(No Model.)

5 Sheets—Sheet 1.

H. H. BLISS.

MINING MACHINE.

No. 585,018. Patented June 22, 1897.

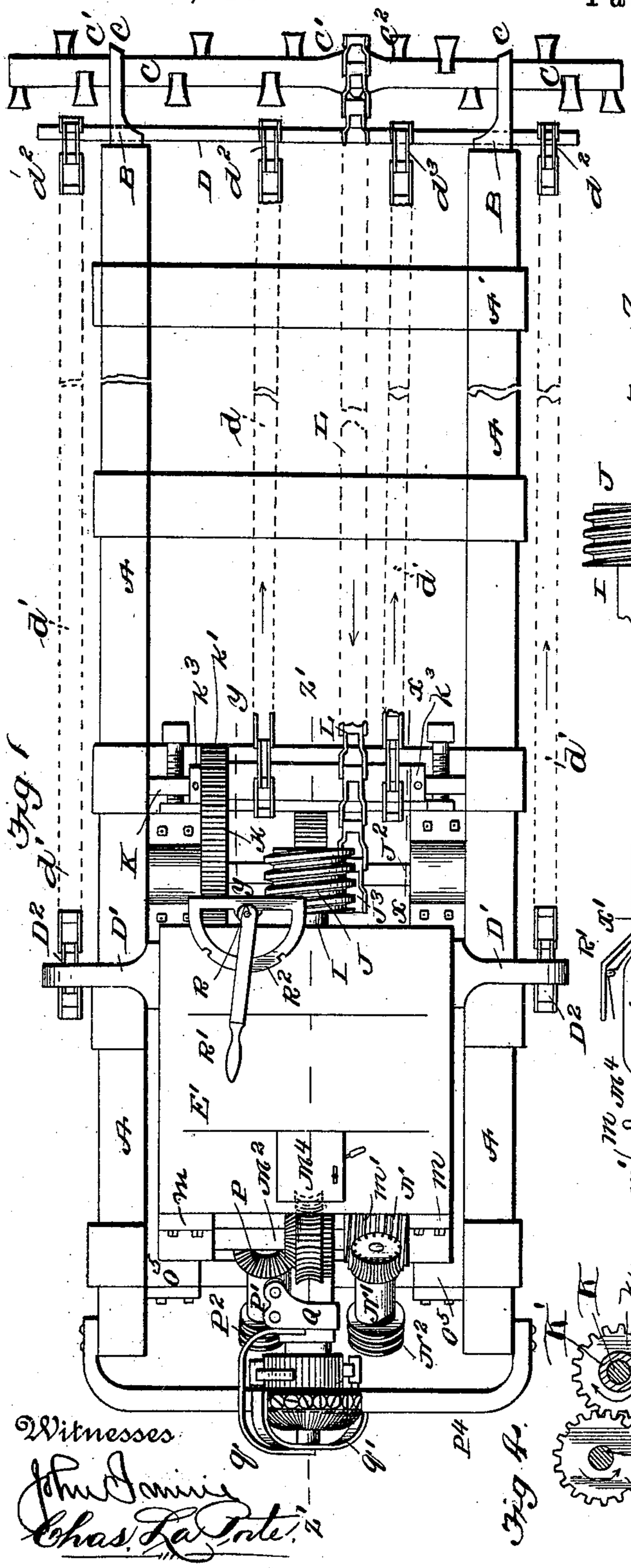

Fig. 1.

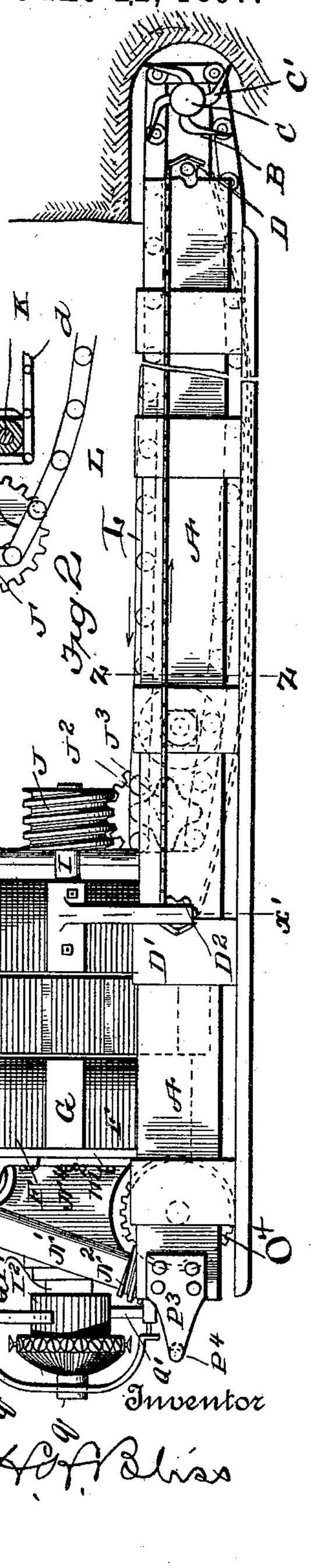

Fig. 2.

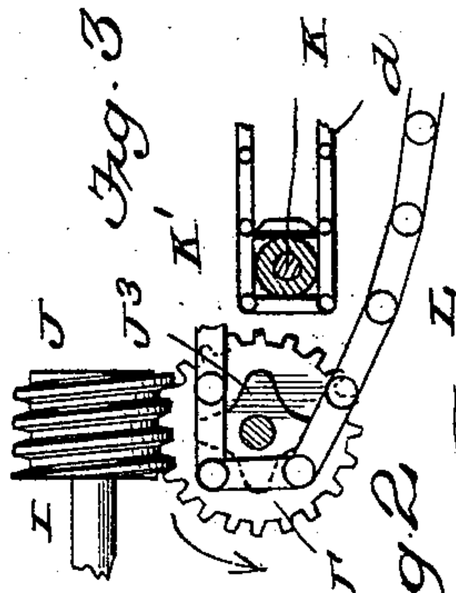

Fig. 3.

