(No Model.) 3 Sheets—Sheet 1.

H. H. BLISS.

MINING MACHINE.

No. 568,329. Patented Sept. 29, 1896.

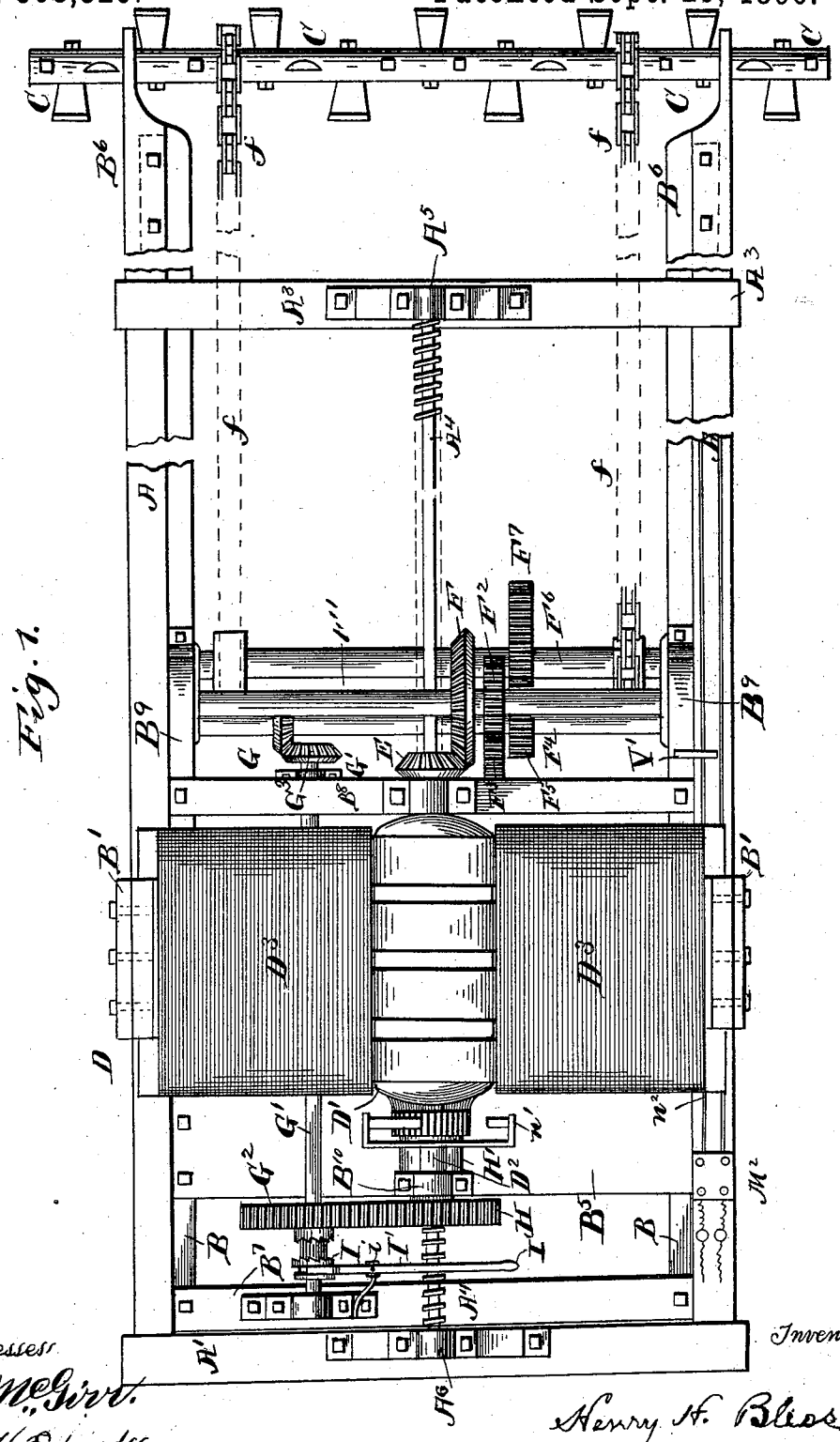

Fig. 1.

Witnesses:
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Wm. H. Edwards.

Inventor
Henry H. Bliss

(No Model.) 3 Sheets—Sheet 2.

H. H. BLISS.

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Fig. 1.

Fig. 2.

Fig. 3.

