(No Model.) 3 Sheets—Sheet 1.

F. M. LECHNER.

MINING MACHINE.

No. 432,754. Patented July 22, 1890.

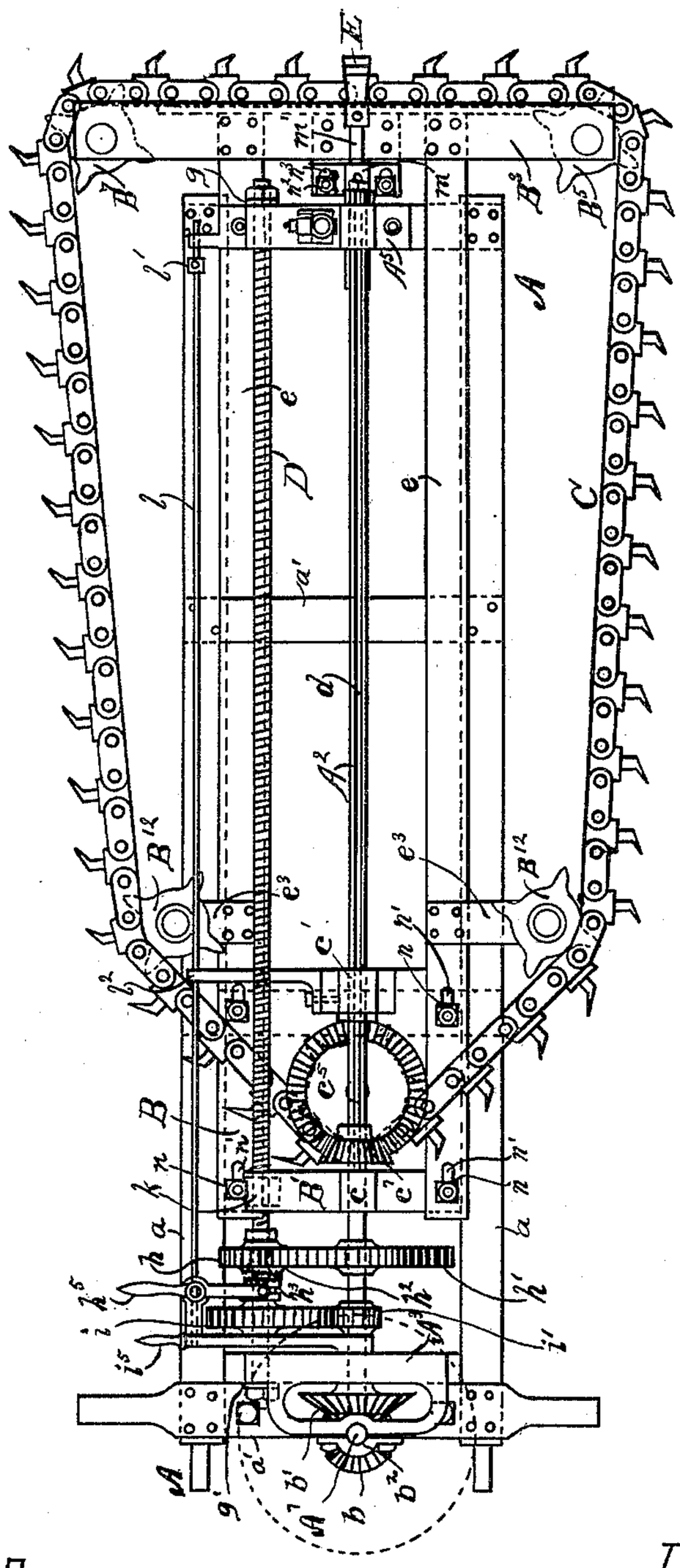

Fig. 1.

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MINING MACHINE.

No. 432,754. Patented July 22, 1890.

