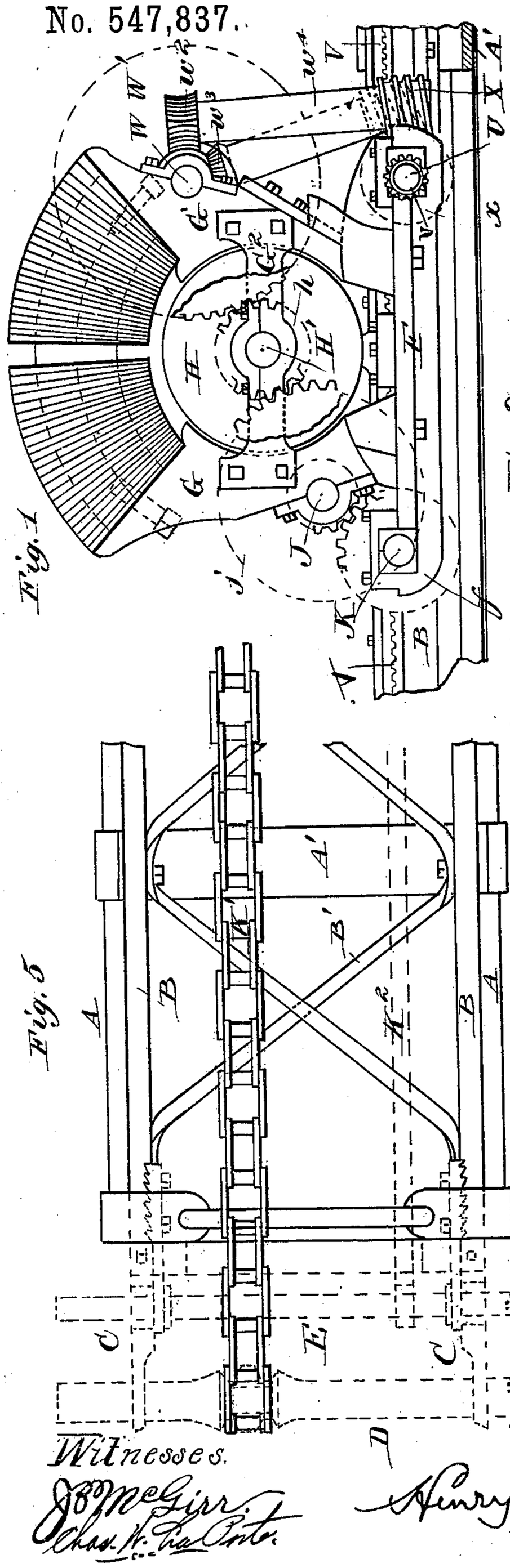
(No Model.)

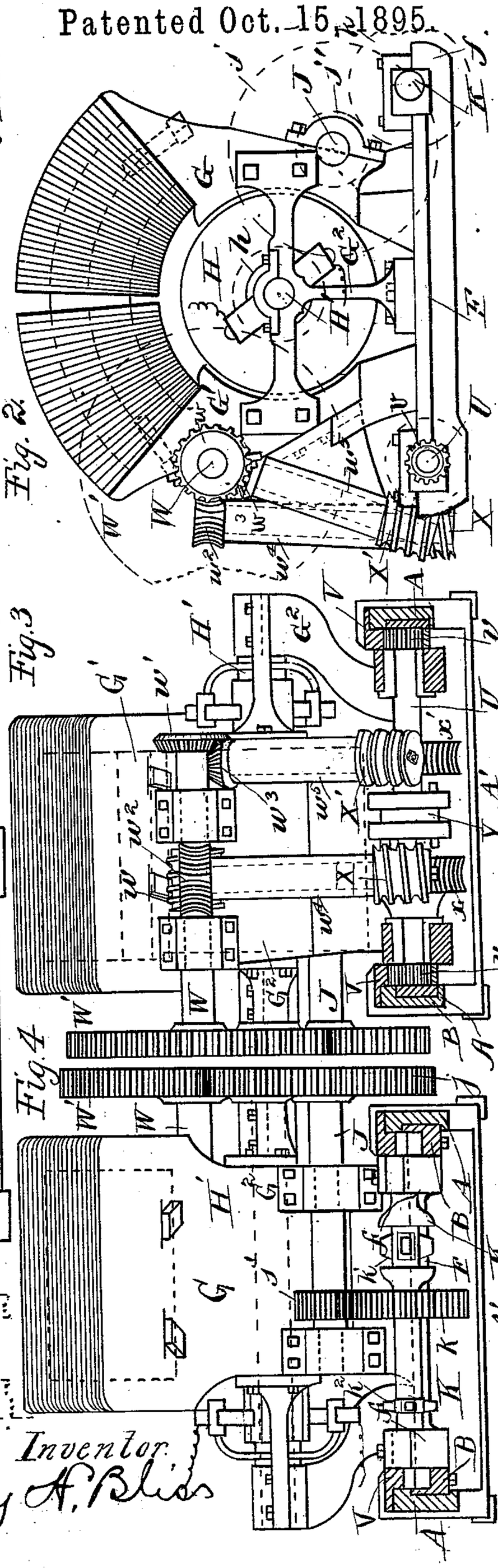
3 Sheets—Sheet 1.

