

(No Model.)

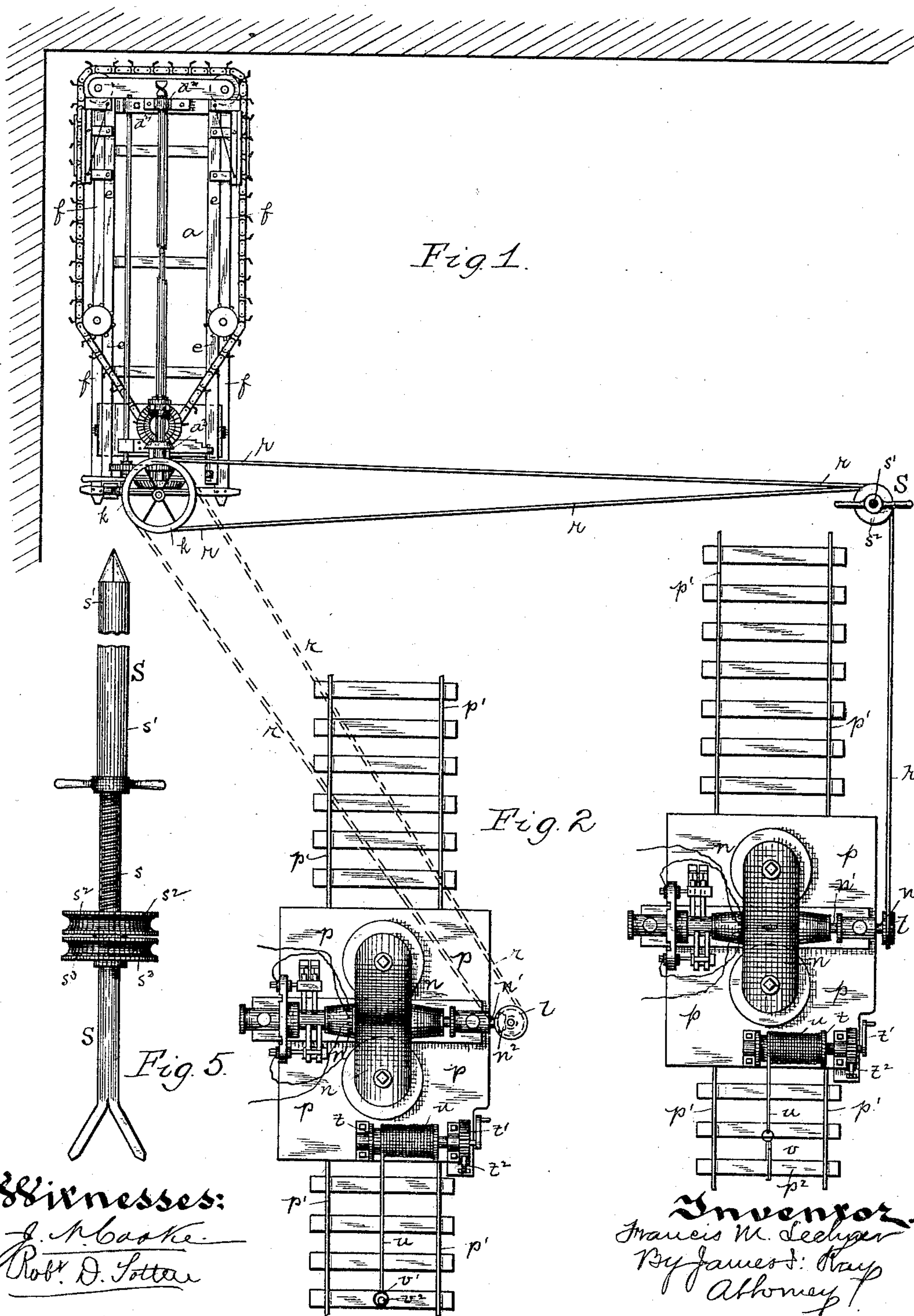
2 Sheets—Sheet 1.

F. M. LECHNER.

MINING MACHINE AND APPARATUS FOR OPERATING THE SAME.

