcrum, on which the arms may rock as the wheel-frame B and wheels B′ B² are raised or lowered to allow the mole-ditching standard E and mole F and connections (which are held to the beam A) to be set for working at any desired depth in the ground, as hereinafter more fully explained.

For raising or lowering the wheel-frame and wheels B B′ B² relatively to the beam A, I employ a screw, G, which is held by its hand-wheel *g* and a collar, *g′*, so as to turn freely and without end movement in the head of standard A′, and said screw G passes loosely through a hole in the head *b* of frame B, and is fitted into a threaded nut, G′, which is fitted to rock in a recess, g^2, of head *b*, into which recess the nut is slipped sidewise. The head *b* has sufficient play in the standard A′, and the nut G′ has sufficient play in the head *b* to allow the entire wheel-frame B and wheels to be moved up and down for quite the full length or height of standard A′ by turning screw G by its hand-wheel *g*, as will readily be understood.

As seen best in Fig. 3, the pivot *d′* is made hollow to allow the passage through it of a shaft, *h*, on opposite ends of which are fixed the chain-wheels *h′* h^2, over which run the chains h^3 h^4, for driving the drain-tile perforator H, which is mounted at the back end of the beam A, as hereinafter more fully explained.

To give the back end of beam A support at both sides when the rear wheel-frame, B, is raised so the lower ends of its parts b^3 b^5 stand above the beam, as when the mole F is working at considerable depth in the ground, I have fitted to the frame parts b^3 b^5 a vertically-movable frame, I, the lower end, *i*, of which comes below the beam, and I fix to the side of the beam the block or plate *a* to fill out the

space between the opposite sides of the frame I, so said sides, which have sufficient length of bearing on the parts b^3 b^5, give a substantial sidewise support to the beam, and to prevent the frame I from falling I connect chains or cords i' to the upper part and run them over pulleys i^2, journaled to frame B, and hang weights i^3 from their other ends, which weights preferably run in boxes or casings i^4, fixed to frame B.

It is evident that the weights i^3 will hold the cross bar i up to beam A, irrespective of the various adjustments of the wheel-frame.

For supporting and vertically adjusting the front end of beam A to level the beam, I provide a yoke, J, the sides j j of which enter notches in the opposite sides of the beam, and to the beam is fixed a nut, J', which has a threaded aperture, in which is fitted the screw K, which may turn loosely in the head j' of yoke J, and is held against end movement by the screw hand-wheel k, and the collar k', at opposite faces of the head. It is evident that by turning the hand-wheel k the forward end of beam A may be raised or lowered at will, as required.

To the sides j j of yoke J are journaled, on suitable short axles l l, the wheels L L, which are designed to run on the ground when it is hard, or nearly so, and when the ground is soft or marshy I will employ the plate M, which has an upwardly-projecting rigid stud, m, which passes through the overlapping eyes of the draft-bars M' M^2, and also through the lower detachable bottom plate, j^2, of the yoke J, and a retaining-pin m', passed through stud m above plate j^2, holds the shoe M and bars M' M^2 to the yoke. The draft-bar M' passes through a slot, m^2, in the forward upturned end of shoe M, and has an eye at its forward end to receive the draft-chain which is to be connected with a capstan or locomotive-engine for drawing the machine along when at work.

To remove the shoe M it only is necessary to remove pin m' and plate j^2, when the draft-bar M^2 may be placed above the plate j^2 before the plate is again fastened to the yoke J, and the draft-chain may then be connected directly with the end of bar M^2, and the rollers L L then will rest on the ground. I connect the back end of the draft-bar M^2 with the lower end of a lever, N, which is pivoted on a bolt, n, between the two parallel timbers used in making the beam A, and the upper end of lever N is connected by a link, N', with the upper hook-shaped end of a heavy spring, N^2, which is fixed to beam A, and has sufficient stiffness to resist the draft of the machine when the mole F and standard E meet no obstructions in the soil, and to provide for giving an alarm when the parts E F meet an obstruction—such as a buried rock or log—I connect the lever N by a link, n', with a trip-lever, n^2, which is pivoted to the case of an alarm-bell mechanism, n^3, so that when the draft-strain suddenly is increased as the mole strikes the obstruction and the head of lever N moves backward against the tension of spring N^2, the tooth of trip-lever n^2 will be swung out of engagement with the ratchet-wheel n^4 of the alarm mechanism, whereby the hammer n^5 will strike the bell n^6 to give the alarm in time to ease the draft and prevent breakage of the machine.