H. H. BLISS.

MINING MACHINE.

No. 547,837. Patented Oct. 15, 1895.





Witnesses.
J. B. McGirr.
Chas. H. La Porte.

Inventor.
Henry H. Bliss

(No Model.) 3 Sheets—Sheet 2.

H. H. BLISS.

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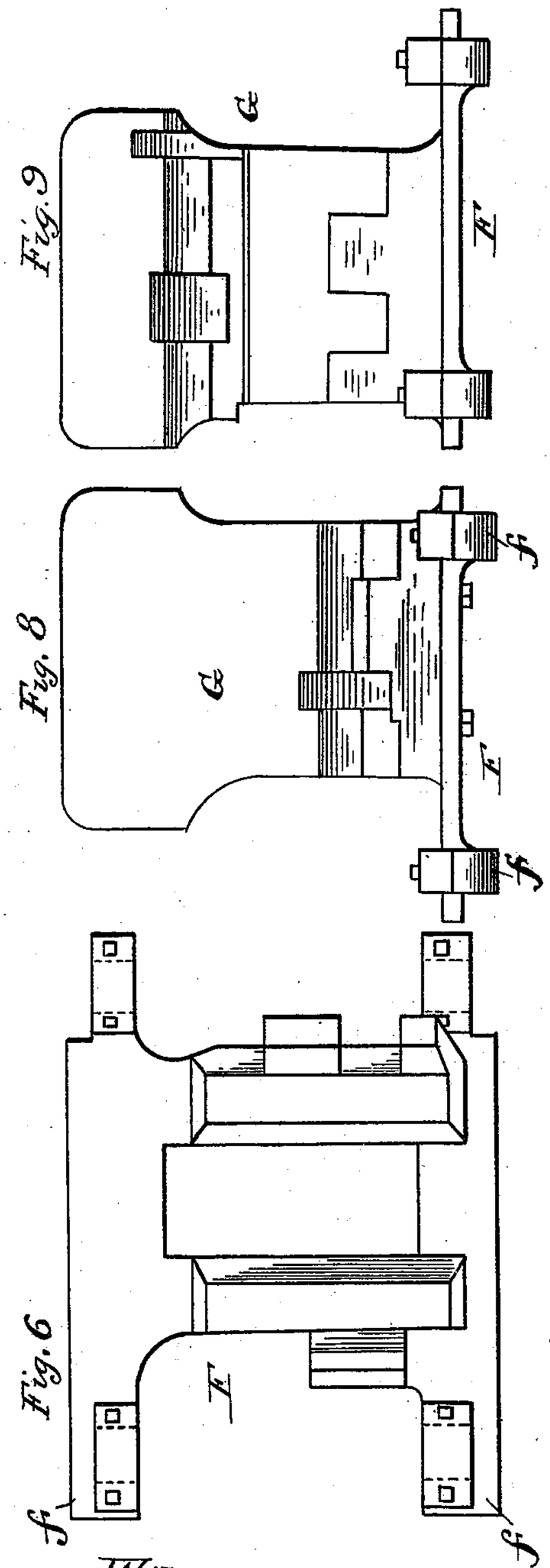