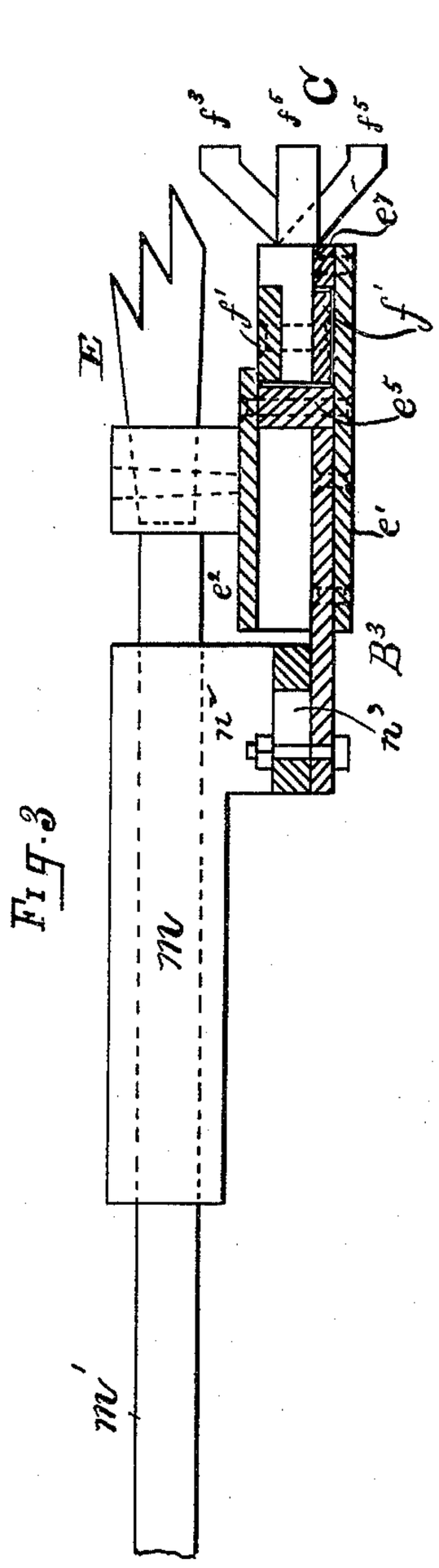

Fig. 3

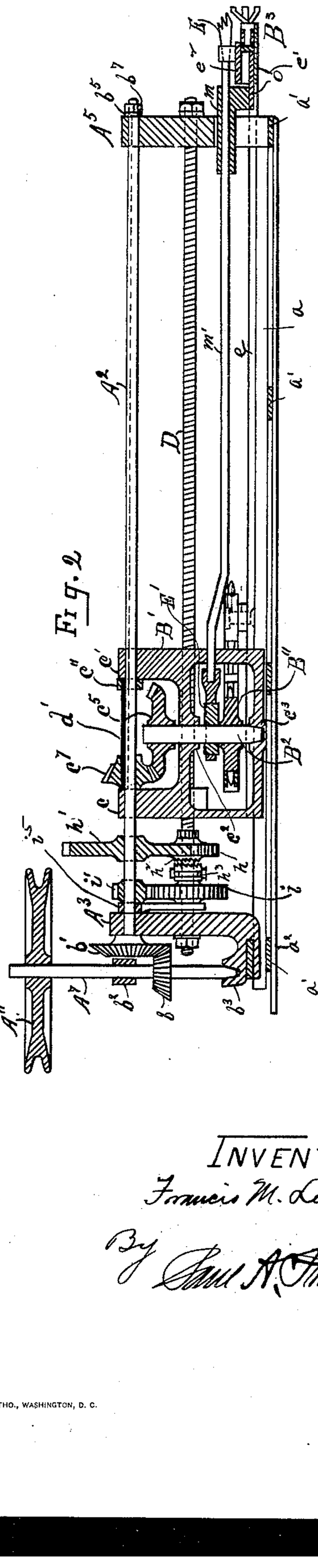

Fig. 2

WITNESSES

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(No Model.) 3 Sheets—Sheet 3.