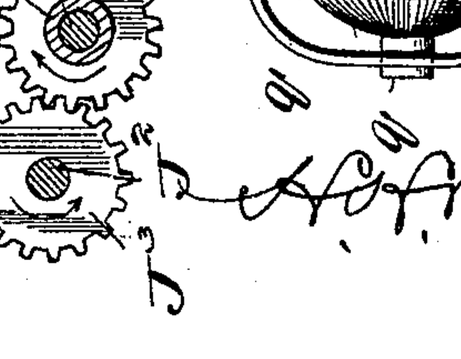

Fig. 4.

Witnesses
John Dewey
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by A. G. & F. Bliss
Attys.

(No Model.) 5 Sheets—Sheet 2.

H. H. BLISS.

MINING MACHINE.

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Fig. 6.

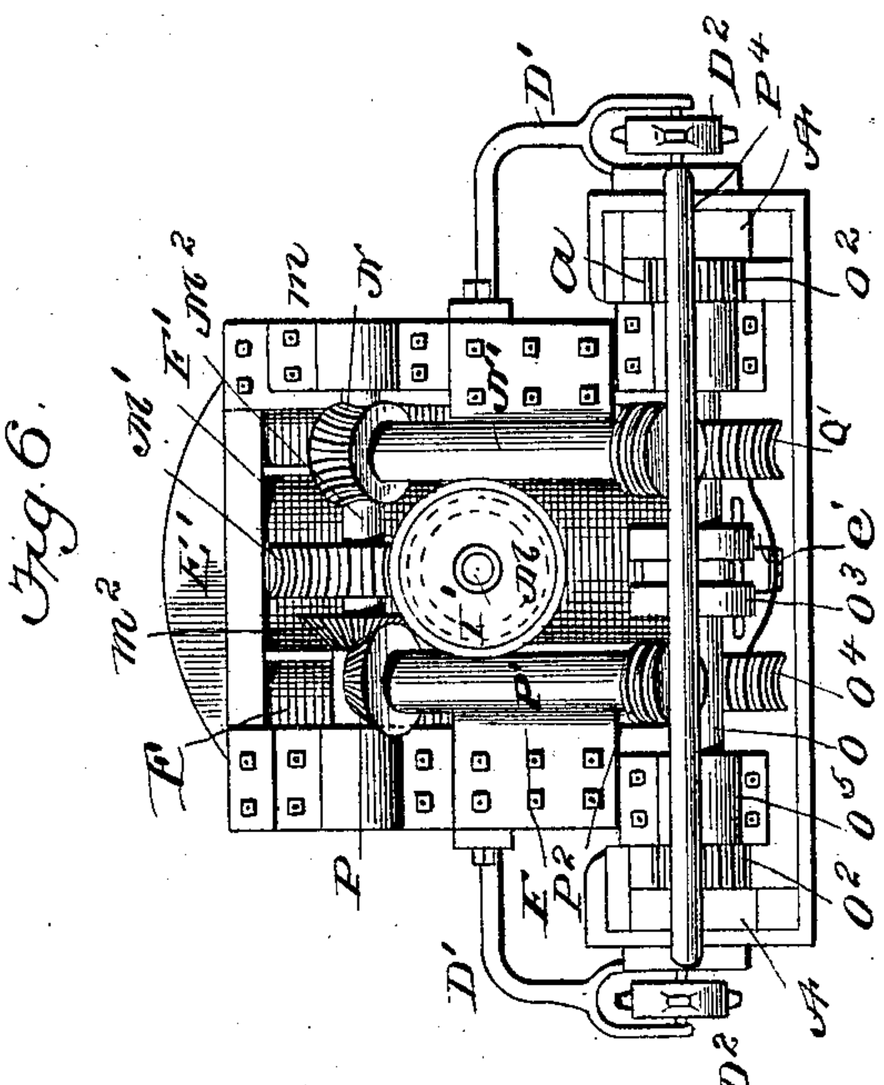


Fig. 5

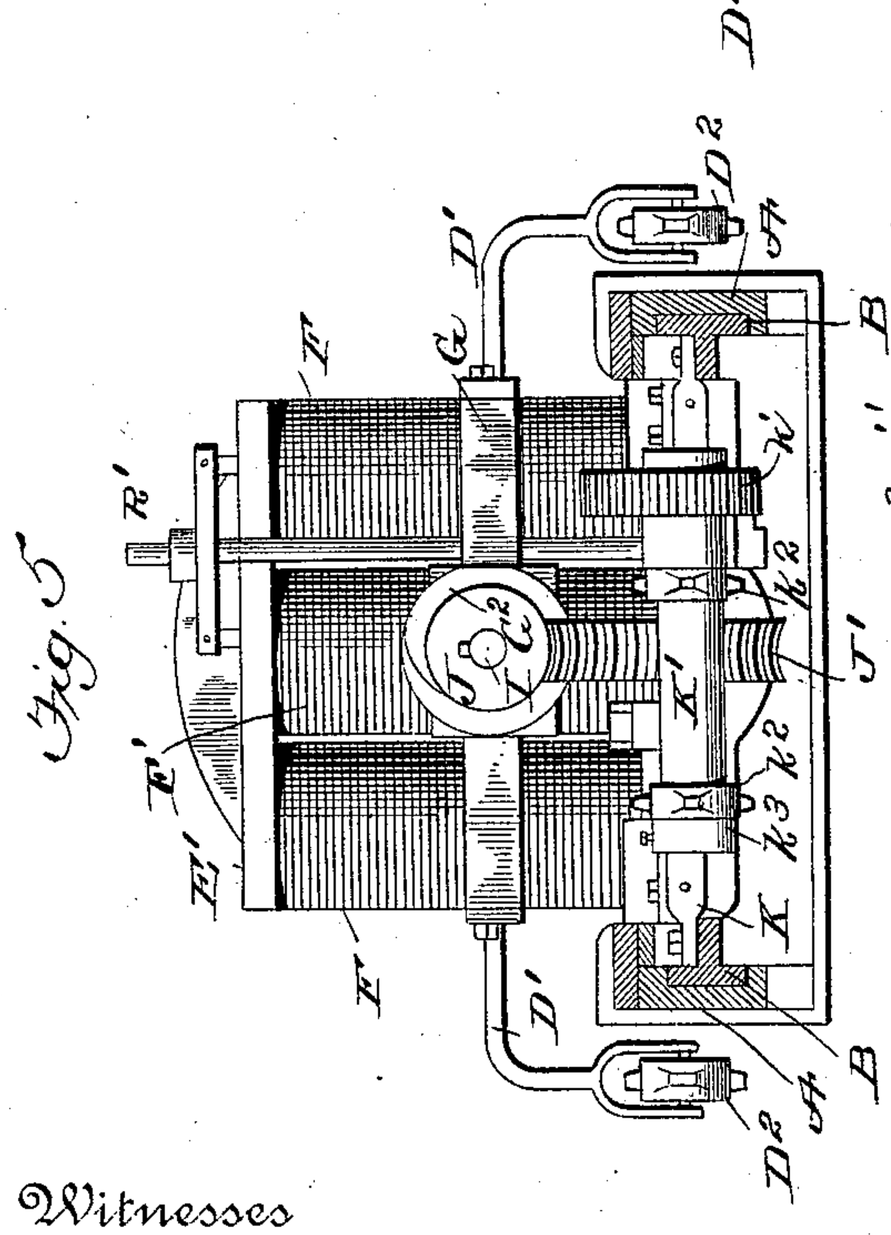
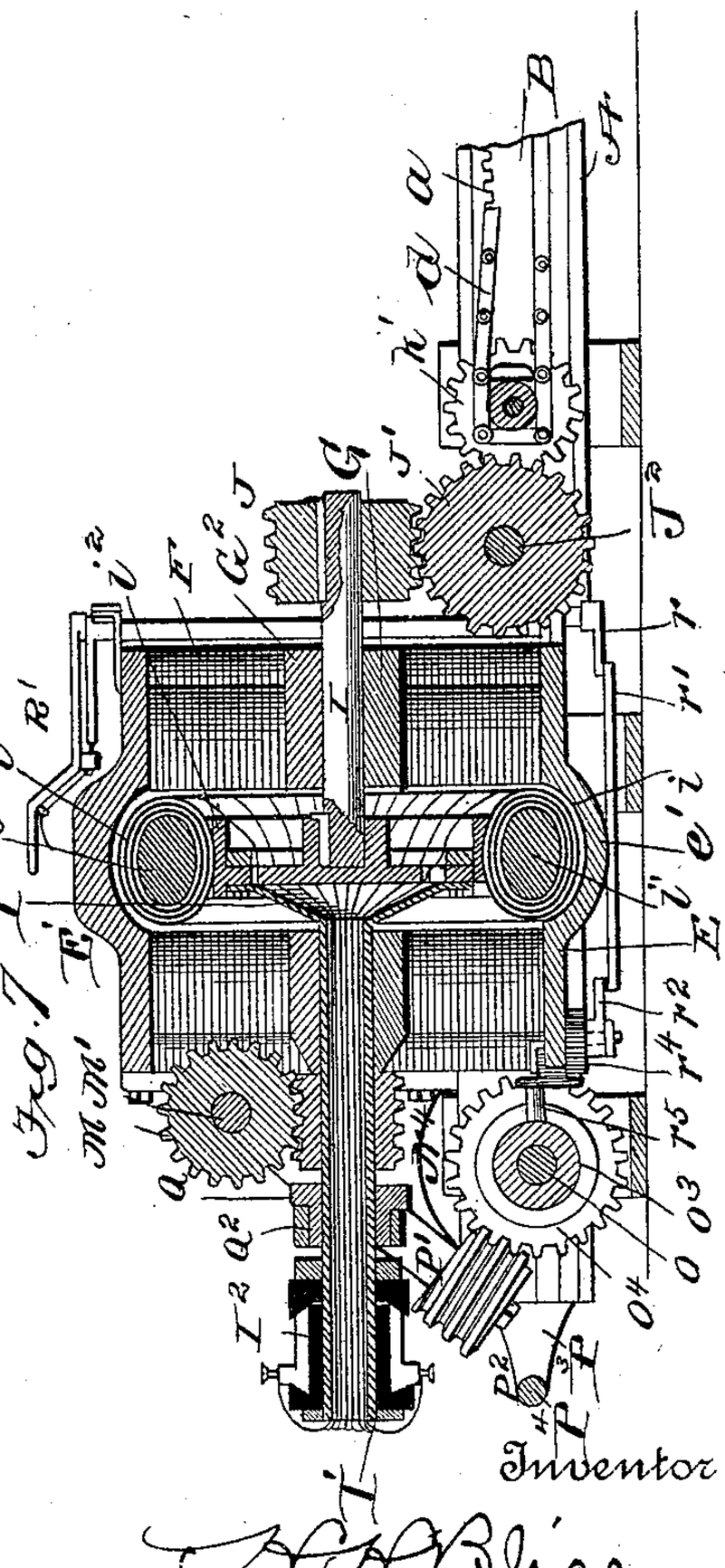


Fig. 7



Witnesses

Thos. Jamie

Chas. W. LaPorte.

Inventor

H. H. Bliss

(No Model.)

5 Sheets—Sheet 3.

H. H. BLISS.

MINING MACHINE.