No. 411,200.

Patented Sept. 17, 1889.



(No Model.)

2 Sheets—Sheet 2.

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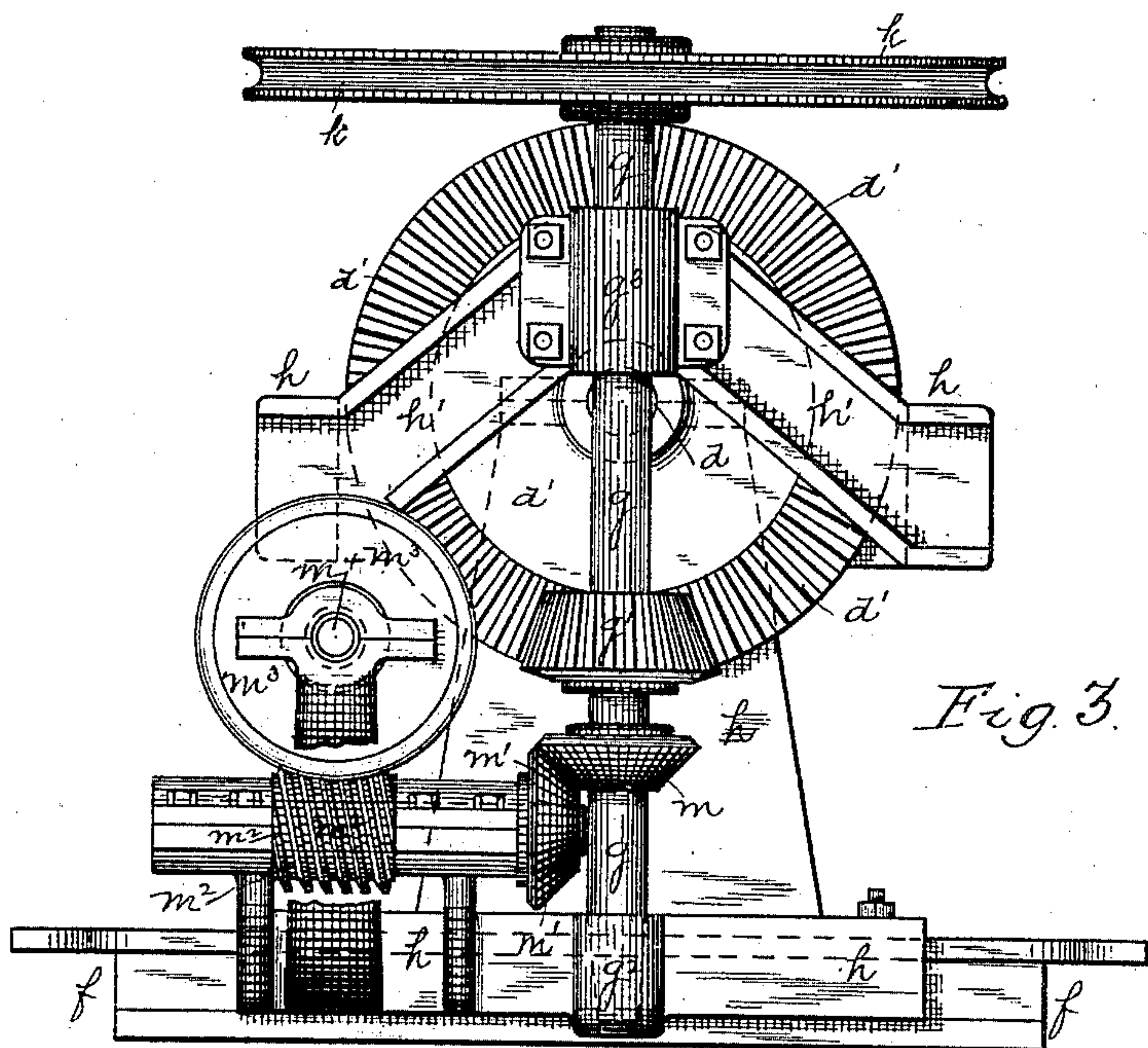


Fig. 3.

