(No Model.) 3 Sheets—Sheet 1.

B. A. LEGG.

MINING MACHINE.

No. 482,045. Patented Sept. 6, 1892.

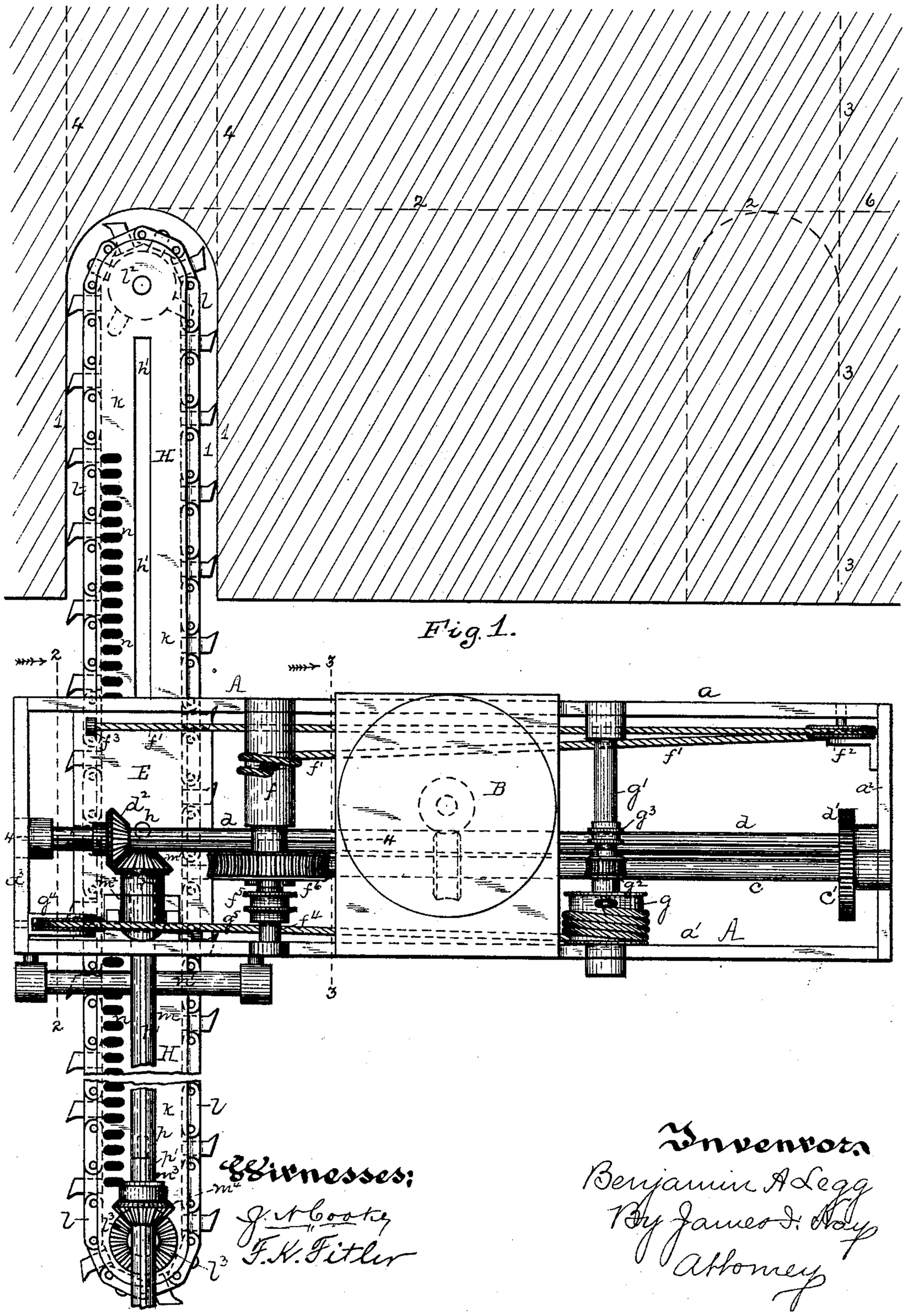

Fig. 1.

Witnesses:
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F. K. Fitler

Inventor:
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(No Model.)

3 Sheets—Sheet 2.

B. A. LEGG.

MINING MACHINE.

No. 482,045.

Patented Sept. 6, 1892.

Fig. 2.