I make the draft-bar M^2 in sections connected by a turn-buckle, m^3, which allows adjustment of the length of the draft-bar.

As seen best in Fig. 2, the stud m of shoe M, when the shoe is used, stands normally at the back end of a slot, j^3, in plate j^2, so that said stud may move forward in the slot as the draft-strain increases and the alarm is sounded; hence the draft will not come at any time upon the forward yoke, J, of beam A, but will always be exerted on the lever N, which is placed quite near the mole F, which makes the machine draw easily.

I describe the construction and operation of the mole-ditching, tile-forming, and wire-laying devices as follows: I secure the head of the standard E to the beam A in any suitable manner, and shape the lower end of the standard h as a forwardly-projecting foot-piece, e, on which detachable moles F, of any size, may be placed, according to the desired size of the mole-ditch. Behind the foot-piece e the standard E is cut away, so as to leave a space, e', into which the cement O may pass after it descends from the hopper O' through an opening, E', made vertically through the standard E. (See Fig. 2.) The forward edge of standard E is sharpened, as at e^2, so it may more easily pass through the soil.

As best seen in Figs. 1, 2, and 6, I fit into the back part or heel of the standard, and preferably by a screw-joint, the bent or curved head P, which projects into the space e', behind the mole F; and I prefer to make the head P round in cross-section and of such size that its lower side will stand above the bottom of the ditch cut by the mole F, to allow the cement O to settle below the head for forming a cement bottom or floor, o, to the continuous tile O^2, and the horizontal part of head P is centered with relation to the top and side faces of the mole F, so that a cement lining, o', will also be formed at the top and both sides of the mole-ditch.

It is evident that by using moles F and heads P of different cross-sectional shape any desired form may be given the ditch and its cement tile-lining O^2.

To the lower end and back edge of the standard E is pivoted at r the trailing plate or arm R, the back end of which is connected at r' with the lower end of a tube, R', to which a collar, R^2, may be fixed by a set-screw, r^2, so that the collar holds the tube R' and arm R up by resting on a plate, R^3, which is fixed to the back end of the beam A, and the plate R^3 is slotted, as at r^3, to allow the tube R' to move laterally either way for a limited distance, and permit the back end of arm R to

swing laterally as the machine may be drawn in a curve to either side. The object of the arm R, which snugly fits the slit E^2, made in the ground by the standard E, is to offer a resistance to the upward spreading of the cement; or, in other words, to compress and solidify the top or roof *o'* of the cement tile by confining the cement around the tile-forming head P, and for a sufficient distance back of or behind the head.

The arm R may be of any desired length, and when it is not desired to use the tube S, which is connected with the head P, for supporting the continuous tile O^2 for a considerable distance back of the head P, the arm R may be fixed permanently to the back of the standard E over the head P, as will readily be understood.

The tube S, which preferably is made of rubber, is connected to the back end of head P, as seen best in Fig. 6, by means of a screw-plug, S', which has a screw-threaded end, *s*, fitted to threads in the back end of head P in front of the collar *s'* of the plug, and back of collar *s'* the plug has a plain portion or shoulder, s^2, on which the head-piece S^2 is placed, said head-piece being made flaring and hollow back of the part s^2 of the plug to allow the crimped or slit end s^3 of tube S to be placed inside of it and over the tapering nut S^3, which has a notched or serrated exterior surface, and is fitted to threads on the back part, s^4, of the plug S'.