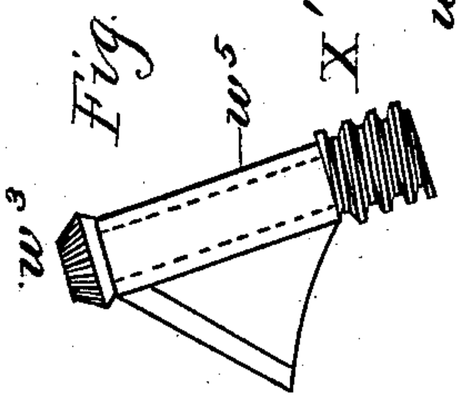

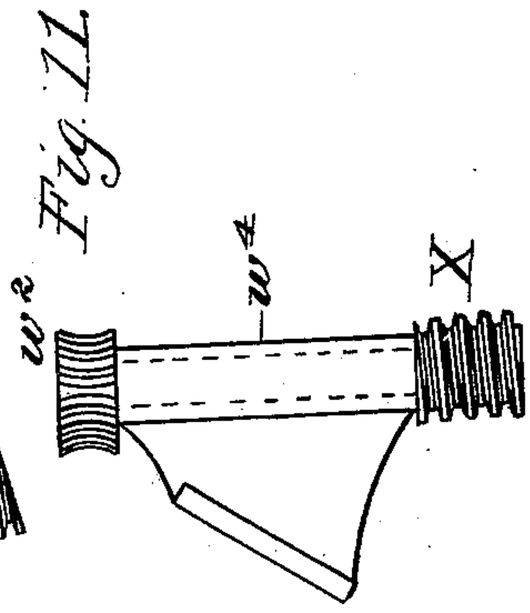

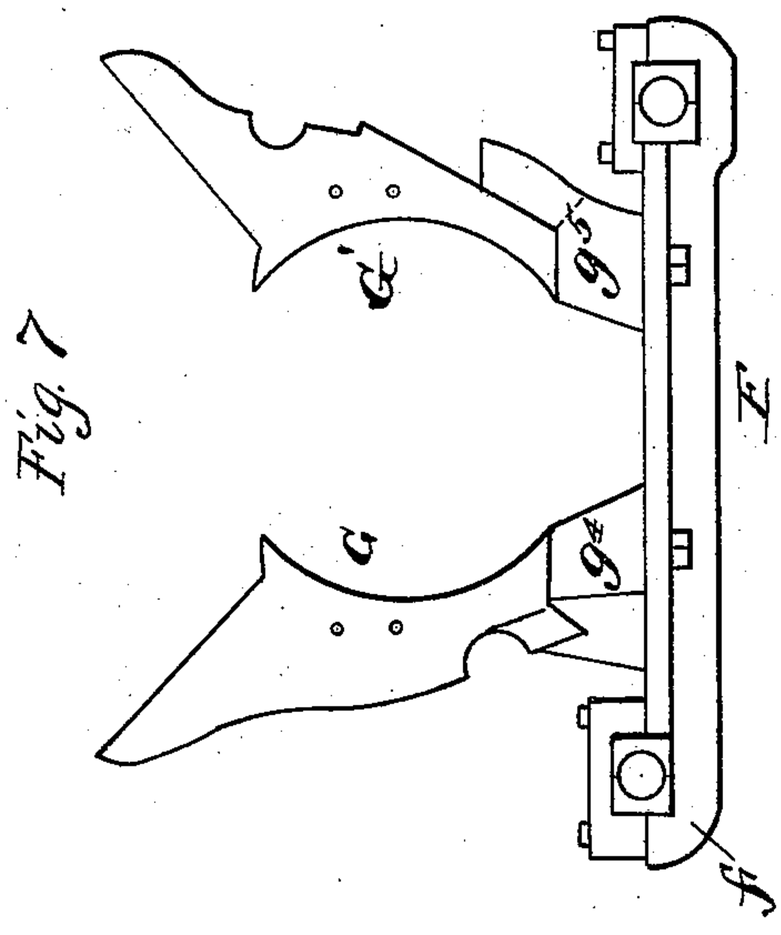

Witnesses

J. B. McGirr.

Chas. H. LaPorte.

Inventor.

Henry H. Bliss

(No Model.)

3 Sheets—Sheet 3.

H. H. BLISS.

MINING MACHINE.