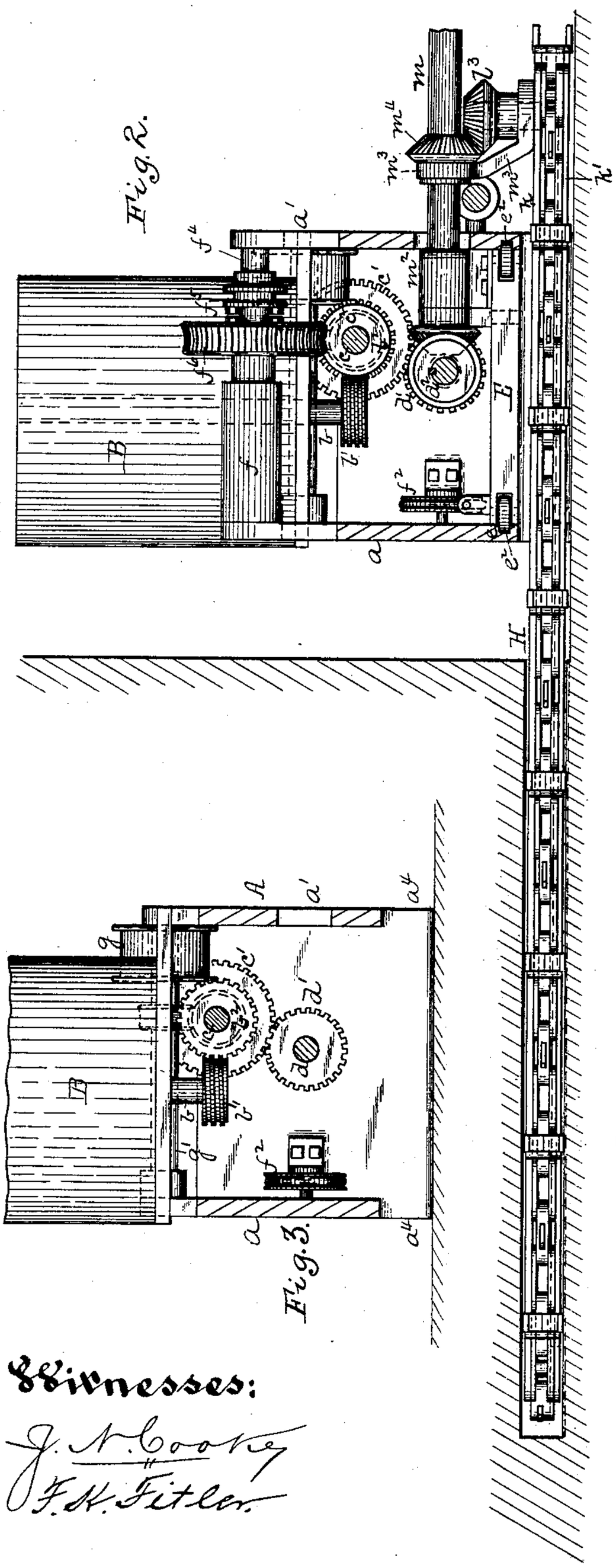

Fig. 4

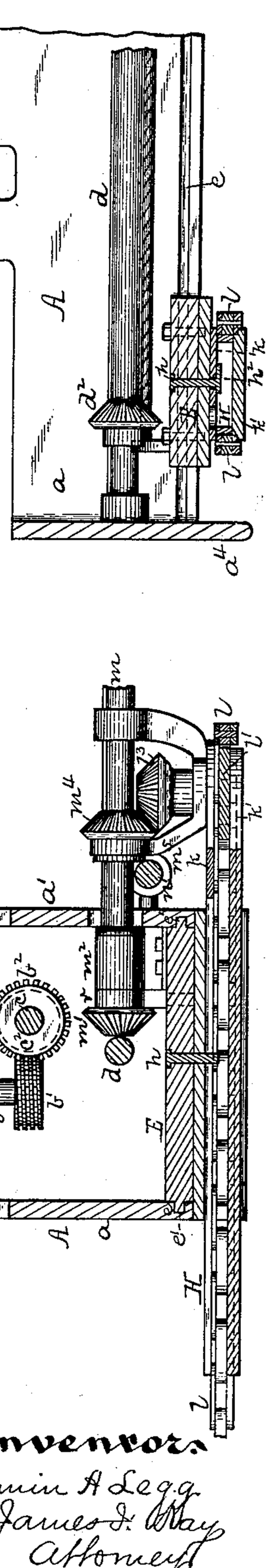

Fig. 3.

Fig. 5

Witnesses:

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(No Model.) 3 Sheets—Sheet 3.

B. A. LEGG.

MINING MACHINE.

No. 482,045. Patented Sept. 6, 1892.