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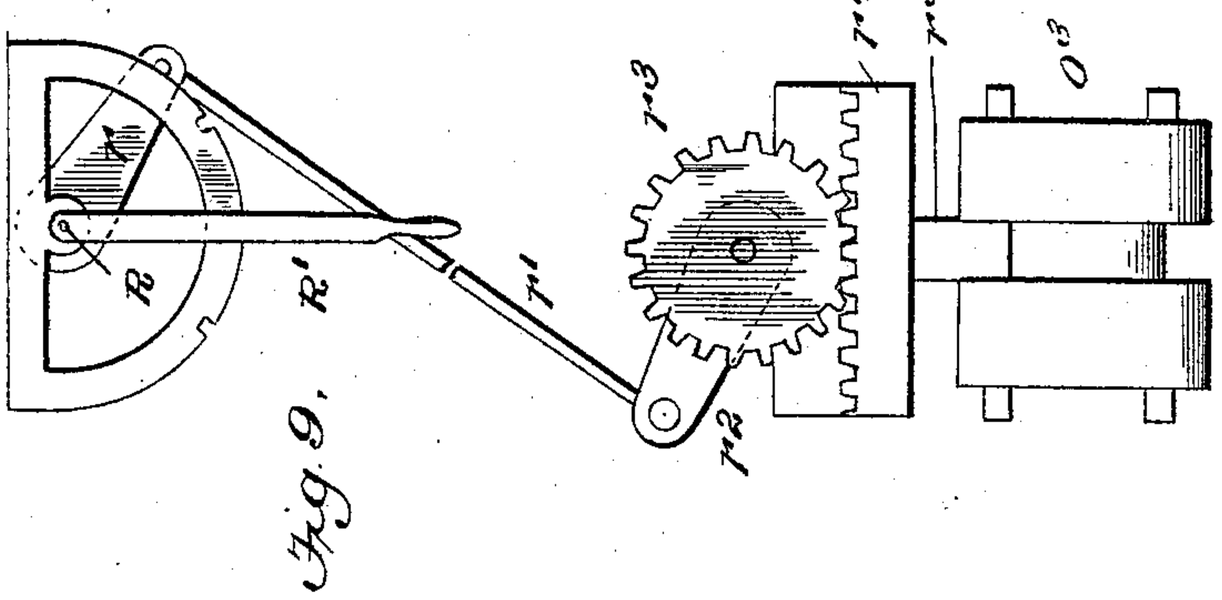

Fig. 9.

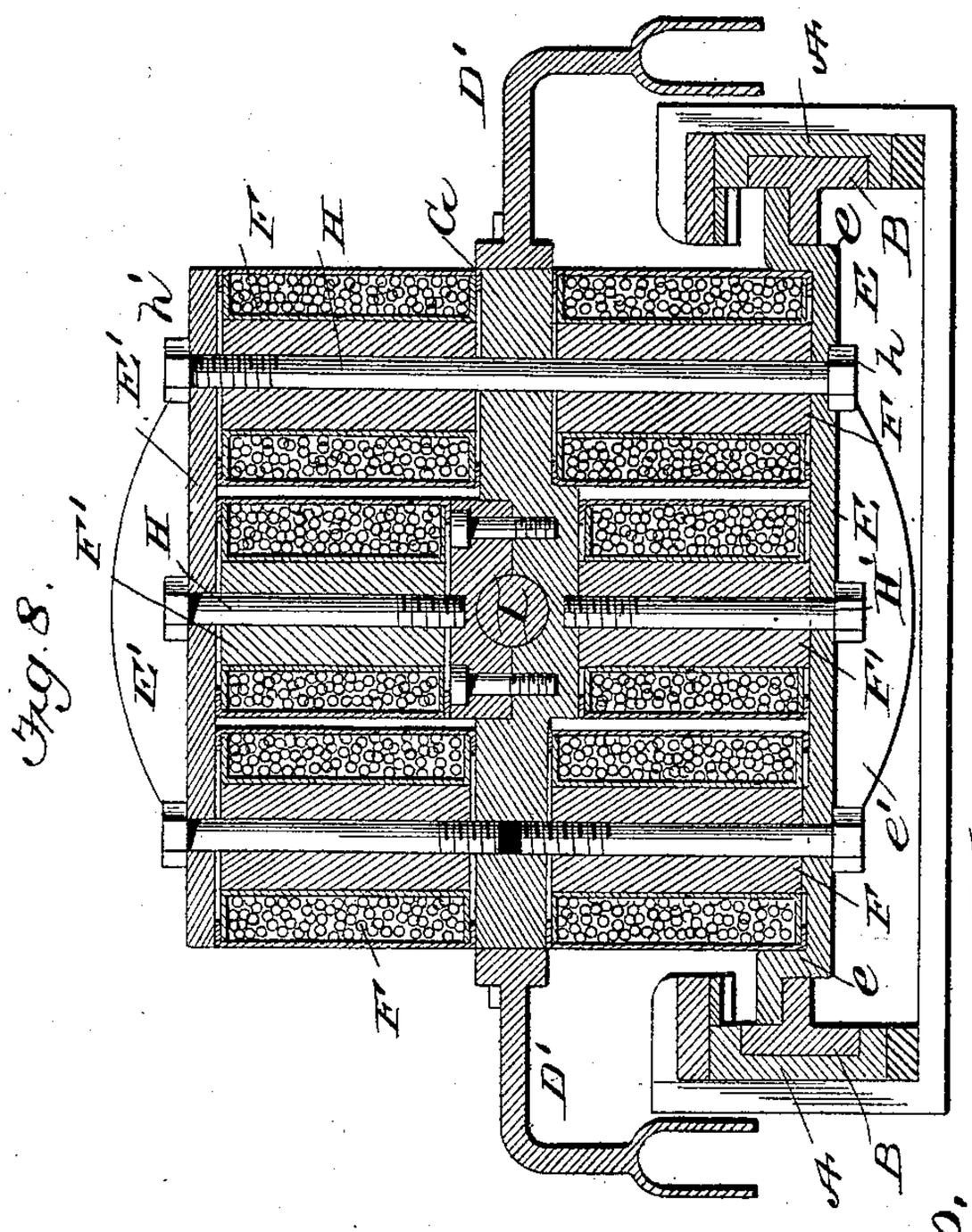

Fig. 8.

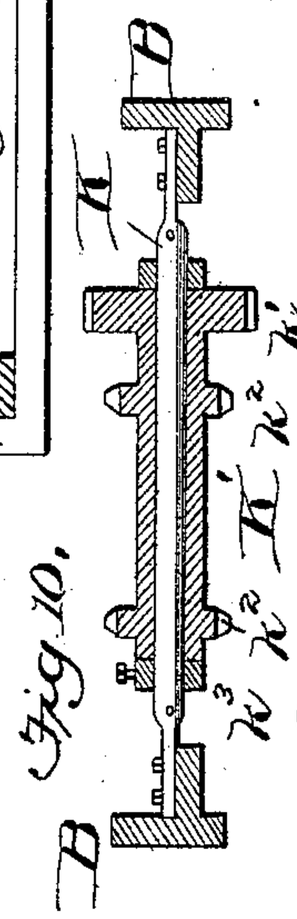

Fig. 10.

Witnesses
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(No Model.) 5 Sheets—Sheet 4.