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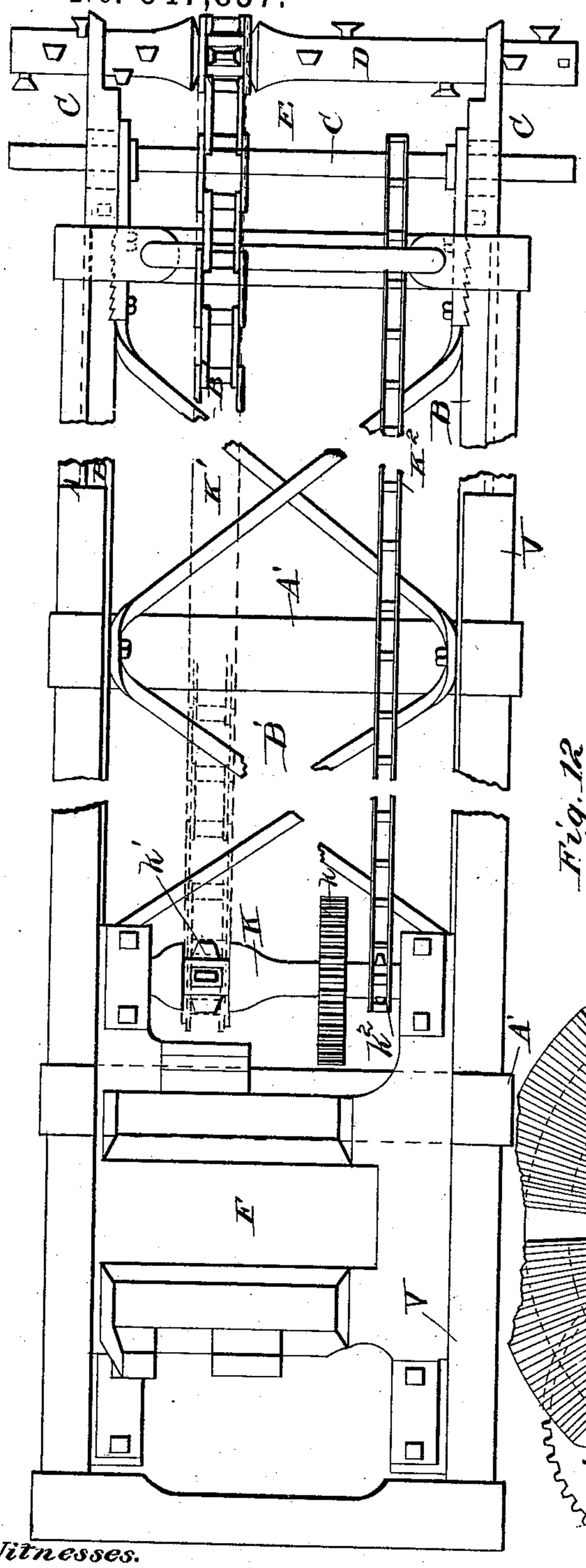

Fig. 12

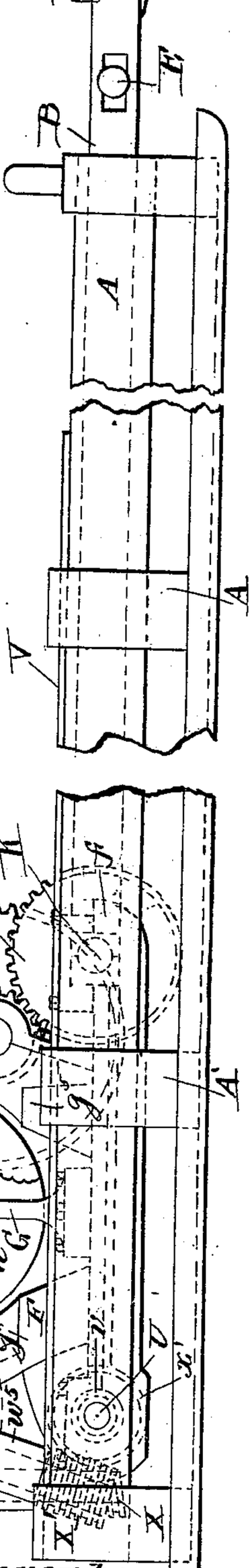

Fig. 13

Witnesses.

J. F. Coleman

Chas. H. La Porte

Inventor

H. H. Bliss

UNITED STATES PATENT OFFICE.

HENRY H. BLISS, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO JOSEPH A. JEFFREY, OF COLUMBUS, OHIO.

MINING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 547,837, dated October 15, 1895.

Original application filed April 2, 1889, Serial No. 305,797. Divided and this application filed August 5, 1893. Serial No. 482,466. (No model.) Patented in England November 2, 1893, No. 20,789; in Belgium January 26, 1894, No. 108,290, and in Austria June 25, 1894, No. 54,267.

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, (for more or less of which patents have been granted in Austria, No. 54,267, dated June 25, 1894; in England, No. 20,789, dated November 2, 1893, and in Belgium, No. 108,290, dated January 26, 1894,) of which the following is a specification, reference being had therein to the accompanying drawings.

Figure 1 is a side view of the power parts of a mining-machine embodying my improvements, parts at the bottom being removed. Fig. 2 is a view from the opposite side, showing the motor, the gearing, and the carriage-plate. Fig. 3 is a rear elevation showing the bed and the carriage in cross-section. Fig. 4 is a front view of the motor and gearing, showing the bed and carriage in cross-section in another vertical plane. Fig. 5 is a plan of the front parts of the bed, the carriage, the cutter mechanism, and other parts. Fig. 6 is a plan view of the carriage-plate. Fig. 7 is a side view of this and parts of the motor. Fig. 8 is a rear view, and Fig. 9 is a front view, of the parts in Fig. 7. Fig. 10 is a side view of the carriage-advancing devices. Fig. 11 is a side view of the carriage-withdrawing devices. Fig. 12 is a plan view with the motor detached, and Fig. 13 is a side elevation of the machine.