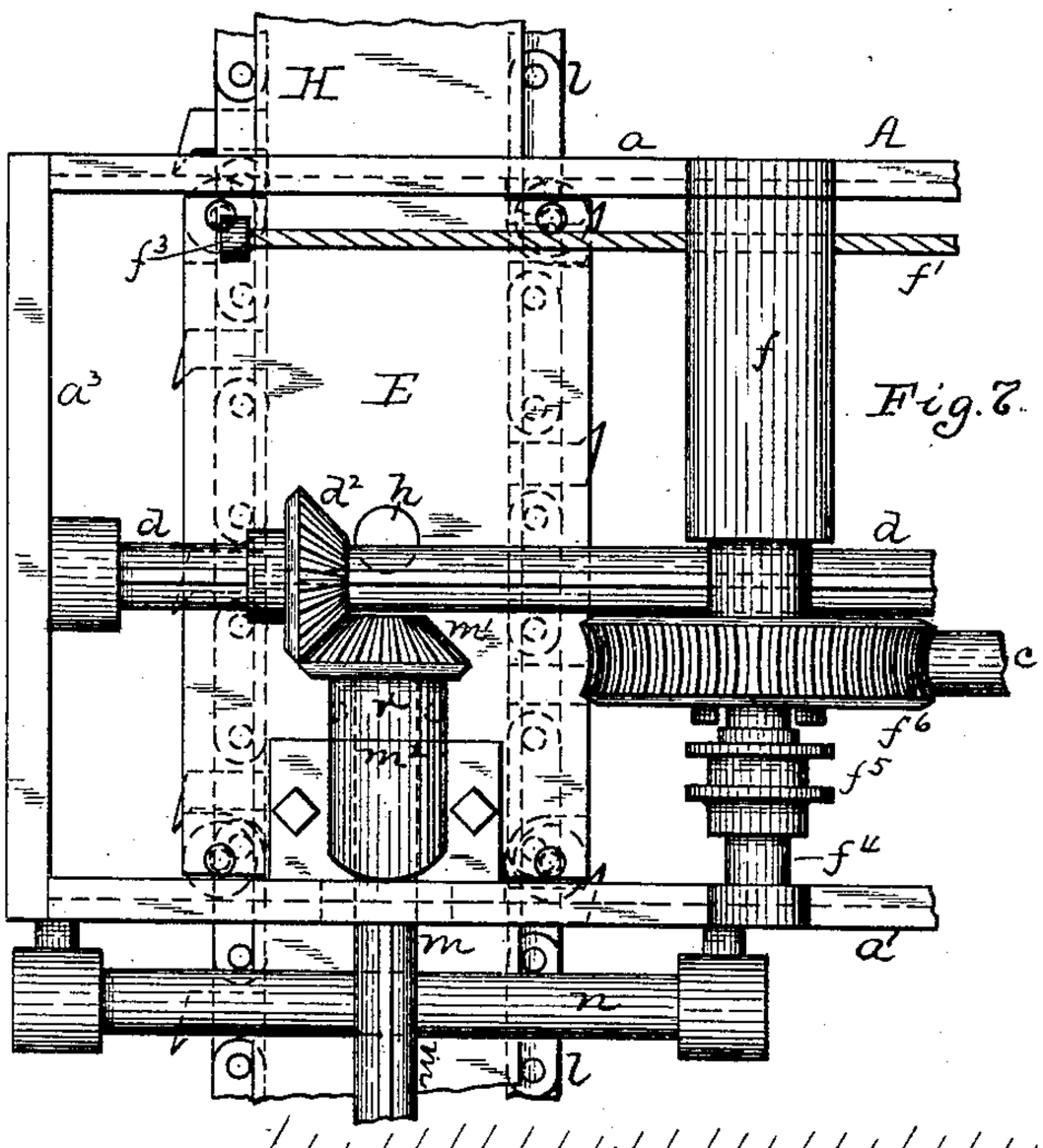


Fig. 7.

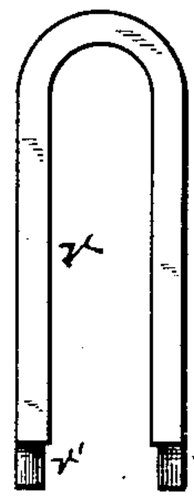


Fig. 9.

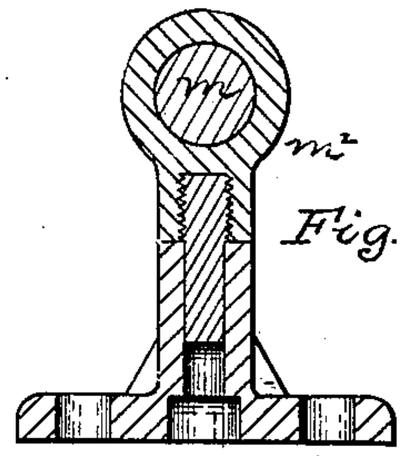


Fig. 10.