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Fig. 4

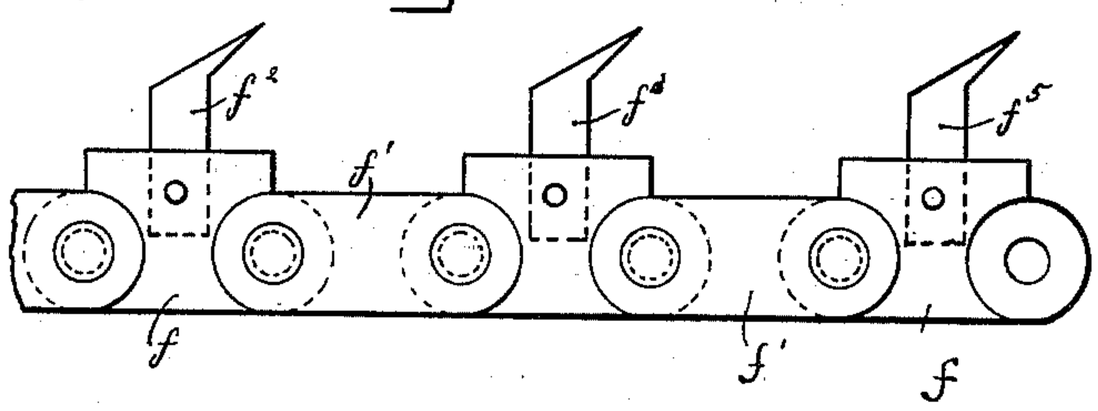


Fig. 5

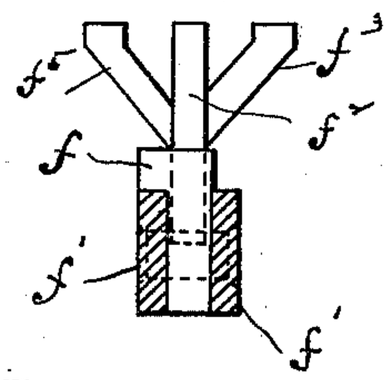


Fig. 6

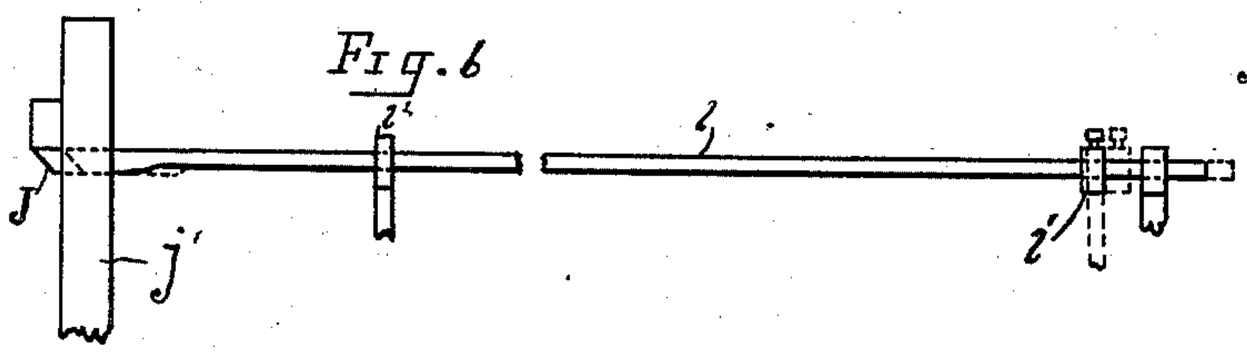


Fig. 7

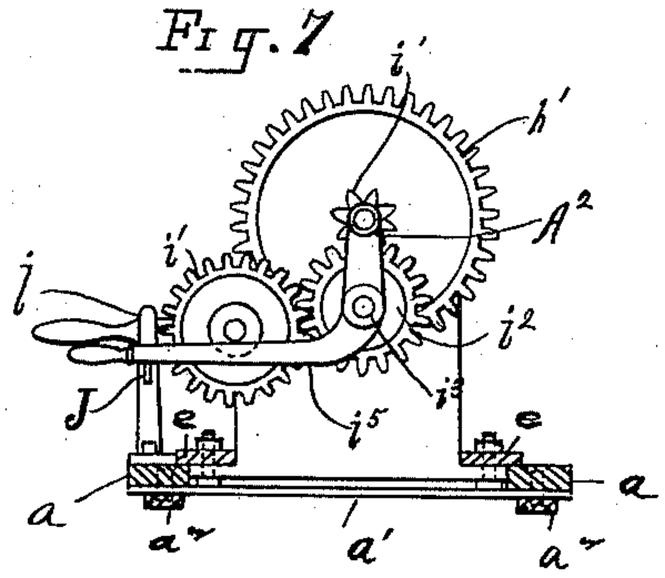


Fig. 8

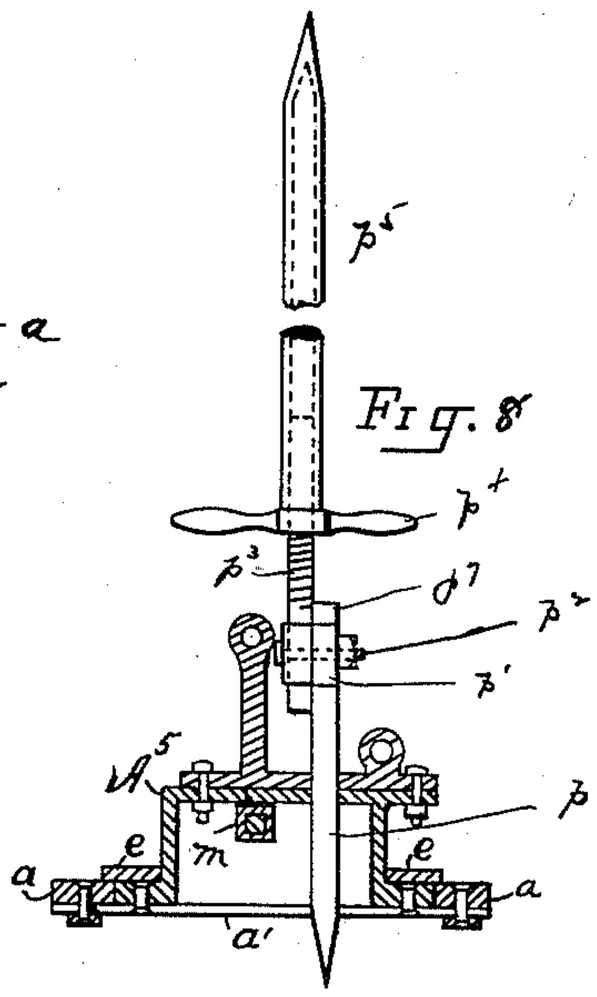
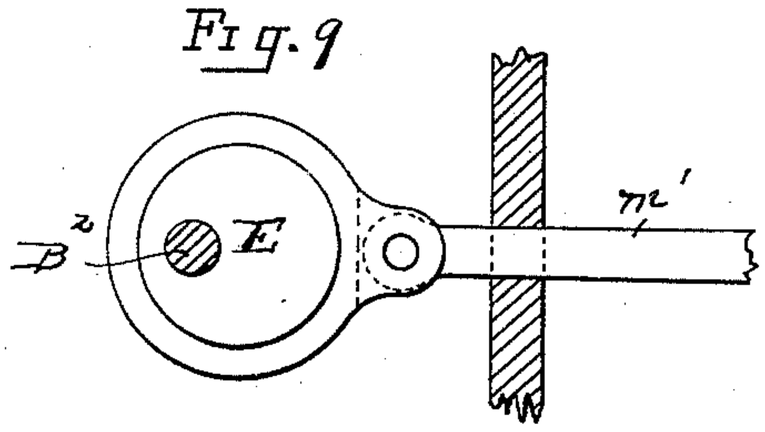


Fig. 9



WITNESSES

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Chas. I. Welch

INVENTOR

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UNITED STATES PATENT OFFICE.

FRANCIS M. LECHNER, OF COLUMBUS, OHIO, ASSIGNOR TO THE LECHNER ELECTRIC MINING MACHINE COMPANY, OF SAME PLACE.

MINING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 432,754, dated July 22, 1890.

Application filed March 31, 1890. Serial No. 345,968. (No model.)

To all whom it may concern.

Be it known that I, FRANCIS M. LECHNER, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Mining-Machines, of which the following is a specification.

My invention relates to improvements in mining machinery, the object of my invention being to provide a machine of simple construction especially adapted for mining coal and similar substances.

My invention consists in the various constructions and combinations of parts hereinafter described, and set forth in the claims.

In the accompanying drawings, Figure 1 is a plan of a machine embodying my invention. Fig. 2 is a longitudinal sectional elevation of the same. Fig. 3 is an enlarged view, partly in section, of a portion of the cutting and holding mechanism and its supporting-frame. Figs. 4 and 5 are respectively a plan and cross-section of the endless belt or chain cutters which I preferably use. Fig. 6 is a detailed view of a portion of the mechanism for automatically throwing out or disengaging the feed. Fig. 7 is a detail view, partly in section, of the mechanism for operating the feeding device. Fig. 8 is a transverse sectional elevation of the main frame and a portion of its supporting mechanism, showing the arrangement of the "jack" or fastening device for holding the main frame in position. Fig. 9 is a detail view showing the manner of driving a portion of the cutting mechanism, which forms a part of the holding device and which will be more fully referred to hereinafter.

Like parts are indicated by similar letters of reference throughout the several views.

In the said drawings, A A represent the main frame of the device, which consists, essentially, of the longitudinal bars a a and transverse connecting-bars a' a', the main frame being also preferably provided with under supporting strips or runners a^2, extending longitudinally under each of the frame-pieces a, the said strips or runners a^2 being adapted to facilitate the movement of the machine to different positions.