H. H. BLISS.

MINING MACHINE.

No. 585,018. Patented June 22, 1897.

Fig. 12.

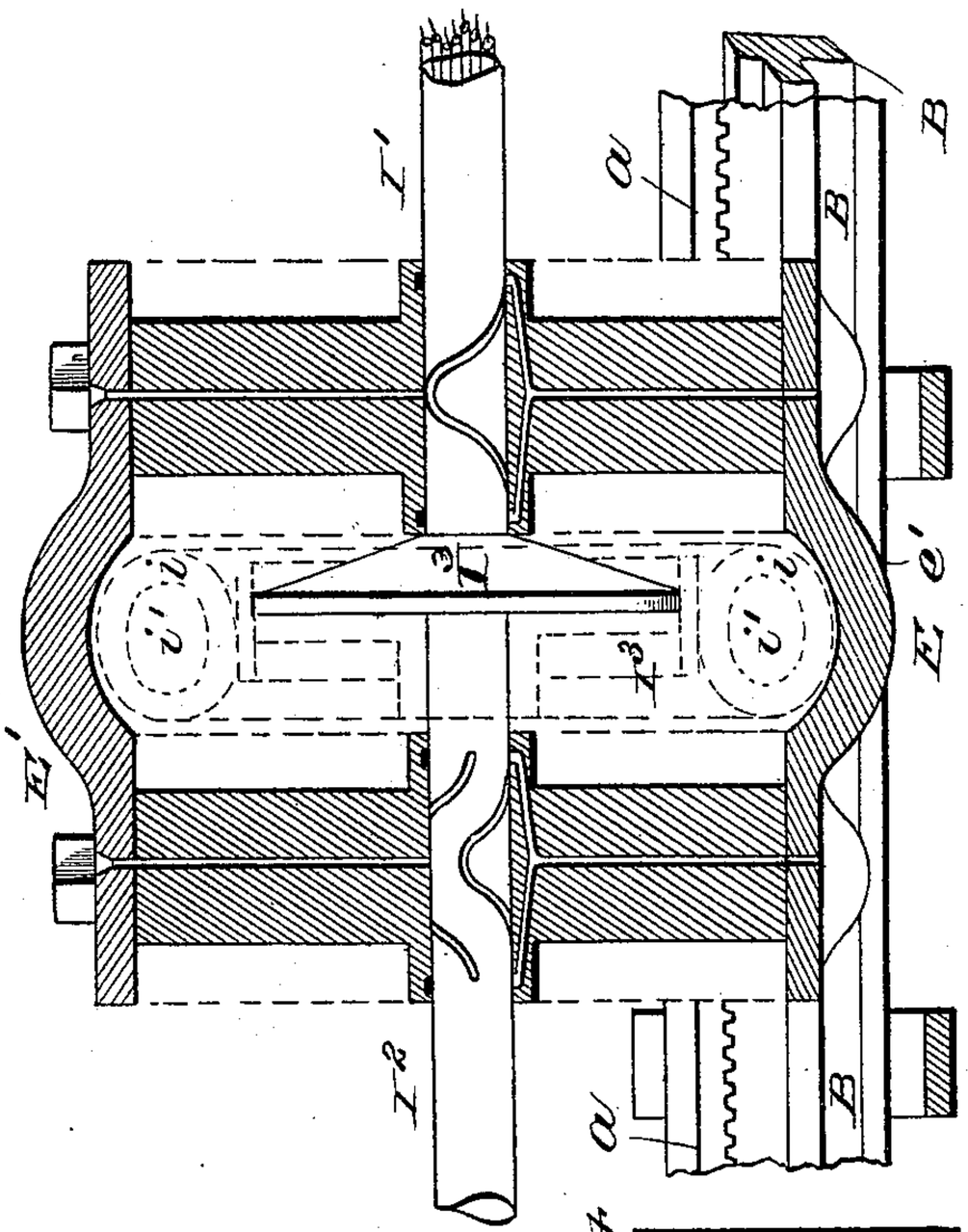

Fig. 11.

Witnesses
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Inventor
Henry H. Bliss

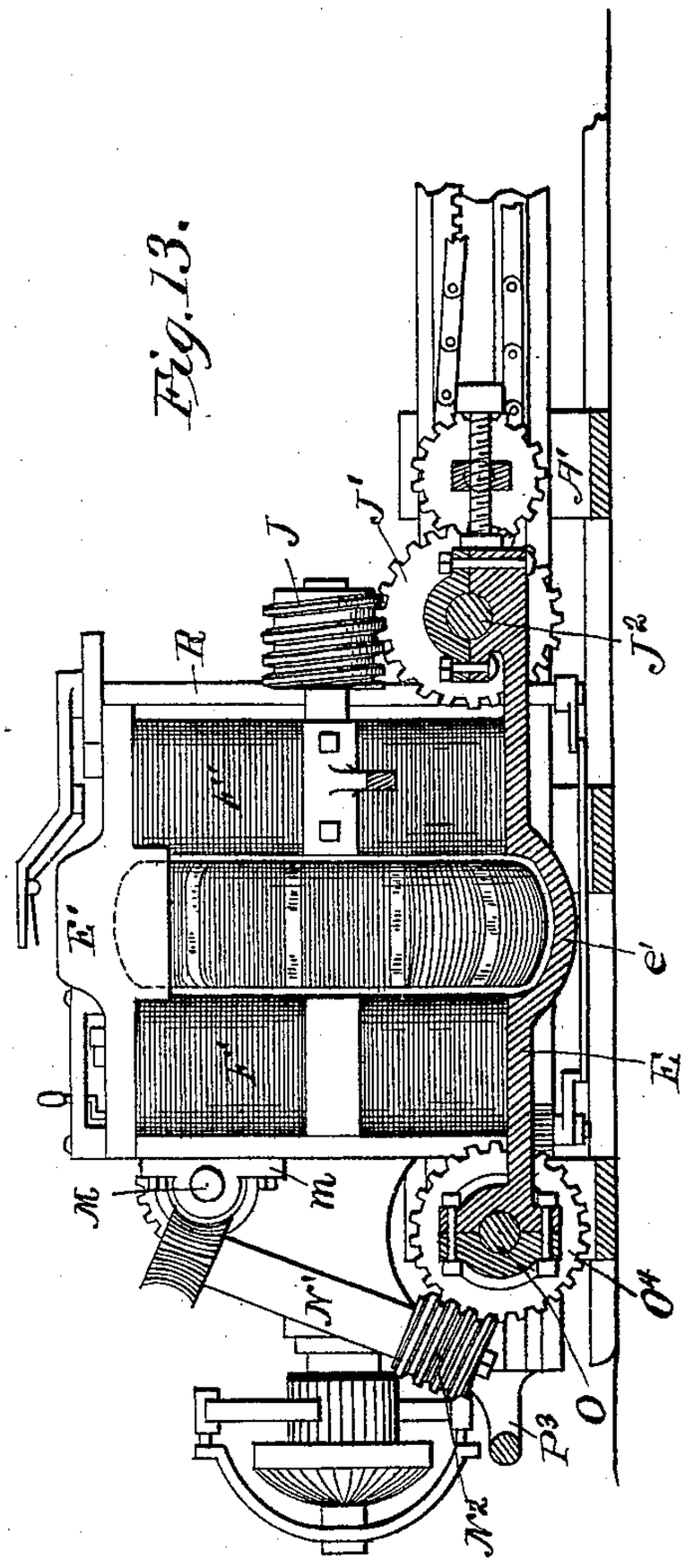
(No Model.) 5 Sheets—Sheet 5.