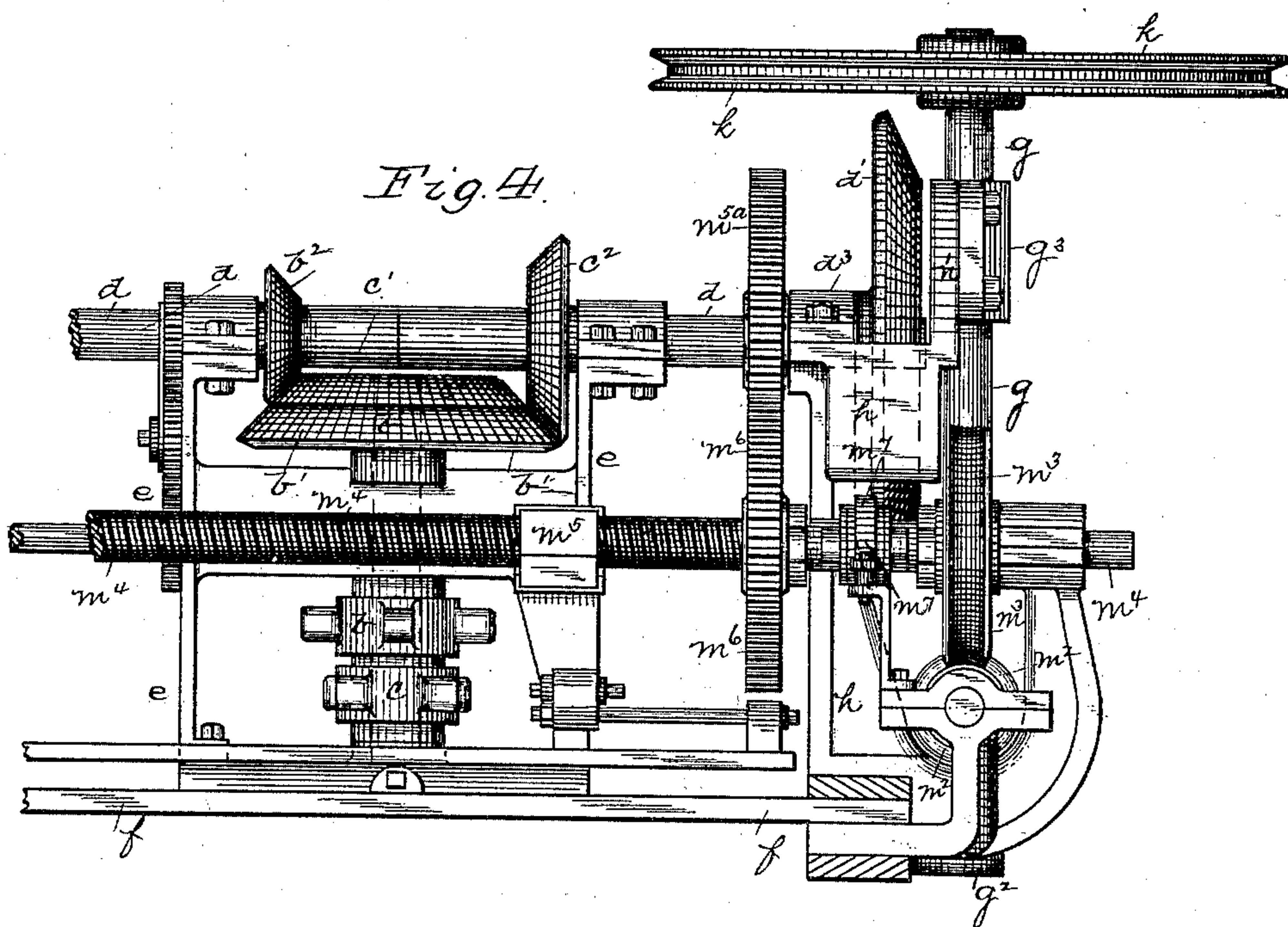


Fig. 4.

Witnesses:

J. H. Cooke  
Robt. D. Lottan

Inventor  
Francis M. Lechner  
By James S. Ray  
Attorney



# UNITED STATES PATENT OFFICE.

FRANCIS M. LECHNER, OF COLUMBUS, OHIO.