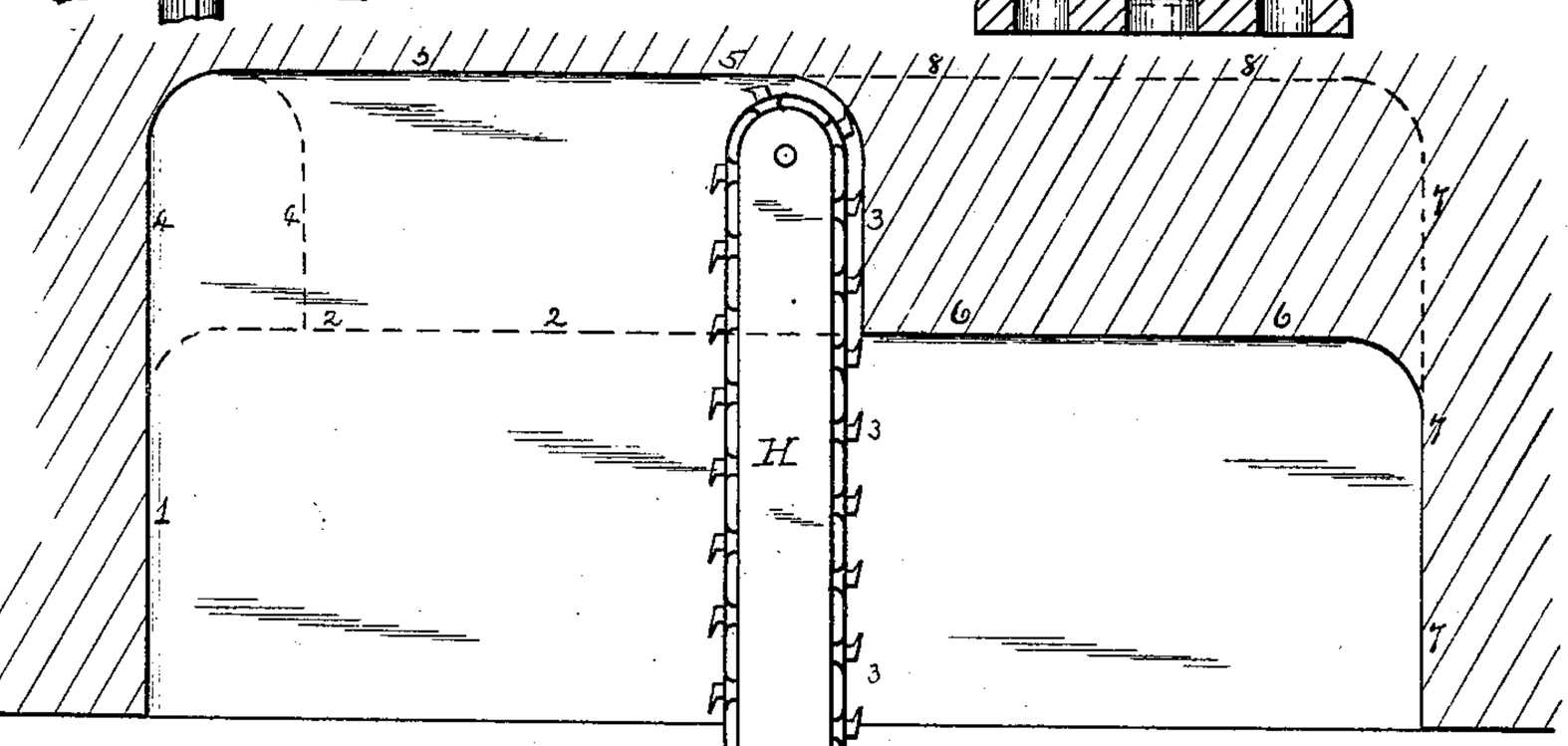
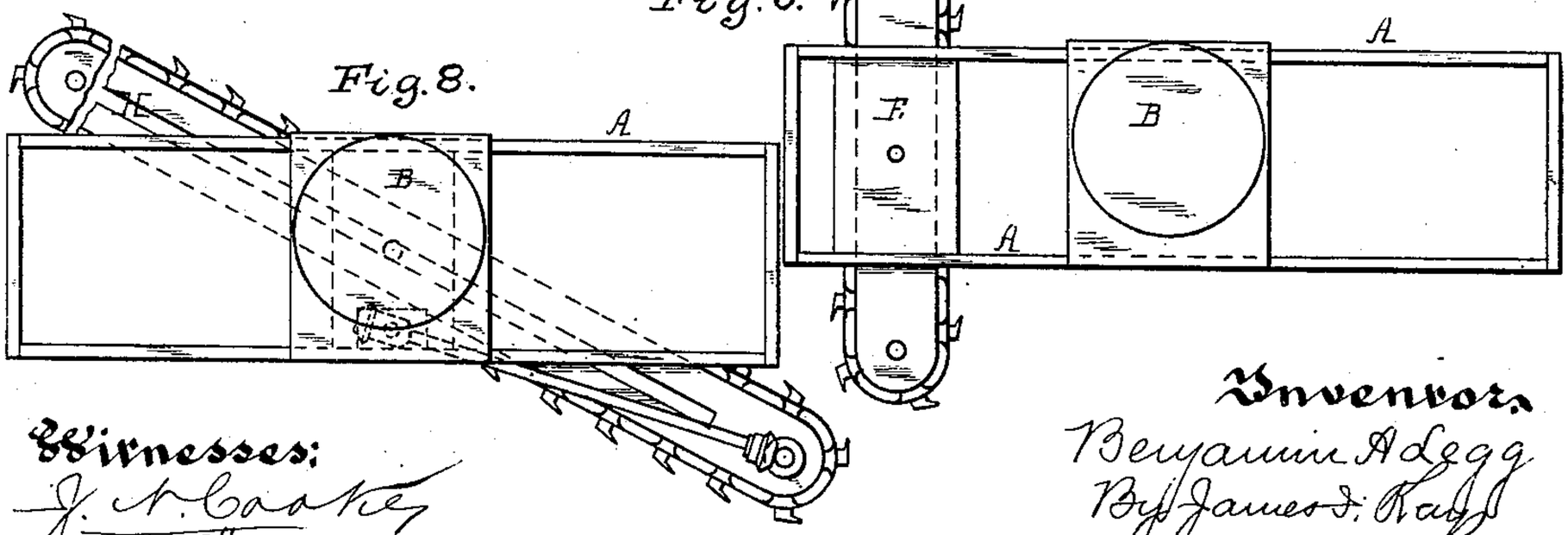


Fig. 6.