H. H. BLISS.

MINING MACHINE.

No. 585,018. Patented June 22, 1897.

Fig. 13.



Witnesses:
Howard D. Orr.
Arthur L. Bryant

Inventor:
H. H. Bliss

UNITED STATES PATENT OFFICE.

HENRY H. BLISS, OF WASHINGTON, DISTRICT OF COLUMBIA.

MINING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 585,018, dated June 22, 1897.

Application filed January 8, 1894. Serial No. 496,159. (No model.)

To all whom it may concern:

Be it known that I, HENRY H. BLISS, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Mining-Machines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

Figure 1 is a top plan view of a mining-machine embodying my improvements. Fig. 2 is a side elevation. Fig. 3 is a section on line *x x*, Fig. 1. Fig. 4 is a section on line *y y*, Fig. 1. Fig. 5 is a section on line *z z*, Fig. 2. Fig. 6 is a rear view. Fig. 7 is a longitudinal section on line *z' z'*, Fig. 1. Fig. 8 is a cross-section on line *x' x'*, Fig. 2, showing the field-coils covered. Fig. 9 is a plan view of the clutch-shifting devices. Fig. 10 is a section of the devices that actuate the cleaner-chains. Fig. 11 is a cross-section corresponding to Fig. 8, except that the cores of the magnets are continuous from side to side. Fig. 12 is a central longitudinal section of Fig. 11. Fig. 13 is a view on the line *x x* of Fig. 5 of a portion of the machine.

In the drawings, A A represent the bars of a bed-frame of the kind common in machines of this sort. This frame has ways in which are mounted the sliding bars B B of a cutter-carrying frame. These sliding bars project forward and carry the cutter-bar C in bearings at *c*. Behind the cutter-bar they carry a shaft or support D, which holds the devices which carry back the cuttings or slack. At the rear of the movable part of the machine is mounted the power mechanism.

E represents a plate extending across from one side bar to the other and bolted thereto. As shown, it droops at *e* and has a depressed portion *e'*. Upon this rest and through it are bolted the bottom cores F F' of parts of the field-magnets. Upon the upper ends of these cores F F' rests the bar G. At the center it is provided with a bearing for the armature-shaft. On the upper side of the bar G rest the upper cores F F', and upon the upper ends of these cores rests the top piece E'. The parts E E' constitute the pole-pieces of the electric engine, the lower one serving as a carriage-plate and the upper serving as a cover for the other parts. They are bolted together and also fastened to the cores and to the bar G by means of either through-bolts H, with heads *h* at the bottom and nuts *h'* at the top, said bolts passing entirely through the cores and bar G, or they are fastened by shorter bolts extending from the top and the bottom into the cross-bar G, it having threaded sockets to receive them.

The center cores F' F' are somewhat shorter than the side cores F F, because of their being adjacent to the bearings and the cap, and hence shorter bolts, such as at H', are necessary. By referring to the drawings it will be seen that there are two sets of these cores F F', one in front of the armature and the other in the rear. The armature is represented as a whole by I^4. There are coils of wire at *i* around the core *i'*, secured to a brass hub i^2. The hub is secured to the hollow shaft I', extending rearward, and the solid shaft I, extending forward, the latter being mounted in the front bar G and the former in the rear. The hollow shaft I' terminates in a flaring flange I^3. The hub is provided with perforations l^3, through which pass the connections for the commutator, said connections also passing through the hollow shaft I'. Shaft I' carries the commutator at the rear end.

J is a worm at the front end of the shaft engaging with the worm-wheel J', secured to shaft J^2, mounted on the carriage. This shaft has sprocket-teeth at J^3 which engage with the main drive-chain L, which extends out to and actuates the cutter-bar C. This shaft J^2 rotates in the direction indicated by the arrow, so that the upper part of chain L moves backward, and consequently the cutter-bar so turns as to cut upwardly. This, as is well known, is advantageous in that it holds the front end of the machine down. When it is rotated in the opposite direction, the reaction tends to elevate the machine, but it has been impossible heretofore to turn the cutter-bar in this way by a direct chain connection, as the drive-chain has carried so much of the slack or cuttings inward that a path could not be formed for the sliding parts. I overcome this difficulty as follows: On shaft J^2

there is a spur-wheel k engaging with wheel k' on cross-bar or shaft K. This shaft K has a sleeve K', to which is fastened or with which is formed the wheel k' and sprocket-toothed wheels k^2 k^2. The cross-bar K is fastened to the carriage. The sleeve can be mounted thereon in any suitable way, or even mounted upon another support. As shown, it is held in place by a collar and set-screw k^3. Sprockets k^2 k^2 are connected to the cleaner-shaft D by chains d d.