Located upon the main frame A A and adapted to slide upon the longitudinal pieces a a is a moving frame or carriage B B, which carries the cutting mechanism and is adapted to be fed longitudinally along the main frame in a manner hereinafter more fully described.

Extending longitudinally along the main frame A A is a power-shaft A^2, which is supported in suitable bearing-stands A^3 A^5 at each end of the main frame A A. This shaft A^2 receives motion from a vertical shaft A^7, located at one end of the machine, through the medium of beveled gears b b', the vertical shaft A^7 being supported in suitable bearings b^2 b^3 in the supporting-stand A^3. The power to drive the machine is supplied to the vertical shaft A^7, preferably through the medium of a rope or cable to a driving sheave or pulley A^{11} from any convenient source of supply.

Connected to the rear end of the traveling frame B B is a supporting stand or frame B′, provided at the top with suitable bearings c c' to receive the power-shaft A^2, the said bearings being adapted to move longitudinally along said shaft and at the same time permit a rotary movement of said shaft therein.

Supported in suitable bearings c^2 c^3 in the supporting-stand B′ is a vertical shaft B^2, provided at its upper end with a beveled gear c^5, which meshes with a beveled pinion c^7, which turns with the power-shaft A^2. The line-shaft A^2 is provided throughout the greater portion of its length with a keyway d. In the keyway and extending between the bearings c and c' is a spline or feather d', connected rigidly to the beveled pinion c^7 and to a collar c^{11}, which rest, respectively, against the bearings c and c', and thus prevents longitudinal movement of the said pinion with reference to the supporting-stand B′, means being thus provided whereby the motion of the power-shaft A^2 is transmitted to the vertical shaft B^2, while at the same time the traveling frame B B and supporting-stand B′ are permitted a longitudinal movement with reference to the main frame and to said line-shaft.

It should be noted that the power-shaft A^2 is held against longitudinal movement through the bearing-stands A^3 A^5. This is preferably accomplished by placing a collar b^5, adapted

to bear against the bearing-stand A^5, while the beveled gear b' bears against the other bearing-stand A^3, the collar b^5 being preferably held in place by a retaining-nut b^7, the shaft being turned down and threaded for this purpose.

The traveling frame B B is provided with longitudinal bars *e e*, which rest upon the longitudinal bars *a a* of the main frame, the traveling frame being constructed slightly wider than the distance between the inner edges of the main frame-bars *a a*, so that the bars *e e* overlap the frame-bars *a a* sufficiently to form a bearing for the parts, as shown in Figs. 1 and 8.

The bearing-stand A^5 on the main frame A A is preferably formed with a yoke or U-shaped bottom, and is connected to the longitudinal bars *a a* of the main frame through the medium of one of the cross-bars *a'*, all the parts being preferably riveted or otherwise rigidly secured together. The bars *e e* of the traveling frame are adapted to bear against the sides of the U-shaped portion of the bearing-stand A^5, which thus forms lateral bearings for said traveling frame to prevent a lateral movement of the said frame with reference to the main frame. (See Fig. 8.)

The traveling frame B B is provided at the front end with a transverse supporting-bar or bearing-support B^3, which extends entirely across said frame and to some distance on either side of the main frame A A. This supporting-bar B^3 consists, essentially, of two longitudinal plates e' e^2, connected rigidly to the bars *e e*, the parts being preferably riveted rigidly together. At the outer extremities of this supporting-bar B^3 are sprocket-wheels B^5 B^7, around which pass the endless chain or belt cutter C. This endless chain or belt cutter C receives its motion from a sprocket-wheel B^{11} on the vertical shaft B^2, idlers or guiding-wheels B^{12} being provided on either side of the frame to support the said belt cutter and guide it onto the driving-sprocket B^{11}. These idlers B^{12} are supported on outwardly-extending plates e^3, connected to the longitudinal bars *e* of the traveling frame.

The endless belt or chain cutter C consists, essentially, of cutter heads or blocks *f*, connected together by suitable connecting-links *f'*, arranged at suitable intervals to receive the teeth of the sprocket-wheels. The cutter heads or blocks *f* are provided with cutters f^2 f^3 f^5, the said cutters being adapted to travel in different parallel planes—*i. e.*, the first cutter extends straight out from the cutter-head at right angles to said cutter-head. The next cutter is provided with a bent shank, which throws the cutter below the plane of the first cutter, the third cutter being provided with a bent shank, which throws the cutter above the plane of the first cutter, each third cutter being thus adapted to travel in a different plane. The links and cutter-heads of the endless belt C are so formed that when the parts are extended, as shown in Fig. 4, the backs of the respective links and cutter-heads stand flush and form a straight line.