Fig. 8.



Witnesses:
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F. W. Fitler.

Inventor.
Benjamin A. Legg
By James F. Ray
Attorney

UNITED STATES PATENT OFFICE.

BENJAMIN A. LEGG, OF ALLEGHENY, PENNSYLVANIA.

MINING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 482,045, dated September 6, 1892.

Application filed April 30, 1891. Serial No. 391,026. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN A. LEGG, a resident of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Mining-Machines; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to machines for mining or undercutting coal, having for its objects the providing of a machine which after it has once cut its way into the coal upon entering a room will provide for the cutting of a deep kerf of considerable length, and will also after the first cut is made operate in a narrow space, so that much space is not required within the room for placing the machine in front of the coal.

My invention also has other certain objects in view, as will more fully appear.

To these ends my invention consists in certain improvements and combinations of parts, all of which will be more fully hereinafter set forth and claimed.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a plan view illustrating my invention. Fig. 2 is a cross-section on line 2 2, Fig. 1. Fig. 3 is a cross-section on line 3 3, Fig. 1. Fig. 4 is a detailed cross-section on line 4 4, Fig. 1. Fig. 5 is a cross-section on line 5 5, Fig. 4. Fig. 6 is a diagram view illustrating the method of cutting in operating the machine. Fig. 7 is an enlarged detail plan view. Fig. 8 is a diagram view illustrating the method of mounting the machine during transportation. Figs. 9 and 10 are detail views of the yoke and bearing, and Fig. 11 is a detail cross-section of the cutter-frame.

Like letters of reference indicate like parts in each of the figures.

The stationary frame A of the machine is formed of the longitudinal beams a a' and the end beams a^2 a^3, which are properly secured together, the entire frame being supported the proper distance above the ground floor by the feet or standards a^4, and so providing for a clear course under the entire stationary frame, for the purpose hereinafter described.

I have illustrated the machine in connection with an electric motor B, though any suitable power-generating apparatus may be employed; and I have illustrated said motor as supported on the stationary frame A at about the center thereof, this being considered very desirable in the construction of the machine, as it places the weight of the motor about centrally of the entire mining-machine and so distributes its weight that it acts to hold the machine steady during the cutting operation, overcoming to a great extent the necessity of jacking down the machine, which is usually found necessary in such machines, while at the same time it overcomes the necessity for lifting any of the heavy weight at either end of the machine and enables the machine to be handled much more easily, since when lifted at either end greater leverage is provided for lifting the motor at the central part of the machine.

One further point, and one of great importance in the way of securing the motor to the stationary frame, is that I am enabled to apply the power more directly, while at the same time I am enabled to carry the cutter-frame or cutting apparatus entirely underneath the motor and from end to end of the machine, instead of having to travel only from a point forward of the motor, while the motor itself rests on that part of the frame which extends down to the ground floor. For any longitudinally-cutting machine such construction provides, therefore, for the placing of the machine with its longest face parallel to the breast of the coal, and therefore provides for a longitudinal cutting of the kerf and the cutting apparatus passing underneath the motor. I prefer to mount the motor with its armature-shaft b in a vertical position, and from such shaft, through the worm b' and the worm-gear b^2, drive the longitudinal shaft c, which is mounted on the end beams of the machine-frame and which carries at one end thereof a cog-wheel c', driving a cog-wheel d', secured at the end of the longitudinal grooved shaft d, which is in like manner mounted in the end beams of the stationary frame and which extends for the full length thereof and acts to drive the cutting apparatus.

Sliding in the guideways e in the station-

ary frame is the carriage E, which carriage has ribs e' formed along its edge, fitting in such guideways e, so as to guide its movement in the stationary frame, the carriage having, also, antifriction-rollers at the four corners thereof, which act to bear upon the inner walls of the guideways and so to relieve the same of the heavy strain in the operation of the cutter-frame, as hereinafter described. In order to move such carriage during the cutting operation and to return the same after the cut is made, I have provided the following apparatus: Mounted in the side plates a a' of the frame A is the drum f, from which a wire or like rope f' extends forward to the pulley f^2 at one end of the machine and around said pulley and thence back to the carriage E, being secured thereto at f^3. This drum is secured to a shaft f^4, carrying a clutch f^5, which engages with a worm-wheel f^6, mounted on said shaft f^4 and turned by a worm c^2 on the shaft c, such mechanism providing for a slow or gradual feed of the carriage longitudinally of the stationary frame. The receding mechanism is of practically the same construction, the drum g being mounted on the shaft g', driven by a worm on the shaft c through the worm-wheel g^2, running loosely on said shaft g and connected thereto by the clutch g^3. Extending from such drum g to a pulley g^4 at the opposite end of the stationary frame to the pulley f^2 is the wire or like rope g^5, which passes around said pulley and then extends to the carriage E, and so provides for the drawing of the carriage toward the pulley g^4.