Undercutting mining-machines of the class known as "heading-machines" as heretofore constructed have been of one or the other of two classes, I referring by "heading-machine" to one having a portable bed to rest on the ground and serve as an abutment, a carriage moving forward and backward on the bed, and a cutting apparatus at the front end of the carriage adapted to form a kerf of such a nature that the cutters and all the forward parts of the carriage can be passed thereinto. In such machine the lines of thrust and reaction from the carriage-pressure are directly in the longitudinal lines of the machine, this being in contradistinction to those machines in which some form of cutting apparatus is arranged eccentric to such lines of thrust and reaction. Now the two classes consist of, first, those machines wherein the power for the cutting is transmitted from the rear of the carriage to the front by rigid devices, such as continuous longitudinal shafting or the like; and, second, those in which use is made of a relatively long chain with large heavy links for transmitting the power from the rear part of the carriage to the points of cutting at the front. The present improvement relates to machines of the second class. In each of these classes there are what may be termed numerous subdivisions. For instance, the Patents No. 246,328 to Tacey, No. 333,960 to Lucas, and No. 47,168 to Haupt and Smith show some of the types of the first class referred to. Illustrations of the types of the second class will be found in Patents No. 208,361 to Blythe, No. 186,854 to Lechner, No. 299,855 to Legg, No. 295,183 to Lechner, and No. 340,791 to Lechner. Now in a machine of any of these last-mentioned sorts having parts of such nature as to give it undercutting capacity enough to make it saleable and economical in use the chain which actuates the cutters is the principal element of difficulty. It extends from the rear driving-shafting to the front of the machine over a distance of from six to seven feet, the total length being fifteen or more feet, and is made up of numerous heavy links joined by proportionately numerous pivots. It is liable to sag and bear downward and is in many respects destructive of the power, as is well known to engineers, its inertia causing it to tend to move with a jerking and irregular motion. Prior to my invention it was always customary to drive these chains by intermittingly-acting engines, and yet it was for many years known that the intermitting action of the engine and the rapidly-intermitting reactions from the chain were matters of great disadvantage and loss.

One of the objects of the present invention is to provide a driving-engine or power mechanism which will be absolutely balanced and uniform in its rotary action and whose essential parts shall be of such a nature that not only the initial energy delivered to the machine can be applied to the intermittingly-re-

acting chain-links, but also an additional high power will be available in the form of momentum, so that the chain will be under even draft at all times and a force much higher than the initial energy will be ready at any instant to apply itself at the times of greatly increased load on the cutters.

The nature of the improvement will be readily understood from the following description.

I have selected for illustration a machine of one of the above types, such as is illustrated in Patent No. 299,655 to Legg.

In the drawings, A represents the side bars of a stationary frame, these being joined by suitable cross connecting-bars A′ of any suitable number. In or upon this bed there is mounted a sliding frame or carriage having the side bars B, with a vertical flange fitting in channels or grooves in the side bars A, and at the front ends braced by suitable bars, as at B′. At the front the bars B have shoes C C, which are adjustably secured to them and which support a revolving cutter-bar D at the front, and also a slack chain-bar E. The motor and the parts which transmit the power for actuating the operating parts and for moving the carriage to and fro are supported upon a plate, indicated as a whole by F.

Having reference now more particularly to Figs. 1, 2, 6, 7, 8, and 9, G′ G′ represent the pole-pieces of a motor, which I have shown converging downwardly for the purpose of shortening the space on the carriage occupied by the power mechanism and its accessories. Between them is situated the armature H, it being supported on the shaft H′, mounted in bearing-arms G^2, one on each side of the motor. This armature-shaft is not arranged as have been those in some of the earlier machines which I have devised and constructed—that is, it is not longitudinal of the whole machine, but is situated transversely in order that the power may be transmitted by straight spur-gearing. The shaft H′ carries a pinion *h*, which meshes with the wheel *j* on a shaft J. The latter is mounted in a plane below that of the armature, and, as shown, is held in bearings formed for it in one of the pole-pieces. This enables me to avoid the weight of the additional parts that would be requisite to carry it if they were added to the machine for that special purpose, and is here permissible by reason of the arrangement of the pole-pieces. Shaft J rotates another shaft K by means of gear-wheels *j′* and *k*. Shaft K is mounted in bars or arms *f f*, projecting from the carriage-plate F. The cutter-bar D is driven by this shaft K by means of one or more chains K′, there being a sprocket-wheel at *k′* on shaft K. The cleaner-shaft E is driven from a sprocket-wheel k^2 by another chain K^2.