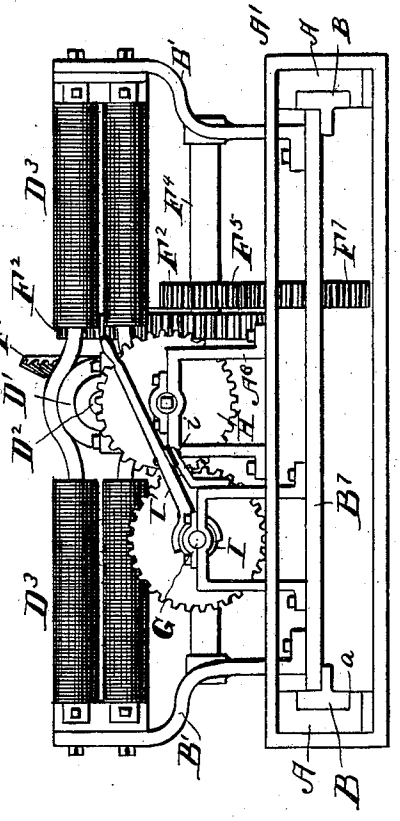
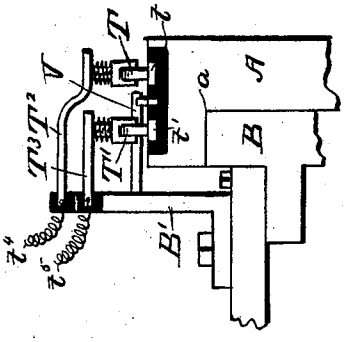


Fig. 8.



Witnesses
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(No Model.) 3 Sheets—Sheet 3.

H. H. BLISS.

MINING MACHINE.

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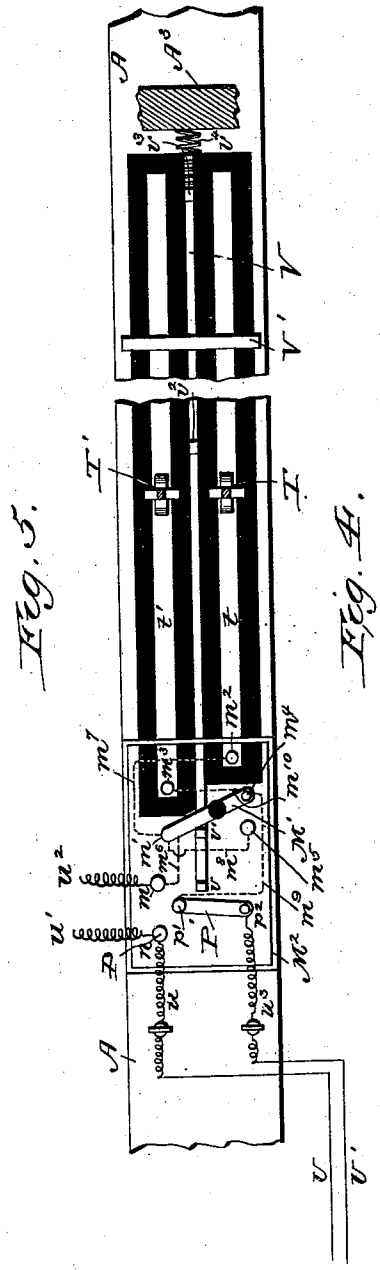

Fig. 5.

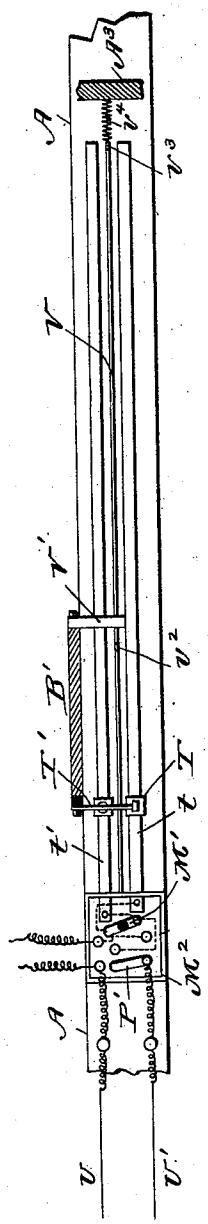

Fig. 4.

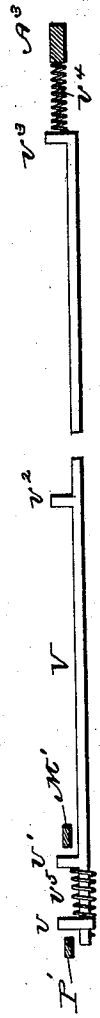

Fig. 6.

Witnesses
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Arthur L. Bryant

Inventor
Henry H. Bliss

UNITED STATES PATENT OFFICE.