The cutter-frame H is carried by the carriage E and is secured thereto by a king-bolt h, which passes through the body of the carriage and thence down into a slot h', formed in the top plate k of the cutter-frame, fitting between such top plate and the bottom plate k' thereof and having an enlarged head h^2, which enables it to give the necessary support to the cutter-frame through the top plate k thereof. The cutter-frame is thus hung from the carriage and is hung through the slot h' of the cutter-frame, so that it is not only free to swing on the king-bolt, but may have imparted thereto a sliding motion with relation to the carriage, the king-bolt sliding within said slot h' of the top plate, while it supports the cutter-frame, no matter in what position it stands with relation thereto. The cutter-frame is preferably formed of the two plates k k' and of two side plates, through which the top and bottom plates k k' may be riveted, so as to form a strong cutter-frame, such cutter-frame supporting the chain l, which travels around the same, its end portions being mounted in the sprockets l' l^2, mounted in the top and bottom plates of the cutter-frame l. The sprocket-wheel l' at the rear end of the cutter-frame is power-driven and imparts the necessary motion to the cutter-frame, while the sprocket-wheel l^2 is loose, and simply guides the chain in its motion around the same during the cutting operation.

In order to drive the cutter-chain l upon the frame, I employ the following mechanism: Mounted and sliding upon the grooved shaft d is the bevel-pinion d^2, which engages with a bevel-pinion m' on the grooved shaft m, which is mounted in the bearings m^2 m^3, the bearing m^2 being upon the carriage E, while the bearing m^3 is at the rear end of the cutter-frame. Such shaft m is stationary—that is, it does not slide with the cutter-frame, but has mounted upon it a bevel-pinion m^4, which slides in the groove thereof, so that it acts to rotate said pinion, no matter in what position the cutter-frame may be with relation to the carriage. The sprocket-wheel l' is secured to a vertical shaft, which is mounted in the bearing m^3 and carries at its upper end the bevel-pinion l^3, which engages with the pinion m^4, said pinions l^3 and m^4 being held in place by the bearing m^3, a strap or arm m^5 extending out from said bearing and forming the bearing of the pinion m^4 around the grooved shaft m. By such construction it is evident that upon the rotation of the shaft d it will, through the pinions d^2 and m', rotate the shaft m, which shaft will, through the pinions m^4 and l^3, rotate the sprocket-wheel l' and so impart the necessary motion to the cutter-chain l. It is thus evident that the cutter-chain can be driven from the motor, no matter in what position longitudinally the cutter-frame is brought with relation to the carriage or in what position the carriage is brought with relation to the stationary frame.

For the purpose of feeding the cutter-frame into the coal—as, for example, when the machine is first placed within a room—I may either employ a rack on the cutter-frame or may employ any other suitable propelling device. As such is only to be made when the machine is taken into said room, however, I find it desirable to employ as simple a mechanism as possible, and for this purpose I have formed a rack-face n in the cutter-frame H by forming a series of holes through the top plate k, which can either be engaged by a pinion so as to feed the cutter-frame forward or, as preferred by me, may simply form seats into which a suitable lever may take, so as to press the cutter-frame into the coal, such lever resting against the bar n', secured to the side beam a', so as to give the necessary leverage for feeding in the cutter-frame. After such first cut is made, however, it is only necessary to adjust the cutter-frame the right distance, where it has a free opportunity to swing, and a hook may therefore engage with the notched rack n and draw the frame to whatever position is desired.

It is of course necessary to use a grooved shaft m of as great length as the feed or longitudinal movement to be imparted to the cutter-frame h, and when the machine is first taken into the room it is necessary to have a

space of sufficient length to provide for the turning of the cutter-frame at right angles to the stationary frame and to feed the same into the coal. After the first cut is made, however, the cutter-frame always remains about three feet within the kerf of the coal, and has only about two feet of movement longitudinally, and I have therefore found it desirable to form the grooved shaft *m* in two sections *p p'*, which sections are connected together by a threaded connection p^2, the main body *p* being sufficiently long to extend through the bearing m^3 while the machine is doing its ordinary cutting, but it being necessary to secure the removable section *p'* to the end thereof whenever it is desired to draw the cutter-frame entirely back from the body of the coal. As a matter of fact, as soon as the first cut is made with the machine the operator simply unscrews the removable section *p'* until he reaches the end of the room, when it can be quickly secured in place when the carriage is drawn back.