## MINING-MACHINE AND APPARATUS FOR OPERATING THE SAME.

SPECIFICATION forming part of Letters Patent No. 411,200, dated September 17, 1889.

Application filed September 19, 1888. Serial No. 285,816. (No model.)

*To all whom it may concern:*

Be it known that I, FRANCIS M. LECHNER, a resident of Columbus, in the county of Franklin and State of Ohio, have invented a new and useful Improvement in Mining-Machines and Apparatus for Operating the Same; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the operating of mining-machines—such as the machines heretofore employed for undercutting the body or vein of coal in coal-mining—and for other like purposes. These mining-machines have generally heretofore been operated either by hand or by compressed-air power, and in the latter case the engines have been mounted upon the stationary bed or the movable carriage of the machine, and the air has been conducted to the engines from compressing apparatus at the mouth of the mine through a line of pipe, and finally by hose to the engines. When the machines were in use, they were placed in position to make the cut, and secured therein with jacks or beams to hold the bed stationary, and after the cut was made they were moved along into position for the next cut, it being necessary to shift the machine every few minutes and secure it in place, so that a light machine was found especially desirable. The principal objections to this method of operating the machines are that the power exerted by the engines caused the vibration of the machines, so that it was very difficult to hold them down in place during the cutting operation, the machine being liable to move either backward or sidewise, and thus requiring specially heavy jacks or like devices to hold it in place, and the strain often causing the crushing or breaking of the coal against which the jacks pressed and held. The engines and their frames or supports being mounted on the mining-machine, also added largely to the weight of the machine, these parts being generally one-third the weight of the entire mining-machine. There was the further serious objection that the cost of the compressor and of operating it and the cost of maintaining the lines of pipes through the mine were very great, and the principal reason that this class of machinery has not come into general use has been the

cost of the original plant, and especially of the compressing apparatus.

The object of my invention is to overcome these objections to the use of mining-machines, and to render them lighter and more easily handled and operated, and its special object is to adapt such machinery for use for operation by electric power, thereby doing away with the necessity of the use of compressed air.

To these ends it consists, generally stated, in the combination, with the mining or like machine, of a motor mounted upon a separate movable carriage, driving-rope, or like power connections between this motor and the operating mechanism on the mining-machine, and a drum on the motor-carriage carrying a rope to be secured to a stationary object for adjusting and holding the motor in proper position to operate the mining-machine, so that as the mining-machine is moved in arranging it in different positions, according to the desired drilling or cutting operations to be performed by it, the motor may also be moved to the proper position to transmit the power through the rope to the machine and held in such position, and in case the machine moves while making the cut the motor may be so adjusted by the operator to take up any slack and hold the rope in proper condition to transmit the power.

It also consists in certain other improvements, as will hereinafter be more particularly described.

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 shows the motor in another position with relation to the machine. Fig. 3 is an end view of the mining-machine, showing the preferred arrangement for connecting the machine and motor. Fig. 4 is a side view of the rear part of such machine, and Fig. 5 is a side view of the jack for directing the course of the driving rope or chain.

Like letters of reference indicate like parts in each.

In describing my invention, I will refer more particularly to machines for undercutting coal, as this is the class of mining-machines



most generally in use, and will refer more particularly to that class of machines which is described in Letters Patent No. 287,032, granted to S. C. Lechner, October 23, 1883, and No. 340,791, granted to V. A. and S. C. Lechner, April 27, 1886, though it is evident that my invention can be employed in connection with other constructions of mining-machines either for the undercutting of the vein of coal or for other like purposes.