The lower plate e' of the supporting-bar B^3 is made wider than the upper plate e^2, the front edge of said plate being extended beyond the upper plate. Fastened securely between the plates e' and e^2, preferably riveted thereto, is a guiding strip or bar e^5, placed slightly back of the front edge of the upper plate e^2. The front face of this guiding strip or bar e^5 is arranged in a line tangent to the front of the sprocket-wheels B^5 B^7, so that the back of the chain or belt cutter, in passing between said sprocket-wheels, rests against and travels along said guide strip or bar e^5, the said links and blocks of said chain being adapted to fit snugly between the said plates e' e^2. Each of the cutter heads or blocks *f* is extended beyond the front edges of the links *f'*, the backs of the said links and blocks being arranged flush, as before described. The extended portion of each cutter-head *f*, however, is cut away at the bottom for a distance equal to the thickness of the lower link *f'*. Secured rigidly to the front edge of the plate *e'* is a retaining-strip e^7, of a thickness equal to the thickness of the links *f'*, and arranged at a distance from the guide-strip e^5 equal to the width of the said links. When the chain or belt cutter C is in position, this retaining-strip e^7 comes in the cut-away portion of the cutter-head *f* and rests against the front edge of the lower links *f'* of said endless belt or chain cutter. It will be seen that in traveling between the sprocket-wheels B^5 and B^7 the endless chain or belt cutter will thus be held firmly in position against lateral or vertical movement in either direction.

It will be understood from the description thus far that the motion imparted to the driving-shaft A^7 will be communicated to the endless belt or chain cutter C, supported on the traveling frame B B. Means are provided for feeding this traveling frame forward along the main frame A A. The traveling cutter is thus brought in contact with the bank of coal or other mineral and forms an under-cut or incision in the bank or vein.

To provide for feeding the traveling frame forward automatically as the cutters perform their operation, I employ a longitudinal shaft D, having a bearing at each end in the bearing-supports A^3 and A^5 and screw-threaded for the greater portion of its length, as shown in Figs. 1 and 2. This screw-threaded shaft D is held against longitudinal movement in its bearings by suitable collars *g g'*, secured rigidly at the ends thereof. Journaled loosely on the screw-threaded shaft D is a spur-pinion *h*, adapted to engage in a spur-gear *h'* on the line-shaft A^2. This pinion *h* is provided on one side with a clutch-face h^2, adapted to be engaged by a similar sliding clutch-collar h^3, operating on a spline-key, in a well-known manner, on the shaft D. A shifting-lever h^5 is adapted to throw the clutch-collar h^3 in con-

tact with the pinion h, and thus cause the screw-threaded shaft D to revolve with said pinion.

Secured rigidly to the screw-threaded shaft D and at the other side of the clutch-collar is a spur-gear i, adapted to receive motion from a spur-pinion i' on the line-shaft A^2, through the medium of an intermediate gear i^2. (See Fig. 7.) It will be seen that by this construction the spur-gear i and the shaft D are caused to rotate in an opposite direction to the spur-gear h, which turns loosely on the shaft. The intermediate gear i^2 is journaled on a suitable supporting-stud i^3 on an L-shaped shifting-bar i^5, journaled or pivoted on the power-shaft A^2. A spring-latch j in a supporting-standard j' is adapted to hold the shifting-lever i^5 in position to cause the intermediate gear i^2 to engage with the spur-gear i' on the screw. When said latch is withdrawn, the shifting-lever i^5 will drop down, causing the intermediate gear to be disengaged from the spur-gear i'. If now the clutch h^3 is thrown into engagement with the spur-gear h^2, the screw-threaded shaft D will be revolved in the opposite direction.

Located in the supporting-stand B′ and secured thereto is a screw-threaded nut k, adapted to engage with and travel on the screw-threaded shaft D. It will be seen now that as the shaft D is revolved in either direction the traveling frame B B, together with the endless-belt cutter, will be carried forward or back along the main frame A A.