The threads on parts *s* s^4 of the plug S' are preferably made right and left handed, so that when the part *s* is entered into head P and the nut S^2 started on the part s^4, by applying a wrench to collar *s'* and turning the plug S', said plug will be screwed home on head P, and the end s^3 of tube S will be clamped firmly between the nut S^3 and the inside of the tapering head-piece S^2, and so that the friction between the tube S and the walls of the continuous tile O^2 will not uncouple the tube.

I make special mention of the flaring backward of the head-piece S^2 of the pipe-coupling, as said head serves as a finishing former to the interior of the continuous tile O^2, and its flaring exterior surface acts on the cement back of the first tile-forming head P, to gradually enlarge the interior bore or cavity of the continuous tile from the diameter or size of the head P to the diameter or size of the tube S, which has the effect of finally compacting the walls of the tile beneath the arm R to such an extent as practically to force most of the moisture from the cement into the earth around it, so that by the time the tube S has passed the tile will be quite hard and dry, and the said tube will give the tile a smooth interior finish as it passes through it. The head-piece S^2 and tube S may have the same general form in cross-section as the head P, to give any desired shape and size to the tile. It is evident that the head-piece S^2 bears on its flaring face all the strain of finally compressing the cement, and as the back end of this head-piece is fully as large, or a little larger, than the tube S, it will relieve the tube from excessive friction or wear at its forward end. The arm R may be concaved transversely at its under side, if preferred.

As best seen in Fig. 2, the chisel or cutter H' of the perforator H passes down through the tube R', so that the top *o'* of the cement tile O^2 may be perforated, as at T, to allow surface-water to pass freely into the tile, to be conveyed thereby to any point of discharge, and the tiles may thus be laid at intervals, so as to constitute an effective system of land-drainage. I cause the perforator to work through the tile at T, over the tube S, which yields sufficiently to allow the perforations to be made, and at the same time supports the top of the tile from being broken by the perforator.

I connect the perforating-chisel H' to the head of the perforator by a screw or other joint, as at H^2, allowing larger or smaller or differently-shaped chisels to be substituted, one for the other, to cut any size or shape of perforation desired.

The head of the perforator is connected by a suitable coupling, which may be formed of two links, H^3, pivoted together, with an eccentric or crank fixed to or formed on the shaft *t*, which is journaled in bearing-plates *t' t'*, fixed to the sides of the back end of the beam A, and on said shaft *t* is fixed the chain-wheel h^5, over which the chain h^4 passes, to vertically reciprocate the perforator by the agency of the chain-wheels *h' h²*, chain h^4, and the driving-chain wheel h^6, which latter wheel, when the perforator is to be worked, is made fast to the shaft *b'* of wheel B' by a pin, h^7, Fig. 4, and when the perforator is not to be worked the pin h^7 will be withdrawn to allow the wheel h^6 and its connected driving-gearing h^3 *h' h²* h^4 h^5 to remain at rest, and at such times the chisel H' may be disconnected from the head of the perforator, or may simply be raised up within the tube R'.

When the tile is to be used to convey water from one place to another without mixing with surface-drainage, the perforator will not be used; and when the tile is laid across lands which are not to be drained, and so as to drain lands only that are at a higher level and at a lower level, the perforator will not be worked while the tile is being laid in the intermediate lands; hence the tile may be laid so as either to drain or not drain lands, at will, by controlling the action of the perforator, as above described.

By substituting different-sized chain-wheels, one for the other, the perforator may be driven at any desired speed for spacing the perforations T in the tile at any desired distance apart.

To adapt the machine for laying wires U—such as telegraph or telephone wires—in the continuous tile as it is formed, and so that the tile serves to protect the wires, I make a vertical passage, U', through the standard E,

and communicating passages U^2 U^3 through the head P and plug S′, respectively, so that the wires may be unreeled from a spool, U^4, supported in bearings *u*, fixed to the standard A′, and passed through the passsage U′ U^2 U^3 into and through the tube S, and thence to the inside of tile O^2, as clearly indicated in Fig. 2. The loose end of the wire U will be fixed to a stake, U^5, or other object in the earth at the starting-point, so that wires will be unreeled and laid automatically as the machine advances to form the ditch and tile.