By examining Fig. 3 it will be seen that the parts constituting the motor and its immediate accessories—such as the commutator, the brushes, the bearings, and the pinion *h*—are so disposed as to about balance each other both in reference to their weights and also in respect to their positions. In these machines it is essential that none of the more fragile parts should be allowed to project in any direction beyond the bed-frame, inasmuch as the machines are being frequently moved by means of crowbars and similar implements, and hence nothing should be exposed which cannot safely receive powerful and numerous blows and strainings. In the present construction the armature is safely guarded and the commutators and brushes are inside of such lines as limit, ordinarily, attacks from the sources above specified.

In order to prevent the loss of magnetism from the pole-pieces, they are supported upon brass or other diamagnetic carriers $g^4 g^5$, which are bolted to the carriage and extend upward, so as to lie under and more or less surround and brace the pole-pieces. They serve as standards or supports to uphold the intermediate shafting and gearing as well as the motor and keep them in proper relations to the cutter-driving shaft and to the carriage-moving mechanism. It will also be seen that the power is transmitted directly from the cross armature-shaft by means of straight spur-gearing, the machine in this respect being distinguishable from those in which use is made of worms and worm-wheels. The worm-gearing is advantageous under some circumstances, as thereby the machines can be simplified and few parts used and in working lighter materials is very efficient; but where the material worked upon is hard and the machines are under continual strain I have found that the friction incident to the worm-gearing is objectionable, and consequently have turned the armature-shaft transversely of the machine and have placed the train of gear-wheels outside of the outer vertical plane of the bed and the commutator-brushes and bearing on the opposite side of the motor. By this arrangement, while the machine as a whole is made somewhat wider and the parts for transmitting the power somewhat greater in number, nevertheless I transmit a much greater part of the power for the effecting of heavier work.

For advancing and withdrawing the carriage and with it the cutter-bar, the chains, the motor, and the parts connected therewith, I employ the following mechanism:

U is a shaft situated transversely of the machine and engaging by means of pinions *v* with a rack V on the bed. This shaft is turned slowly in one direction to advance the carriage or rapidly in the opposite direction to withdraw it by the following devices:

W is a shaft situated transversely of the machine and rotated by gearing connecting it with the armature-shaft. As shown, it has a wheel W′, meshing with the pinion *h*. On shaft W there is a worm *w* and a bevel-wheel *w′*, the former engaging with the worm-wheel w^2 and the latter with a bevel-pinion w^3.

Wheel w^2 drives a shaft in bearing w^4 and wheel w^3 drives a shaft in bearing w^5.

X X′ are worms on shafts in bearings w^4 w^5, respectively, engaging with wheels x x' on shaft U, they being loose, but adapted to engage with the wheel by means of a clutch Y.

The shaft W and the bearings w^4 w^5 are all supported on the pole-pieces G′ of the motor, as will be readily seen. In this construction the chain-shaft K and the shaft J which drives it are in front of the motor and the carriage-moving shaft U in rear.

It will be seen that I employ a cutting mechanism moving continuously in one direction, continuously-rotating gearing and chains for driving the cutter mechanism, and a continuously-rotating initial power-shaft, so that a smooth and uniform action is obtained throughout all of the operative parts, and the jerking and reactionary thrusts incident to the air-engine machine are prevented.

An electric motor of substantially the character shown provides an important feature, which cannot be practically employed with the engine 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.

I am aware that it has been merely suggested in various crude ways that electric power could be used for actuating drills and mining-machines; but I am not aware that prior to my invention any successful mechanism for operating the cutters of a machine of the character of the present one has been even suggested. The patent to Tacey, No. 246,328, presents one such suggestion in connection with a row of augers, some dotted lines indicating what is referred to as an electric motor. It is unnecessary to point out at length the radical differences between a machine like the one there suggested and the one presented herein. In the present case an actually constructed motor is shown in substantially working relations to the other parts, it being arranged in a fixed relation to the cutters and secured with them to a common carriage and moving forward and back with them at a fixed distance, so that it not only applies the power to them uniformly under the same conditions, but is used to assist in bracing the cutters and their carriage, so as to form with them one of the unitary parts of the machine. In the Tacey patent it is proposed to in some way place what is called a "motor" on a fixed platform, apparently separate from both the carriage and frame of the cutting apparatus, in such way that if the cutters could be rotated or moved at all they would be constantly advancing away from the motor. Again, in the present machine I have found that a motor which is apparently largely out of proportion with respect to size and weight to the cutting apparatus to be none too powerful for actuating the cutters, even when slowing-down gearing is interposed to reduce the speed of the armature. In the Tacey machine appears the suggestion of driving a wide row of augers with a speed at least as high as that of the armature, there being no slowing-down gearing contemplated.