The mining-machine *a* illustrated in the drawings is of the class known as a "chain-machine," and has the two cutter-chains moving side by side in opposite directions over sprocket-wheels at the forward end of the movable carriage or cutting-frame, as fully described in said patents, and a particular description of which is not necessary in connection with my present invention. The said cutter-chains pass over driving-sprockets *b c* at the rear of the machine, these driving-sprockets being driven by the bevel-wheels *b' c'*, which are in return driven by the bevel-wheels *b<sup>2</sup> c<sup>2</sup>*, such construction for driving the said cutters being fully described in said patent, No. 340,791. Instead of securing said bevel-wheels *b<sup>2</sup> c<sup>2</sup>* to the horizontal shaft by which they are rotated, as in said patent, however, they are secured to the shaft *d* by feather-and-groove connections, so that the movable carriage *e*, carrying this cutting apparatus, can be advanced on the stationary bed *f* or drawn back, while said shaft *d*, to which the power is applied, has no longitudinal movement, said shaft being mounted in the bearings *d<sup>2</sup> d<sup>3</sup>* at the rear and front ends of said stationary bed *f*. The shaft *d* has on its rear end the large bevel gear-wheel *d'*, which meshes with a small bevel-pinion *g'* on the vertical shaft *g*, this vertical shaft being mounted in a socket *g<sup>2</sup>* on the stationary bed *f* and within a suitable bearing *g<sup>3</sup>* near the upper end of the shaft. This bearing *g<sup>3</sup>* and the bearing *d<sup>2</sup>* for the horizontal shaft *d* are preferably formed as part of the frame *h*, which is secured to the bed *f*, and has the brackets *h'*, supporting the bearing *g<sup>3</sup>*, the frame *h* thus holding these two shafts *d g*, which are the main operating-shafts, rigidly in position. Mounted at the upper end of the vertical shaft *g* is the pulley or sheave *k*, through which the power is applied to the mining-machine.

Suitable means for feeding forward and drawing back the movable frame or cutter-carriage *e* of the machine can, of course, be employed, those shown in the drawings being the bevel-wheels *m m'*, worm *m<sup>2</sup>*, worm-wheel *m<sup>3</sup>*, mounted on the screw-bar *m<sup>4</sup>*, which engages with the nut *m<sup>5</sup>* supported on the movable carriage *e*, for feeding the machine forward, and the cog-wheels, *m<sup>5a</sup>* on the shaft *d*, and *m<sup>6</sup>* mounted on the screw-bar *m<sup>4</sup>*, for drawing the machine back, a suitable reversing-clutch *m<sup>7</sup>* on the bar *m<sup>4</sup>* engaging with the wheels *m<sup>3</sup>* and *m<sup>6</sup>*.

The mining-machine is also provided with

suitable jacks or braces for holding it in the desired position. As thus constructed it is evident that the mining-machine is relieved from the entire weight of the engines and their frames and connecting mechanism. The parts so removed generally constituted about one-third the weight of the machine.

The motor employed for driving the mining-machine is preferably an electric motor, such as shown at *n*, as it is found that by such form of power apparatus the necessary power to operate the machine can be easily obtained, and the cost of fitting up and maintaining air pipes or conduits throughout the mine is overcome, while the cost of the plant and expenses of running it are reduced. The motor employed may be an ordinary Sprague or other electric motor, and the motor *n* is mounted upon a suitable car *p* or other separate movable support, the motor being supported in this car, which runs on the ordinary track *p'* within the mine, and, as these tracks are generally laid close to the point from which the work is being done within the mine, it is evident that the car carrying the motor can be brought comparatively close to the point where the mining-machine is being operated within the mine. No special change is required in the motor employed, it being only necessary to attach a suitable form of pulley, sprocket, or sheave *l* either to the driving-shaft *n'* of the motor or to a vertical shaft driven from said shaft *n'* by bevel-gearing, as at *n<sup>2</sup>*, and carry the driving rope, belt, or chain *r* from this pulley *l* to the pulley *k* on the mining-machine. To accomplish this I may employ two means of arranging the driving rope or belt, both of which are illustrated in the drawings, in the one case the rope from the pulley *l* passing around a jack *S*, which can be placed at any suitable point within the mine, and is provided with the threaded extension *s*, by means of which the sleeve *s'* may be forced against the roof of the mine and hold the jack in proper position, while mounted on this jack are the loose pulleys *s<sup>2</sup> s<sup>3</sup>*, around which the rope *r* passes from the pulley *l* to the driving-pulley *k* on the mining-machine, the power being thus transmitted from the motor to the mining-machine by means of the driving rope or belt *r*. This jack may be employed whenever it is impracticable to carry the rope directly from the motor to the mining-machine, such as where it necessarily passes around a pillar or wall in the mine. Where, however, the driving-rope can be carried directly from the motor to the machine, as shown in Fig. 2, the jack is not required; but the sheave or pulley *l* should be mounted on a vertical shaft, as above described, and it is generally desirable to have the sheave so mounted, as the driving-rope will run better. The car *p*, carrying the motor *n*, can be drawn backward or forward upon the track *p'* to the proper position to hold the driving-rope taut, the mining-machine being first secured in proper position