It is evident that the machine may be used for cutting the mole-ditch and laying wires U therein, and without forming the cement around the wires, if desired, and any number of wires may be laid in the tile or ditch at once.

At V is shown an indicator, which is pivoted at *v* to a frame, W, fixed to beam A, and the lower end of the indicator is weighted, as at *v*′, so its top or point v^2 shall range along a scale, X, at the head of frame W, which scale has a series of graduations, *x*, in relation with which the pointer v^2 indicates the extent to which the machine stands out of level lengthwise while at work, so that any predetermined grade of the mole ditch or tile may be maintained at any particular place.

By stretching a wire or cord above ground and lining the top of the beam with the wire a uniform depth of mole ditch and tile from the ground surface may be secured.

In Figs. 1, 2, and 4 the machine is represented as working along a ditch, E^3, cut in advance of it, and in which ditch the shoe M rests, so that the standard E will move through the solid earth E^4 so much the easier when the mole F is worked at considerable depth in the soil.

It will be understood that the wire-passage through the standard shown at U′ may be substituted by a pipe running through the cement-passage E′, in which case the head P would be an elbow fitted on the lower end of the wire-guiding pipe. The tile-forming head P may be larger in diameter than the mole-plow F in advance of it, in which case the cement will be forced into the earth as it is pressed outward every way by the head P. Lead pipe may also be laid in the mole-ditch, formed either with or without a cement lining or tile, the pipe running from a reel into the ditch, substantially as above described for the telegraph-wire.

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

1. In a mole-ditching machine, the beam A, provided with the standard A′ and mole-plow standard E, and the rear wheel-supporting frame B, fitted to slide in standard A′, and connected with the rear ends of arms D D, which are pivoted at their front ends to the beam A, in combination with a screw, G, and nut for raising and lowering frame B, and a forward yoke or frame, J, provided with screw K, working in a nut attached to the beam, for vertically adjusting its forward end, substantially as herein set forth.

2. The combination, with the beam A, the standard A′, sliding frame B, pivoted arms D D, and a forward support to the beam, of a rear wheel, B′, journaled to frame B, and the opposite wheel, B^2, journaled on an eccentrically-placed stud fixed to a worm-wheel, C, journaled to frame B, and the worm C′, substantially as herein set forth.

3. The combination, with the beam A and wheel-supporting frame B, of the frame I, fitted to slide on frame B, and cords and weights *i*′ i^3, to give lateral support to beam A, substantially as herein set forth.

4. The draft-bar M^2, connected at the under side of beam A near the mole-standard E, in combination with the forward yoke, J, having wheels L, and a removable bottom plate, j^2, and the shoe M, having a stud, *m*, passing through plate j^2 and the forward end of bar M^2, and said shoe M having draft-connections, whereby the forward supports of the machine may be adjusted to sustain the beam either on the wheels L or shoe M, substantially as herein set forth.

5. The combination, with the beam A, mole-standard E, and draft-bar M^2, of the lever N, link N′, spring N^2, and connections, substantially as herein set forth.

6. The mole-standard E, made with a recess, *e*′, behind the mole, a cement-passage, E′, opening into the forward part of recess *e*′, and a tile-forming head, P, secured to the standard behind the passage E′, and having a horizontal portion centered in the mole-ditch, said standard having the aforesaid passage and recess, and to which the head is connected, constituting also the standard or shank of the mole, substantially as herein set forth.

7. The combination, with the beam A, mole-standard E, having the recess *e*′, the cement-passage E′, and the tile-forming head P, of an auxiliary gradually-enlarging forming-head arranged intermediately of the tube S and head P, as at S^2, for compressing the walls of the tile and finishing its interior bore or face, substantially as herein set forth.