To provide for automatically throwing the feed mechanism out of gear when the traveling frame has reached the limit of its forward travel, I furnish a connecting-rod l, attached to the spring-latch j, said connecting-rod being preferably extended the entire length of the main frame A and journaled in suitable bearings thereon. On this connecting-rod l, I provide a movable collar l', adapted, as the traveling frame is moved forward, to be engaged by a projecting arm l^2 on the supporting-stand B′, and thus move said connecting-rod longitudinally and withdraw the spring-latch j from contact with the shifting-lever i^5. By means of the adjustable collar l' means are provided for disengaging the feed and thus stopping the forward movement of the traveling frame at any desired point in the length of its travel, after which it may be returned to its original position by causing the clutch a^5 to engage with its pinion, and thus reversing the movement of the feeding-shaft D.

I preferably construct the bearing in the standard A^3, which supports the feeding-shaft D, so that said shaft may be disengaged and the spur-gear i removed and other gears of different sizes be inserted in its stead to provide for different speeds in the forward feeding of the traveling frame, the intermediate gear being made of sufficient size to engage with any of said gears when placed thereon.

For holding the traveling frame B B against lateral movement in the operation of the cutting device when said frame has been moved outwardly from the main frame I furnish an additional or auxiliary cutter adapted to cut a channel immediately above the incision or kerf made by the endless-belt cutter, and furnish on said traveling frame a holding projection adapted to engage in said channel as the frame is advanced, and thus prevent any side or lateral movement of the traveling frame. This I preferably accomplish as follows: Immediately above and slightly back of the line of cut of the endless-belt cutter I place a reciprocating cutter or chisel E, having a bearing near its outer end in a bearing-box m, through which it is adapted to reciprocate, the said box m being preferably formed rectangular in cross-section and of a size substantially equal or slightly less than that of the reciprocating cutter E. A reciprocating motion is given to the cutter E through the medium of a connecting-rod m', which extends backwardly through the supporting-stand B′, and is connected to an eccentric E′ on the vertical shaft B^2 on the traveling frame. It will be seen now that as the shaft B^2 revolves to impart motion to the endless belt or chain cutter a reciprocating motion is imparted through the medium of the eccentric E′ to the reciprocating cutter E. This cutter, operating against the bank or vein immediately above the kerf or incision formed by the endless-belt cutter, produces a channel substantially rectangular in shape and opening into said kerf or incision, into which the projecting bearing m enters as the traveling frame is advanced, thus holding said traveling frame firmly against lateral movement and against the thrust of the cutters as they advance into the mineral. To provide for adjusting the distance between the driving-sprocket B^{11} and the supporting-sprockets B^5 B^7, to loosen or tighten the endless-belt cutter, I connect the supporting-standard B′ to the frame B B by bolts n, which pass through slotted openings n' in the longitudinal bars e of said traveling frame. The projecting bearing-box m is also similarly connected to the front portion of the frame by means of bolts n^2, passing through slotted openings n^3, the box m being preferably connected to a backwardly-projecting plate o, riveted or otherwise secured to the transverse supporting-bar B^3.

To provide for holding the main frame in position, I furnish what I term the "holding-jack," which is best illustrated in Fig. 8. This consists, essentially, of a spike or sharpened bar p, preferably formed at the outer part of rectangular shape in cross-section and adapted to pass through a similar-shaped opening in the supporting-stand A^5. This spike p is provided with an enlarged or swelled portion p', through which is extended a fastening-bolt p^2, thus connecting thereto a screw-threaded bar p^3, a pivoted connection being formed by means of the bolt p^2 between the respective parts p and p^3. Located on the screw-threaded

bar p^3 is a hand-nut p^4, adapted to be elevated or depressed upon the said bar p^3. Resting on the nut p^4 is a tubular connection p^5, which may be of any suitable length to extend to the top or ceiling of the gallery or mine in which the machine is operated, this tubular connection being also provided with a spike or pointed end p^6. The spike-shaped bar p is provided with an upper extended portion p^7, which projects slightly above the enlarged or swelled portion of said bar, so that when the screw-threaded bar p^3 is turned on its pivoted center, so as to lie in a horizontal plane, the portion p^7 extends above the said screw-threaded portion and is adapted to form a head, upon which a hammer or sledge may be used to drive the spiked portion p^3 into the floor or gallery of the mine, after which the screw-threaded portion is elevated to the proper angle, and the tubular connecting-piece placed thereon and forced to the roof or ceiling by means of a hand-nut p^4. It will be seen by the construction that after the spike portion is started into the floor the frame is held against a lateral movement. When the upper extension is placed thereon, the top parts may be forced in opposite directions into the ceiling and the floor, respectively, and thus hold the frame firmly against any movement in either direction.