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

MINING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 568,329, dated September 29, 1896.

Application filed August 6, 1895. Serial No. 558,409. (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 machine embodying my improvements. Fig. 2 is a central longitudinal vertical section. Fig. 3 is a rear view. Fig. 4 is a plan view of some of the details of the current-controlling devices. Fig. 5 is a top plan view showing these devices in detail and on a larger scale. Fig. 6 is a side view of the switch-operating bar. Fig. 7 is a view of the rear end of the said bar. Fig. 8 is a rear view showing the traveling contacts for the motor.

In the drawings, A A indicate a bed-frame, which, while being portable, is adapted to be made stationary from time to time during the cutting operations. It is formed of side bars joined by cross frames or bars, as shown at A^3 A', at the front and rear, and with intermediate bars A^5. This frame provides a guide for a traveling carriage having side bars, as at B B, fitted to a guide, the bed-bars being preferably formed with a groove *a* to receive the carriage-bars or a portion thereof. At the front end of the carriage the cutting apparatus is arranged. That illustrated consists of a cutter-bar C, mounted in traveling supports at B^6 B^6, secured to the carriage. The cutting apparatus is driven by one or more chains, as at *f f*. These extend backward from the cutting apparatus to the rear part of the carriage, the machine being of the class adapted to form a six-foot or longer undercut.

At the rear the side bars of the carriage are joined by one or more cross plates or bars, as at B^4 B^5 B^7. These cross bars or plates are utilized to support the power parts, the shafting, and gearing which effect the movements of the cutting apparatus and also cause the forward and backward movements of the carriage of the bed.

F^6 is a cutter-driving shaft mounted on the platform or cross-plate B^4 and moving forward and back therewith. It actuates the cutters through the medium of the chain *f*, which engages with it. It is rotated by a gear-wheel F^7, which it carries and which meshes with a pinion F^5 on a shaft F^4. This shaft F^4 is driven by the wheels F^2 F^3, that of F^2 being secured to a shaft F'.

Shaft F' is driven as follows: D indicates, as a whole, an electric motor. The one illustrated is of the "Siemens" type, the field-magnets and armature of one of that construction being so disposed that I can arrange beneath it several of the essential parts of the machine. The armature is indicated by D' and the armature-shaft by D^2. It is unnecessary to illustrate or describe the details of the construction of these parts, the commutator, &c., as they are well understood by those acquainted with such mechanism. Nor is it necessary herein to present a detailed description of the advantages arising from and the actual operation of the cutting apparatus in mining-machines of the several sorts in the class indicated, as I have described these matters in my applications, Serial No. 305,797, filed April 2, 1889, and Serial No. 482,866, filed August 5, 1893.

Reciprocating engines driven by compressed air have been generally used prior to my improvement, use being made with each machine of two cylinders and pistons. The pistons make from six hundred to a thousand strokes a minute. The reactions from these are powerful, and act to not only displace the machine and make it difficult to hold it to its work, but result in the loss of much power. Again, it has been impracticable, in fact, virtually impossible, to supplement the direct action of the engines by momentum; and consequently when the cutters meet, as they constantly do, suddenly increased resistance from hard materials interspersed through the coal the engines are slowed down and frequently stopped. To overcome these objections, I employ a motor having a

continuously-rotating armature, which is so constructed as to act as a fly-wheel and generate momentum, and can be so disposed relatively to the field-magnets as to have the lines of force pass through each in such way that it will be virtually balanced; that is to say, I not only provide for storing up the momentum, but also for avoiding shocks, jars, and jolting to any part of the machine. The wear and tear of the parts is reduced and much power is saved, which with reciprocating engines is lost.

The field-magnets D^3 are supported by uprights or brackets B′, which are bolted to the carriage-plate B^4. In order to generate sufficient power, a comparatively large motor must be employed, and the disposition of it with respect to the other parts and the machine as a whole is an important matter. It must be so arranged that the machine will not be top-heavy, so that there shall be no parts, particularly no fragile parts, to project laterally to a material distance beyond the side lines of the carriage and bed, and so that the shafting, gearing, and carriage-moving mechanism can be suitably arranged without elongating or widening the carriage beyond certain practical limits. To meet these ends I so arrange the motor that it shall utilize the space across the carriage, place the cutter-driving device in front and the carriage-moving mechanism behind them, with power-transmitting devices in the space below the motor.