For the transportation of the machine it will be evident that it will be necessary to provide for the turning of the cutter-frame substantially in line with the stationary frame, and I provide for this by mounting the frame so that it can swing on the carriage. To provide for such swinging of the frame on the carriage, I construct the bearing m^2, (as more fully shown in the detailed view,) so that it and the grooved shaft *m* swing or turn, and I provide the U-shaped yoke *r*, which fits between the rear face of the pinion *m'* and the bearing m^2 and holds the pinion in engagement with the pinion d^2, the yoke having the end pins *r'* entering the seats in the carriage E. The bearing m^2 is also mounted so as to swing or turn upon the carriage, and as the cutter-frame is turned it will turn with it, so that it is not necessary to remove the grooved shaft from its bearing. For the same purpose the bearing m^3 at the rear end of the cutter-frame is also mounted in the cutter-frame, so as to have a slight movement or play therein and permit the turning of the grooved shaft with relation to the cutter-frame. This is necessary, as it will be plain that the bearing m^2 is not exactly in line with the king-bolt *h*, connecting the cutter-frame and carriage, and when the cutter-frame swings on the carriage it will be necessary that these bearings m^2 and m^3 shall swing, so as to relieve the grooved shaft *m* from strain. This is more clearly shown in Fig. 8, in which the cutter-frame is turned in the position usually occupied during the transportation of the machine, and it will then be seen that when in such position the grooved shaft *m* does not extend exactly parallel to the cutter-frame, but at a slight angle thereto.

In order that the chain may be properly supported during the cutting operation, I generally prefer to form along the side edges of the lower plate *k'* of the cutter-frame a longitudinal bead *s*, and I form in the chain-links a like rabbet s^2, into which such bead can fit, the chain being held during the cutting operation by the longitudinal bars k^2, extending between the upper and lower plates and being also guided along its forward edge by the side ribs *s*. Around either end of the frame the chain is held in proper line by the sprocket-wheels.

The operation of the mining-machine as so constructed is practically as follows: When the operator transports the machine, he lifts it upon any suitable truck by which it may be drawn into the mine, the cutter-frame H being then drawn practically into line with the main frame, as shown in Fig. 8. As soon as the machine is brought into proper position it is lifted from the truck and the operator draws back the cutter-frame and secures the stationary frame parallel with the face of the coal. He then draws the cutter-frame at right angles to the stationary frame and forces the pinion *m'* into gear with the pinion d^2, locking them in such a position by the yoke *r*, which fits between the pinion *m'* and the bearing m^2, taking its seat in the carriage. The carriage is then brought to the starting-point of the machine, such as shown in Fig. 1, and the motor started. The first operation is to cut an entrance-kerf into the coal, as at line 1, this being done by feeding the cutter-frame forward by means of the lever taking into the notched rack *n* or by means of other suitable mechanism. During this operation the cutter-chain is driven from the armature-shaft *b* through the worm *b'*, worm-wheel b^2, shaft *c*, pinions *c' d'*, grooved shaft *d*, pinions d^2 *m'*, grooved shaft *m*, and pinions m^4 l^3, and sprocket-wheel *l'*. The cutter-frame is fed forward in this way until it cuts more than one-half its full cutting distance into the coal. For example, in a machine cutting five feet I prefer to cut into the coal a distance, say, of three feet at once. When the cutter-frame has been advanced this distance, as it is not desirable to subject it to great strain, the feeding of the frame forward is discontinued, and by throwing the clutch f^5 into connection with the wheel f^6 through the mechanism above described and the rope *f'* a slow feed is imparted to the carriage E, which carries with it the cutter-frame. During the movement of the carriage in its course within the stationary frame it is supported by the ribs *e'*, fitting within the grooves *e*, so as to enable it to sustain the weight of the cutter-frame, while at the same time, as it is evident that a considerable side strain is imparted to the carriage, this is removed or relieved by the antifriction-rollers e^2 at the ends of the carriage, which bear upon the inner faces of the grooves *e* and substantially relieve the carriage from such strain. The cutters of the cutter-chain then cut in their forward entrance into the kerf, carrying the coal along therewith and depositing it in the kerf previously cut or carrying it out from the kerf, the first cut made being along the line 2 up to the line

3. He then throws out the clutch f^5 and throws the clutch g^3 into engagement, so connecting up the retracting mechanism, which through the drum g and rope g^5 draws the carriage E back to the starting end of the machine, this being done rapidly, as the retracting mechanism is arranged to run at a considerable speed. As soon as the machine reaches this point he then proceeds to cut in some distance farther—say for a couple of feet or to the end of the movement of the cutter-frame—cutting out a further entrance kerf—say along the line 4—and as soon as this is completed he connects up the feed mechanism, which cuts parallel with the machine along the line 5 and up the line 3, so completing the cut which can be formed by the machine. He then runs the cutter-frame back to the starting-point by means of the retracting mechanism and moves the machine along to the next position in which the cut is to be made—that is, to such position that the cutter-frame will lie close to the line 3 and extend in as far as its first cut—say three feet into the coal—and proceeds to make that cut along the line 6 and up to another line 7, when he runs his cutter-frame back to the line 3, advances it to the line 5, and cuts along the line 8 and up to the line 7, so completing that cut. He so continues until he reaches the end of the room. During this operation, and indeed as soon as he has fed the machine, say, three feet into the coal when making the first cut, Fig. 1, in the room, he can unscrew the removable section p' of the grooved shaft m, so that the machine will occupy practically little space further than its own width within the room of the mine. As soon as the cutting is completed in that room it is only necessary to screw on the section p' of the shaft m to lift out the clevis r and draw back the shaft m, so as to disengage the pinion m' from the pinion d, when the cutter-frame may be swung to any desired position under the stationary frame. The carriage E assumes the proper position, so that the cutter-frame may be brought substantially into line with the main frame or so close thereto as to occupy but little room in transporting the same. During all such movements of the cutter-frame in connection with the carriage it is properly supported by the king-bolt passing through the longitudinal slot h' in the top of the upper plate k of the cutter-frame. It will also be noticed that the cutter-frame, while made of sufficient strength to stand all strains to which it is subjected, can be made of but little height, being simply composed of the two plates k k' and the ribs or bars k^2, separating the plates, and that the cutters l^4, carried by the chain l, extend above and below the frame sufficiently to give a clear course for the entrance of the same; also, that by supporting the cutter-frame in the manner above described, through the king-bolt and slot, I am enabled to hang it directly from the carriage and to provide for all movements thereof while it is held firmly to the carriage.