By examining the drawings it will be seen that hollow shaft K' revolves oppositely to the shaft J^2, and hence the chains d d move oppositely to the chain L—that is to say, while the under part of the chain L moves inward or toward the cutter-bar C the lower parts of the chains d d move outward, scraping the floor of the cut and therefore carrying outward the cuttings. Of these chains d d there may be as many as is desired between the side bars of the frame. I have shown two, one being comparatively close to the large chain L. Then on the outside there are two cleaner-chains d' d', driven by shaft D at the front end and at the rear supported on chain-wheels D^2 in brackets D', which are bolted to the motor.

The bar K, by means of set-screws K^2, is also utilized as an abutment for adjusting the motor back on the carriage-frame to put it in proper position and to keep the drive-chain L at proper tension.

With devices of this character I can produce an upward cut of the cutter-bar driven directly by the chain, and at the same time can effectively scrape the bottom of the floor by outward-moving devices and avoid the use of the intermediate shafts and gear-wheels or chains that have been heretofore used behind the cutter-bar.

In order to move the carriage forward and back on the bed, I employ a worm M behind the motor, engaging with a worm-wheel M' on the shaft M^2. The shaft M^2 is transverse to and above the armature-shaft I'. It is mounted in diamagnetic bearing-plates m m, which are bolted to the top piece E' and to the rear bearing-bar G. Preferably they are made of brass, so there shall be no magnetic circuit through them. Shaft M^2 carries a worm m' and a bevel-wheel m^2. Worm m' engages with a worm-wheel N, secured to a shaft N'. At the lower end of the shaft there is another worm N^2, turning worm-wheel O', loose on the cross-shaft O. Shaft O is mounted in bearings at O^5 on the carriage, and at the ends has pinions O^2, meshing with racks a on the bed. O^3 is a clutch feathered to the shaft O. When engaging with wheel O', the latter, through the clutch, rotates pinions O^2 in such way as to advance the carriage.

Bevel-wheel m^2 on shaft M meshes with bevel-wheel P on shaft P', the latter having at the lower end a worm P^2, which drives worm-wheel O^4, loose on shaft O and adapted to engage with clutch O^3. Wheels O and O^4 turn in opposite directions, the former fast and the latter slow. Shafts N' P' are mounted in bearing brackets or standards more or less similar to each other, one of them being indicated by N^4, Fig. 2, and which are bolted to the downwardly-extending brass or diamagnetic plates m m.

The commutator-brushes Q Q' are supported by a carrier q, secured to an adjustable ring Q^2 inside the commutator. As shown, it is bolted to some part of the motor, as to the bearing-stand N^4 or P^4, or both. This avoids the necessity of a surrounding frame to carry the brush-holder.

The clutch O^3 is actuated as follows: R is a shaft having at the top a long lever R', and I have shown it in front of the motor, such position being desirable, as the lever can be so arranged as not to project out laterally. At the lower end of this shaft there is a short crank-arm r, and to this is connected a link r'. The link extends backward under the motor and is connected to another crank r^2, which is secured to a rocking toothed part r^3. This engages with a sliding rack r^4, held in a guide on the bottom of the motor and provided with a rearward-projecting finger r^5, which engages with clutch O^3.

Heretofore much trouble has been experienced in operating mining-machines of this sort when actuated by air-engines from the fact that the radius of the sprocket-wheels on the cutter-bar is very short and the application of power thereto by the chains is variable. Two alternately-acting engines have been employed on each machine, their pistons moving at a high rate of speed, the blows and vibrations being very disadvantageous, causing the machine to move about with violent jerks when at work. Much of the power exerted by the engines is wasted in these movements of the machine, and precautions have to be taken to hold them to their work, use being made of several screw-jacks.

With a machine of the character of the herein described, this is almost entirely obviated, as the parts of the electric engine are so arranged that there is great steadiness and all of the power generated can be applied to the cutters without wastage in moving the machine about bodily.

It will be seen that I employ a continuously-moving cutting apparatus, continuously-rotating gearing, a chain for imparting power to the cutters, and a continuously-rotating prime power-shaft, so that a smooth and uniform action is maintained throughout all of the parts and the jerking and reactionary thrusts incident to machines with reciprocating engines are prevented.

I restrict the present case to the matters of novelty incident to the construction and arrangement of the motor, its armature, the gearing for transmitting power from the motor to the carriage and to the cutter-chain, as set forth in the following claims.

An electric motor of substantially the char-

acter shown provides an important feature which cannot be practically employed with the engines heretofore used arranged to apply intermitting impulses of power to a crank-shaft—that is to say, I can employ the force of momentum to the initial power-shaft or armature-shaft, so that it acts as a fly-wheel, the great weight incident to an armature developing from twelve to twenty horse-power giving it the character of a fly-wheel, so that not only is the initial application of the power continuous, smooth, and uniform, but, moreover, I enable the cutters (moving, as above stated, on a short radius, and therefore very sensitive to an increase in resistance) to revolve uniformly and to cut through materials which at one moment may be hard and of high resistance and at the next soft and of low resistance. None of these ends can be attained with the air-engine machines without the addition of special supplemental parts, and, as is well known, it is absolutely necessary with these machines that they should be as light as possible and as simple as they can be made and compact in their arrangement.

As I have filed another application wherein are presented generic claims relating to the peculiar features of operation incident to having an electric motor secured directly to the carriage in fixed relations thereto and to the cutting apparatus when said motor is constructed to drive the cutter-actuating chain and the other parts of the gearing and shafting with a smooth and continuous motion by reason of the momentum of the armature, I withdraw from and disclaim in the present case such matters—that is to say, I do not herein claim any of the subjects-matter which are set forth in the claims in my application, Serial No. 305,797, filed April 2, 1889, or application, Serial No. 482,466, filed as a division thereof August 5, 1893, or in my application, Serial No. 222,524, filed September 24, 1886, patented as No. 545,569, September 3, 1895, or application, Serial No. 558,409, filed August 5, 1895, as a division thereof, or in my application, Serial No. 400,893, filed July 27, 1891, in which latter there is shown and described a modified machine having the cutters applied directly to the chain.

In the present case I claim merely the features of novelty and usefulness incident to the construction and arrangement herein presented; but at the same time I desire to be understood that there can be modification, so far as concerns the details of the parts shown and their arrangement, without departing from the matters which characterize the present invention.