The details of the construction and arrangement of the carriage, the shafting, the gearing, and motor can be modified in any of the well-known ways so far as concerns the essential features of the invention, although I have shown and described more or less in detail a machine conforming to the above type in order that the improvement may be fully understood.

The motor which I have shown has, as concerns the arrangement of the parts—namely, of the field-magnets, the core, the pole-pieces, &c.—numerous advantages, among which are the above-mentioned facts that the space on the carriage is shortened, the height of the machine is lessened, and bearings for the shafts are readily provided without increasing the total weight. The armature being transversely situated enables me to bring the power down without material loss through one or more shafts parallel to the armature to the chain-shafts, and the momentum of the armature-shaft is sensitively felt at all times by the cutters. As a result of this transverse arrangement of the armature I can utilize the space adjacent to the side of and below the top of the bed for the gearing. The shafts and gear can be differently arranged, if desired—as, for instance, the chain-driving shaft K, which is shown in front of the motor, can be situated behind it, as is shown in my other application, Serial No. 305,797, though in such case the carriage-feeding mechanism is preferably of the sort shown in said other application. When a positive feed is used, comprising two members, one secured to the bed and the other to the carriage, such as a rack and a pinion or a nut and threaded shaft, and which it is desired to have as low as possible, it is preferable to put the essential portion of such mechanism at the rear and the chain-driving shaft at the front.

I do not herein claim any of the matters

claimed in the aforesaid other application, Serial No. 305,797, filed April 2, 1889, from which the matter herein claimed is withdrawn, preferring to claim in such other application the matters incident to a yielding feed mechanism, the claims herein relating to the construction and arrangement of the motor on the carriage and the other parts combined therewith. Nor do I herein claim any of the matters which are claimed in my application, Serial No. 400,893, filed July 24, 1891, wherein the present invention is embodied in connection with a chain having cutters directly attached thereto, as I prefer to claim herein the matters common to both machines, and to limit the claims in said other application to the specific novel features therein; and I further state that I do not herein claim as a specific construction one of the characters which was shown and described in my application, Serial No. 222,524, filed December 24, 1886, and also shown and described in application, Serial No. 558,409, filed August 6, 1895, as a division thereof—that is to say, do not herein claim, specifically, a mining-machine having a bed, front-thrust cutting apparatus, a carriage therefor, an electric motor secured to the carriage and having its armature-shaft arranged longitudinally of the machine, power-transmitting gearing in front of the motor, a chain for actuating the cutters and driven by the said gearing, and carriage-feeding mechanism moving with the carriage and geared to the said motor by shafting arranged longitudinally beneath the motor and driven from the gearing in front—preferring to claim the novel features incident to such construction and arrangement of parts in said application, Serial No. 558,409, filed August 6, 1895.

What I claim as my invention is—

1. In a mining machine the combination of a portable bed adapted to be made stationary, horizontal traveling guides fitted thereto and forming part of a reciprocating carriage, continuously moving cutters supported on and across the front of said carriage, a continuously moving chain for actuating the cutters, an electric motor secured to said carriage and moving forward and back therewith relatively to the bed and having a continuously revolving armature adapted to generate momentum and connected by slowing down gearing with the said chain which actuates the cutters, carriage moving mechanism rotating continuously when in action, and power transmitting means for said carriage moving mechanism connected with said slowing down gearing driven by the electric motor, substantially as set forth.

2. In a mining machine of the character described, the combination of a portable bed adapted to be made stationary, the horizontally traveling guides fitted thereto and forming part of a carriage, the continuously rotating cutter bar mounted upon and transversely of said carriage, the continuously moving chain transmitting power to said cutter bar, the carriage-moving mechanism, the power transmitting devices for said carriage-moving mechanism, and the electric motor secured to said guides and carriage and moving forward and back therewith relatively to the bed, and having a continuously revolving armature shaft or initial power shaft connected by slowing down gearing with the chain which rotates the cutters, the armature being expanded radially beyond the shaft thereof, whereby momentum is provided for the cutters when meeting a relatively high resistance, substantially as set forth.