8. The combination, with the beam A, the mole-standard E, having a recess, *e*′, cement-passage E′, and the tile-forming head P, of an arm, R, pivoted to the standard, substantially as herein set forth.

9. The combination, with the beam A, the mole-standard E, having recess *e*′, cement-passage E′, and tile-forming head P, and a gradually-enlarging finishing-head, S^2, arranged intermediately of the tube S and head P, of the arm R, pivoted to the lower end of the mole-standard, substantially as herein set forth.

10. The combination, with the beam A, the mole-standard E, having recess *e*′, cement-passage E′, and a tile-forming head fixed to the

standard behind passage E′, of a tube or flexible finisher connected to the head, so as to trail in the tile, substantially as herein set forth.

11. The combination, with the beam A, the mole-standard E, having recess *e′*, cement-passage E′, and the tile-forming heads P S^2, of the tube S, secured to head S^2, so as to trail in the tile, substantially as herein set forth.

12. The combination, with the beam A, mole-standard E, having recess *e′*, cement-passage E′, and attached tile-forming head, substantially as specified, of the trailing tube S, held to the tile forming head, and the arm R, extending over the said head and tube, substantially as herein set forth.

13. The combination, with the beam A, the mole-standard E, having recess *e′*, cement-passage E′, and a connected tile-forming head and trailing tube, substantially as specified, of the arm R, and a standard, R′, supporting its rear end from the beam A, substantially as herein set forth.

14. The combination, with the mole-standard E, its tile-forming head P, and the trailing pipe S, of the screw-plug S′, head S, and the tapering nut S^3, substantially as herein set forth.

15. In a mole-ditching and tile-laying machine, a perforator arranged behind the mole-plow and tile-forming devices, and adapted to pierce the top wall of the finished tile, substantially as herein set forth.

16. The combination, with the beam A, mole-standard E, having recess *e′*, cement-passage E′, and a connected tile-forming head or heads, of a perforator acting to pierce the top wall of the finished tile, substantially as herein set forth.

17. The combination, with the beam A, mole-standard E, having recess *e′*, cement-passage E′, and a connected tile-forming head or heads provided with an elastic or yielding tube, which trails in the tile, of a perforator piercing the tile over the yielding tube, substantially as herein set forth.

18. The combination, with the beam A, and mole-standard E, recessed at *e′*, and having a tile-forming head provided with a trailing tube, S, of the arm R, tube R′, and the tool H′ of the perforator H, working in tube R′, and said perforator connected to a crank-shaft for driving it by gearing connected to the wheel of the machine, substantially as herein set forth.

19. The combination, with the beam A, mole-standard E, recessed at *e′*, and having a tile-forming head, and the arm R, tube R′, and perforating-tool H′, guided by tube R′, of a collar, R^2, and a plate, R^3, having a slot, r^3, allowing lateral play of the perforator and arm R, substantially as herein set forth.

20. The combination, with the beam A and the perforator crank-shaft *t*, of the chain-wheel h^5, chain h^4, chain-wheels h^2 *h′*, chain h^3, and the chain-wheel h^6, carried by the axle of wheel B′, substantially as herein set forth.

21. The combination, with the beam A, of mole-standard E, having cement-passage E′ and wire-passage U′, and provided with a cement-tile-forming head behind passage E′, substantially as specified, and the tile-forming head having passages connecting passage U′ with the interior of the cement tile, whereby the wires U may be laid within the continuous cement tile as the machine moves forward, substantially as herein set forth.

22. The combination, with the beam A, draft-bar M^2, lever N, and spring N^2, of the alarm mechanism n^3 n^6, and the connections, substantially as shown and described, whereby an alarm will be given when the mole strikes an obstruction, as set forth.

SAMUEL MONTGOMERY.

Witnesses:
EMMA HAYNES,
A. D. STEWART.