By a mining-machine constructed on substantially the principles above described I am enabled, through the provision for making double cuts while the frame is secured in the one position, to cut deep kerfs and long kerfs, to operate the cutting-chain close to the floor and operate entirely on the bottom surface, and after making the first cut in with the cutter-bar it will never be withdrawn until the entire room is cut, which will leave no offsets or projections on the floor of any kind, thus leaving a smooth and level surface for working on thereafter; also, by supporting the motor centrally of the stationary frame and providing space under the same for the swinging of the carriage I am enabled to place the weight of the motor in the position best adapted to holding the machine steady, and I also obtain a steady and even feed by a mechanism which is very simple in construction, and the machine is relieved of complicated parts.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a mining-machine, the combination of a stationary frame, a carriage sliding therein, a cutter-frame pivoted to and carried by the carriage, a motor secured to the stationary frame and driving a grooved shaft extending longitudinally of said frame, beveled gearing driven by said grooved shaft, a grooved shaft extending longitudinally of the cutter-frame, and beveled gearing driven thereby to drive a cutter-chain on said frame, substantially as and for the purposes set forth.

2. In a mining-machine, the combination of a stationary frame having a motor mounted thereon and driving a grooved shaft extending longitudinally thereof, a carriage sliding in said frame, a cutter-frame having a sliding connection with said carriage, beveled gearing driven by said grooved shaft to drive a grooved shaft extending longitudinally of the cutter-frame, and beveled gearing driven by the latter grooved shaft to drive the cutting mechanism of the frame, substantially as and for the purposes set forth.

3. In a mining-machine, the combination of a stationary frame, a carriage sliding in said stationary frame, a cutter-frame having a sliding connection with such carriage, gearing driven from said carriage to drive a grooved shaft extending longitudinally of the cutter-frame, and beveled gearing driven by the latter grooved shaft to drive the cutting mechanism of the cutter-frame, said grooved shaft being formed in two sections, so that the outer or free end thereof may be removed, substantially as and for the purposes set forth.

4. In a mining-machine, the combination of a stationary frame having a motor secured thereto and having a carriage sliding therein, and a cutter-frame pivoted to said carriage and having a sliding movement with relation thereto, a longitudinal shaft mounted on a

stationary frame and carrying a worm, drums mounted on said frame and driven by such worm, and gearing and rope connections for such drums to opposite ends, respectively, of the machine and thence to the carriage, substantially as and for the purposes set forth.

5. In a mining-machine, the combination of an electric motor mounted centrally of the stationary frame and having a vertical armature-shaft, a longitudinal shaft mounted in the stationary frame, worm-gearing connections between said armature-shaft and said longitudinal shaft, a grooved shaft extending longitudinally of the machine, gearing between such longitudinal shafts, a carriage sliding in the stationary frame, a cutter-frame pivoted to and carried by the carriage, and gearing connections from said grooved shaft to the cutting mechanism mounted on the cutting-frame, substantially as and for the purposes set forth.

6. In a mining-machine, the combination of a stationary frame, a carriage sliding therein, a cutter-frame pivoted to and having a longitudinal movement with relation to the carriage, a grooved shaft extending longitudinally of the stationary frame and having a pinion sliding thereon, a shaft driving the cutting mechanism and carrying a pinion engaging with said pinion and mounted in a swivel-bearing, and a yoke to hold said second pinion in engagement with said first pinion, substantially as and for the purposes set forth.

7. In a mining-machine, the combination of a stationary frame, a carriage, a cutter-frame pivoted to and swinging with relation to the carriage, the shaft m, mounted in the swivel-bearings m^2 m^3, a shaft d, carrying the pinion d^2, the pinion m' meshing therewith, and a clevis r, adapted to fit between the bearing m^2 and a pinion m' to hold said pinions in engagement, substantially as and for the purposes set forth.

8. In a mining-machine, the combination of a stationary frame, a carriage sliding therein, a cutter-frame extending under the carriage and having a longitudinal slot h' in the top plate thereof, and a king-bolt passing through said slot and forming a pivotal connection between the carriage and the cutter-frame, substantially as and for the purposes set forth.

In testimony whereof I, the said BENJAMIN A. LEGG, have hereunto set my hand.

BENJAMIN A. LEGG.

Witnesses:
J. N. COOKE,
I. M. HUGHES.