It will be seen that as thus constructed a machine which is simple and effective in its operation is provided. By the use of the supplemental cutter and the holding projection adapted to follow in a channel made by said cutter I am enabled to produce a machine in which a single endless cutting-belt is adapted to perform all the operation of cutting. By the construction, as described, of the transverse supporting-bar b^3 and the formation of the belt-cutter the said cutter is held firmly against lateral or vertical movement and caused to travel positively in a straight line across the front of the machine, and thus produce a smooth even kerf or incision, the arrangement of the cutters or cutting-teeth being such as to secure a kerf or incision of suitable width and depth to admit the traveling frame and its necessary appurtenances.

It is obvious that the constructions shown and described admit of modifications in the details of constructions and arrangements without departing from the spirit of my invention. I do not therefore limit myself to the exact construction set forth, but claim as my invention—

1. The combination, with a traveling frame and an endless-belt cutter, of an auxiliary cutter operating in a different plane from said endless-belt cutter, and a holding projection adapted to follow said auxiliary cutter into the kerf or incision made thereby to form a holder to operate against the thrust or force of the endless-belt cutter, substantially as specified.

2. The combination, with a traveling frame and an endless-belt cutter thereon, of a reciprocating auxiliary cutter arranged above and slightly in the rear of the line-cut of said endless-belt cutter, a holding projection having substantially the same size as said auxiliary cutter and arranged in the rear and in line with said cutter, and means, substantially as described, for imparting motion to said cutters, substantially as specified.

3. The combination, with the main frame and a traveling frame thereon, of a line-shaft and a feed-shaft on said main frame, means for imparting motion to said feed-shaft in either direction from said power-shaft, an endless-belt cutter, an auxiliary cutter, and a holding projection on said traveling frame adapted to follow said auxiliary cutter, and means, substantially as described, for imparting motion to said cutters from said line-shaft at the same time the traveling frame is moved by said feeding-shaft, substantially as specified.

4. The combination, with the main frame and a traveling frame thereon, of a power-shaft supported on said main frame, a vertical shaft on said traveling frame, an endless-belt cutter adapted to be engaged by a sprocket-wheel on said vertical shaft, and an auxiliary reciprocated cutter operated by an eccentric on said vertical shaft, a holding projection following said auxiliary cutter, and means for communicating motion from said line-shaft to said vertical shaft, substantially as specified.

5. The combination, with a traveling frame, of an endless-belt cutter having cutting teeth or projections traveling in different parallel planes, a transverse supporting-bar for supporting and guiding said endless-belt cutter at the front end of said traveling frame, and an auxiliary cutter adapted to reciprocate in a bearing secured to said transverse bar, said bearing being arranged in line with and adapted to follow said auxiliary cutter to form a holding device to operate against the action of said endless-belt cutter, substantially as specified.

6. The combination, with a main frame and a traveling frame, of a power-shaft on said main frame, and a vertical shaft on said traveling frame, an endless-belt cutter and an auxiliary cutter adapted to receive motion from said vertical shaft, a holding projection arranged in line with and adapted to follow said auxiliary cutter, and means for communicating motion from said line-shaft to said vertical shaft as said traveling frame is advanced in relation to said main frame, substantially as specified.

7. The combination, with a traveling frame having a transverse supporting-bar, of an endless-belt cutter consisting of a series of cutter-heads f, connected together by links f', said cutter-heads being each extended forward of said links, and each being cut away at the bottom equal to the width of said link and supporting-strip e^5 on said transverse bar, and a retaining-strip e^7, adapted to engage in

the way or groove formed by the cutting away of said head, substantially as specified.

8. The combination, with a traveling frame and an endless-belt cutter thereon, of an auxiliary cutter arranged above and slightly in the rear of the line of the cut of said endless-belt cutter, a holding projection having substantially the same size as said auxiliary cutter and arranged in the rear and in line with the said cutter, means for feeding said traveling frame, and means, substantially as described, for imparting motion to said endless-belt cutter and said auxiliary cutter, substantially as specified.

9. The combination, in a mining-machine, of an endless-belt cutter, a transverse holding-bar, over which said belt cutter is adapted to pass, and a reciprocating auxiliary cutter supported in a bearing secured to said bar, said bearing formed of a size substantially equal to the cut of said auxiliary cutter and adapted to follow in the kerf of the same, substantially as specified.

In testimony whereof I have hereunto set my hand this 27th day of March, A. D. 1890.

FRANCIS M. LECHNER.

Witnesses:
CHAS. B. MOLING,
WILLIAM E. MOLING.