for making the cut or drilling the hole or holes, and then the motor and its carriage being drawn to such position as to cause the proper tightening of the driving-rope and  
 5 locked in that position by any suitable means, so that the proper driving of the mining-machine depends entirely upon the position of the motor with relation thereto.

As a simple means for securing the motor  
 10 and its car in proper position with relation to the mining-machine is desirable, because the apparatus must be operated in a mine where complicated mechanism is objectionable, I find the best means of adjusting the position  
 15 of the motor and its car to the mining-machine and of holding it in such position during the operation of making a cut to be that shown in the drawings, consisting of a drum  $t$ , mounted on the car  $p$ , and having a ratchet  $t'$  thereon  
 20 controlled by a pawl  $t^2$ , and rope or chain  $u$  passing around this drum and carrying at its end gripping-tongs, as at  $v$ , to grasp one of the cross-ties, such as at  $p^2$ , of the track, or having a ring  $v'$  passing over a spike  $v^2$  or  
 25 like device driven into the tie. Any other suitable mechanism for adjusting the motor or its car to the position of the mining-machine and holding it in that position may be employed. If desired, the car may be secured  
 30 in approximately the proper position by jacks or braces against the roof or side walls of the mine, and motor made adjustable thereon by rack and pinion, worm, screw, or other suitable mechanism, so that the operator can ad-  
 35 just it before or during the making of the cut.

In operating the mining-machine according to my invention, the properly-insulated wires for carrying the electric current can be strung along the roof or walls of the mine, the labor  
 40 of securing the wires in place and of making connections being comparatively small compared to that in making connections from the air-compressor. The electric current can be generated by a dynamo at a power-station lo-  
 45 cated at any desired point, from which power-station wires can be carried to different mines, so that the one power-station can furnish the electric current for operating the mining machines in a number of mines, whether close  
 50 thereto or a considerable distance therefrom, and the cost of operating the machines be therefore reduced both as to cost of original plant and the running expenses thereof.

In employing my improved apparatus in  
 55 mining coal, as the track is generally carried close to the working at the point at which the mining is being done in order to facilitate the carrying away of the product mined, the motor on its car can be brought comparatively  
 60 near the mining-machine, and when a cut is to be made the mining-machine is first arranged in the proper position, and its bed is secured in such position by means of the ordinary jacks or like devices, so as to hold the  
 65 machine-bed firm and rigid. The motor is then brought along the track and the driving rope, belt, or chain is passed from the pulley

or sheave  $l$  on the motor to the pulley or sheave  $k$  in the mining-machine, and where  
 70 the rope can be drawn in a direct course from the motor to the mining-machine this is of course preferred, the rope being carried in any desired direction from the mining-machine, and after it is passed over the said  
 75 sheaves, in order to draw the rope taut, the motor and its car being drawn back by any suitable mechanism, such as the rope  $u$ , which is connected by spike and link or gripping-tongs to the cross-ties of the track, and by the  
 80 turning of the drum  $t$  this car is drawn gradually back until the driving rope or chain is brought to the proper tension to transmit the power to the machine, the position of the motor being thus adjusted to the position of the  
 85 mining-machine, so that the cut may be made by the mining-machine in any desired direction independent of the position of the motor, while at the same time the power may be transmitted from the motor to the machine.