3. In a machine of the character described, the combination of the bed, the traveling guides fitted thereto and forming part of a carriage, the cutters, the carriage-moving mechanism, the electric motor secured to the traveling guides, and moving forward and back therewith relatively to the bed, the power transmitting devices for the cutters secured to and supported from the electric motor, and the power-transmitting devices, having slowing down gearing for the carriage-moving mechanism secured to and supported from the motor, substantially as set forth.

4. In a machine of the character described, the combination of the bed, the traveling guides fitted thereto and forming part of a carriage, the continuously moving cutters, the traveling electric motor continuously rotating, and the power-transmitting devices for the cutters having a shaft mounted on or supported from the metal constituting the magnetic circuit of the motor, substantially as set forth.

5. In a machine of the character described, the combination of the bed, the traveling guides fitted thereto and forming part of a carriage, the continuously acting cutters, the carriage-moving mechanism, the electric motor supported on said guides, and the power-transmitting devices for the carriage-moving mechanism having a shaft mounted on or supported from the metal constituting the magnetic circuit of the electric motor, substantially as set forth.

6. In a machine of substantially the character described, the combination of the bed, the carriage having an electric motor, the operating mechanism on said carriage divided into two sets of driven parts, the two sets of gearing for the armature shaft respectively connected with the said two sets of driven parts whereby the latter are operated by the armature independently of each other, substantially as set forth.

7. In a machine of substantially the character described, the combination of the bed, the traveling guides or bars fitted to the sides of the bed, the electric motor situated above the bottom of the bed and secured to or formed with said side bars, and the operating mechanism having a carriage moving shaft and

a cutter driving shaft supported thereon and driven thereby substantially as set forth whereby the space occupied by the operating mechanism may be short longitudinally of the machine.

8. The combination of the portable bed adapted to be made stationary, the cutter carriage sliding thereon, the cutters arranged to operate at the front of said carriage, the plate or platform at the rear of the carriage, the cutter actuating chain extending from the front to the rear part of the carriage, the electric motor secured to said platform and having a rotary armature mounted transversely of the carriage, the chain driving shaft mounted on said platform, the support for the motor extending upward from the platform, the transversely mounted intermediate power transmitting shaft carried by the said support, the gearing connecting the intermediate shaft with the armature shaft and gearing connecting it with the chain driving shaft, substantially as set forth.

9. The combination of the bed, the carriage, the cutting apparatus at the front of the carriage, the plate or platform on the carriage, the cutter driving shaft on said platform, the electric motor above the cutter driving shaft and having its armature arranged transversely of the carriage, the intermediate power transmitting shaft, the prime gearing at the side of the motor in proximity to the side lines of the bed and connecting the intermediate shaft and the armature shaft, and the gearing below the motor connecting the intermediate shaft with the cutter driving shaft, substantially as set forth.

10. The combination of the bed, the carriage, the cutting apparatus arranged to operate at the front of the carriage, the plate or platform at the rear of the carriage, the cutter driving shaft on said platform, the electric motor mounted on said platform and having a rotary armature mounted transversely of the carriage, the intermediate shaft mounted transversely on the carriage for transmitting power to the cutter driving shaft, and the standards or supports on the platform, which uphold both the motor and the said intermediate shaft, substantially as set forth.

11. The combination of the bed, the carriage, the cutters arranged to operate at the front of the carriage, the chain for actuating the cutters, the plate or platform at the rear of the carriage, the electric motor on said platform having the armature mounted transversely of the carriage, the carriage feeding shaft behind the motor, a transverse intermediate shaft parallel to the armature shaft for actuating the carriage moving shaft, and the gearing connecting the armature shaft with said intermediate shaft, substantially as set forth.

12. The combination of the bed, the carriage, the cutting apparatus arranged at the front end of and across the carriage, the electric motor secured to the carriage and having a continuously rotating armature shaft, the cutter driving shaft mounted on the carriage, the transverse carriage feed shaft, and two intermediate shafts substantially parallel with the armature shaft and one conveying power from the armature shaft to the chain driving shaft, and the other conveying power from the armature shaft to the transverse carriage feed shaft, substantially as set forth.

13. The combination of the bed, the carriage, the cutting apparatus on the carriage, an electric motor on the carriage extending across the space between the sides of the bed, the transverse carriage feed shaft, the pinions thereon, the racks on the bed, a supplemental carriage moving shaft placed above the pinion shaft and supported directly behind the motor, two trains of oppositely acting, differently speeded gear behind the motor extending down from said upper shaft to the lower pinion shaft, and the clutch for reversing the pinion shaft, substantially as set forth.

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

HENRY H. BLISS.

Witnesses:
MARCUS B. MAY,
N. CURTIS LAMMOND.