I believe myself to be the first to have actually constructed and operated a mining-machine similar to the one herein shown, in having the motor secured to the carriage and placed down at an extremely low position; having the motor arranged longitudinally of the carriage and geared to a continuously-moving chain by power-transmitting devices directly in front of the motor; having the parts so disposed that a powerful magnetic circuit could be provided with a minimum of metal, which at the same time serves as the mechanical support for the operative parts of the gearing and shafting; having the carriage-plate or rear frame or platform arranged so as to serve as part of the said magnetic circuit of the motor, preferably making it as one of the pole-pieces; having the feed-racks on the bed elevated relatively to the bottom of the motor, so that the feeding power can be applied at a relatively high line; having the pinion-shaft which moves the carriage arranged transversely behind the motor and driven by a transverse shaft directly above it; driving the upper transverse carriage-moving shaft by a simplified worm-gear arranged centrally as to said shaft, and having the longitudinal armature-shaft arranged substantially centrally with respect to the worm-gearing and the carriage-moving mechanism.

Prior to the date of my invention it was well known that these front-thrust undercutting-machines employing a chain for transmitting the power to the line of cut could have the cutters themselves supported independently of the chain or attached directly thereto and that the chains could be arranged to move in either vertical planes or horizontal planes, the rear chain-driving shaft being in some cases horizontal and in other cases vertical, both of which forms of machine are illustrated in numerous earlier patents. Hence, as concerns the features of the present invention, it is immaterial as to which of these more or less similar styles of chain-actuated cutting apparatus is employed.

What I claim is—

1. The combination, in a mining-machine, with the bed, the cutting apparatus, and the carriage therefor, of an electric motor having one of its pole-pieces mounted upon the carriage, the chain-driving shaft mounted upon said pole-piece, the gearing for actuating said shaft, and the chain driven thereby and adapted to impart motion to the cutters, substantially as set forth.

2. In a mining-machine, the combination with the bed, the cutting apparatus, and the carriage therefor, having longitudinally-sliding bars, of the electric motor having one of its pole-pieces mounted upon or connected to the said sliding bars of the carriage, said pole-piece having a longitudinal extension, the chain-shaft for driving the cutters mounted on the said extension of the pole-piece, and gearing connecting said shaft with the armature-shaft of the electric motor, substantially as set forth.

3. In a mining-machine, the combination with the bed, the cutting apparatus, and the carriage therefor having longitudinal sliding bars, the electric motor having one of its magnetic pieces mounted upon or connected to the said sliding bars of the carriage, the chain-shaft for driving the cutters, said mag-

netic piece having an extension rearward from said chain-shaft, a supplemental shaft mounted on said extension for moving the carriage on the bed, and gearing connecting the carriage-moving shaft with the armature-shaft of the electric motor, substantially as set forth.

4. In a front-thrust mining-machine, the combination of the bed-frame, having a guideway, a carriage having sliding bars fitted in the guideway, a cutting apparatus on the carriage arranged to operate at the front end thereof, a plate or casting at the rear end of the carriage adapted to serve both as a support for shafting and gearing and as part of a magnetic circuit, field-electromagnets secured to said magnetic plate, and one or more pole-pieces supplemental to said plate and secured to said magnets, said parts forming a stationary portion of an electric motor, the armature of said motor connected with the cutting apparatus, a carriage-moving shaft supported on said plate or casting and having one or more carriage-moving wheels, means on the bed engaging with said wheels, and means for imparting motion thereto from the armature-shaft, substantially as set forth.

5. In a front-thrust mining-machine, the combination of the bed-frame having a guideway, a carriage having sliding bars fitted in the guideway, a cutting apparatus on the carriage and operating at the front end thereof, a plate or casting at the rear end of the carriage adapted to serve both as a support for shafting and gearing and as part of a magnetic circuit, field-electromagnets on said magnetic plate, forming the stationary portion of an electric motor, the armature of said motor arranged longitudinally of the machine, gearing in front of the motor for driving the cutting apparatus, bearings formed in or secured to the said bottom magnetic plate, a transversely-arranged carriage-moving shaft in said bearings, a carriage-moving wheel on said shaft, means on the bed engaging said wheel, and means actuated by the armature for rotating said shaft, substantially as set forth.

6. In a front-thrust mining-machine, the combination of the bed-frame, the carriage moving forward and back thereon, the cutting apparatus on the carriage operating at the front end thereof, the racks on the bed, the motor at the rear end of the carriage having its armature-shaft connected to the cutting apparatus, the cross-shaft having pinions engaging with the said racks, the transverse power-shaft above the pinion-shaft and behind the motor, two trains of differently-speeded gearing extending downward from the upper transverse power-shaft and adapted to connect it to the pinion-shaft, the clutch for alternately engaging the upper shaft to the said pinion-shaft through the said two trains of gearing, and the worm-gearing actuated by the armature and connected to the upper transverse power-shaft, substantially as set forth.

7. The combination of the bed, the carriage, the continuously-acting cutting apparatus at the front end of the carriage, the racks on the bed, the motor at the rear end of the carriage having its armature-shaft in the vertical longitudinal planes of the carriage and connected to the cutting apparatus, the carriage-moving shaft having pinions engaging with said racks, the upper transverse shaft over the pinion-shaft, the two trains of differently-speeded gearing between the upper transverse shaft and the pinion-shaft, means for connecting and disconnecting the two said shafts through the said trains of gearing alternately, the worm-wheel arranged centrally upon the upper transverse shaft, and the worm situated in the longitudinal planes of the carriage and driven by the armature and engaging said worm-wheel, substantially as set forth.

8. The combination of the bed, the carriage, the cutting apparatus on the carriage and operating at the front end thereof, the electric motor on the carriage and arranged on a support which is placed relatively low in close proximity to the bottom bars of the bed, the rack-bars on the bed relatively high and at the sides of the motor, the carriage-moving shaft mounted in bearings fixed relatively to the motor-support, the pinions on the said shaft engaging with the racks, the transverse power-shaft above the pinion-shaft and behind the motor, means for driving the upper power-shaft from the armature of the motor, and gearing extending downward from the upper shaft to the pinion-shaft, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY H. BLISS.

Witnesses:
WM. H. DE LACY,
MARCUS B. MAY.