In case it is necessary to pass the driving-rope in an indirect course from the motor to  
 90 the mining machine, as in passing around pillars or walls, the jack  $S$  may be employed, as in Fig. 1, the rope passing around the pulleys  $s^2$   $s^3$  thereon and the power being trans-  
 95 mitted in this way to the machine. The motor is then started and the power transmitted by the driving-rope or chain to the machine, and the feeding mechanism thrown into gear, and the cutting apparatus of the machinery  
 100 is fed forward to make the cut, and as soon as the cut is completed the receding mechanism is thrown into gear, the cutting apparatus being thus withdrawn and the cut completed.

During the cutting operation the pressure  
 105 exerted against the cutting apparatus of the machine by the coal into which it is forced, or the cuttings or slack formed, or the speed at which the machine is run are liable to force  
 110 the machine out of the position in which it is secured, causing the jacks or braces to slip and the slight backward or side movement of the machine; and during the cutting operation the person in charge of the motor watches the tension of the driving-rope, and  
 115 through the drum  $t$ , or equivalent mechanism, takes up any slack of the driving-rope arising from such cause and insures the making of the cut, even though the mining-machine may be moved under the severe strain to  
 120 which it is subjected. As soon as the cut is completed the mining-machine can be moved along the face of the coal the proper distance to make the next cut and can be secured in position, and as soon as this is done all that  
 125 is necessary is to draw the motor and its car forward or back along the track until the driving-rope is properly stretched and hold it in that position, taking up any slack in the rope during the cutting operation, and this  
 130 being continued and the position of the motor being adjusted at each cut to that of the mining-machine until the entire cutting to be done at that room or part of the mine is ac-



complished, the motor being moved backward and forward along the track, as is required in making the cuts with the mining-machine, and these cuts being on one or the other side of the track, as may be desired. The motor may thus be employed in connection with one machine, and as soon as the cutting in that particular place is completed thereby the motor may be taken into another part or room of the mine and employed in operating another mining-machine. Thus one motor may be used with several mining-machines, this being found practicable, as it is necessary after the undercutting operation is completed to "drop" and remove the coal. As the mining-machine is thus relieved from the weight of the engines, it can be much more easily and rapidly handled in shifting it for making the cuts or in transporting it from one part of the mine to another, and in its operation the shaking and jarring of the machine on account of the movement of the engines thereon are entirely overcome, the only causes leading to the movement or shifting of the machine being those above referred to.

By my invention I am also enabled to apply electric power to the operation of the mining-machine, as would be impossible where the motors were placed directly upon the machines of any considerable power on account of the weight of the motors necessary to operate such machines. The wires leading to the different parts of the mine can be easily and quickly secured in place, and the cost of wire and fitting it up are only about one-third that of the pipes for transmitting the air-pressure heretofore employed in operating such machines. By my invention I am therefore enabled to operate the machine more easily, provide for the furnishing of power from a large central plant to operate the min-

ing-machines in several mines, and to reduce the cost of operating such power-machines; and by adjusting the motor to the mining-machine and holding it in place I am enabled to operate the machine no matter what its position in the mine may be, and even when its position is changed during the making of a cut, and at the same time remove the motor and the parties operating it from the danger in working close to the point where the cutting is being done, and avoid injury to the motor by the coal-dust accumulating in or about the machine.

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

1. The combination, with the mining-machine having a vertical shaft at the rear end thereof, carrying a pulley thereon, and connections from said shaft to the operative parts of the machine, of a motor mounted on a separate movable carriage and having thereon a pulley, a driving-rope or like connection between said pulleys, and a drum or other suitable mechanism for adjusting and holding the motor in proper position for driving the mining-machine, substantially as and for the purposes set forth.

2. The combination of a mining-machine, a motor mounted upon a separate movable carriage, a driving-rope or like power connection between the motor and the mining-machine, and a drum on the motor-carriage carrying a rope to be secured to a stationary object for adjusting and holding the carriage in proper position for driving the mining-machine, substantially as and for the purposes set forth.

In testimony whereof I, the said FRANCIS M. LECHNER, have hereunto set my hand.

FRANCIS M. LECHNER.

Witnesses:

ROBT. D. TOTTEN,  
J. N. COOKE.