The armature-shaft D^2 is longitudinally arranged, so that the power can be taken directly from it to the gearing in front and applied in or near the central longitudinal planes of the machine. It is supported at the front by a cross-bearing bar B^8, which is secured to the uprights B^9 at the sides, and serves to support the shafts F′ and F^4. At the rear the armature is mounted in a bearing at B^{10} in a standard or upright formed with or secured to an upright B^3, secured to the carriage-plate B^5, and also serving other purposes, to be described. The armature is connected by a bevel-pinion E and bevel-wheel F to the power-shafting. When current is supplied to the motor and the armature is rotating, it will, through the above-described gearing, actuate the cutter mechanism smoothly and continuously.

In order to advance the carriage simultaneously with the cutting action, I employ a screw-threaded shaft A^4. This is secured rigidly and stationarily in uprights A^5 A^6 on the front and the rear cross-bars A^3 and A′ of the bed.

H′ is a hollow shaft or rotary nut-carrier which surrounds the screw-shaft A^4. It is supported in the uprights B^3, having journal parts held in bearings thereon. One of its journals is secured to a gear-wheel H. To rotate this nut-wheel and the nut, I employ the gearing at G and G^3, driven by the power-shafting. Wheel G^3 rotates shaft G′, which extends backward under the motor and carries a gear-wheel G^2, arranged to mesh with the aforesaid nut-wheel H. Wheel G^2 is loose on its shaft G′, but can be connected therewith by a clutch I, which is feathered to the shaft G′.

I′ is a shipping-lever pivoted to a support i, extending up from the frame or one of the standards. When the clutch I is in engagement with the wheel G^2 and the motor is in action, rotation will be imparted to the nut-wheel H in such way as to cause the nut to bear backward on the bar A^4 and forward against the standard B^3, and its pressure on the latter will advance the carriage and the cutting apparatus, the latter at such time operating continuously.

I am aware of the fact that carriages have been reversed, that is, caused to move backward, by duplicating the carriage-moving mechanism. I utilize the same devices which feed the carriage forward for pulling it back, but reverse the current in the motor. As the latter revolves much more rapidly when the cutters are unloaded, the carriage comes back much more rapidly than it advances. To so reverse the current, I employ the following means:

On one of the sides A of the bed I place insulated conductor-sections $t\,t'$. With these the supply-mains at U and U′ are connected.

T T′ are traveling contacts which bear against the conductors $t\,t'$. The contacts T T′ are carried by arms T^2 T^3, which have the terminals t^4 t^5 of the motor-circuit secured thereto.

P′ is a switch pivoted at p^2 and adapted to engage with the contact p'.

M′ is another switch pivoted at a suitable point and insulated in any suitable way. One end of it is adapted to engage with contacts m' and m^3 and the other with contacts at m^4 and m^5.

u indicates a wire or circuit-section leading from a main. It runs to the binding-post p, from which a wire u' leads to the field-magnets of the motor, and u^2 is a return-wire from the motor to the contact at m.

m^6 is a wire connecting contact m and one end of switch-lever M′.

m^7 is a wire from post m' to post m^2.

m^8 is a wire from the contact m' to post m^5.

m^7 is a wire from one end of lever M′ to post p', and m^{10} is a wire connecting post m^3 and post m^4, and u^3 is the outgoing wire from the switch P′ to the main or general circuit.

When the parts are in the position shown in Fig. 5, it will be seen that the current enters from one main and passes over wire u, post p, and wire u' to the field, thence over wire u^2 to contact m, over wire m^6, switch M′, and wire m^7 to post m^2, along the conductor t to the contact-wheel T, over the bar T^2 and wire t^4 to the armature, and thence back over wire t^5 to the arm T^3, contact-wheel T′, con-

ductor t' to post m^3, wire m^{10} to switch M', over wire m^9 to switch P', and thence over wire u^3 back to the return-main. At such time the current passes through the armature in the way requisite to revolve the gearing in the direction to cause the cutting and to cause the forward feed of the carriage. If the switch M' be put in its other position, that is to say, if the switch M' touches m^3 and m^5, the armature will be reversed, because the current then passes as follows, namely, over wires u and u' to the field, thence back over u^2 to contact m, over wire m^6 to switch M', post m^3, conductor t', contact-wheel T' to the armature, thence back to contact-wheel T, along conductor t, post m^2, wire m^7, post m', wire m^8, post m^5, lever M', wire m^9, post p', switch P' to wire u^3 and back to the main. To automatically throw switches P' M' in such way as to effect these reversals of the current, use can be made of any suitable trip device. As shown, there is a bar V supported on the bed and extending longitudinally thereof. It has trip-lugs v^2 and v^3. The carriage has an opposing trip-arm V', adapted to strike the lugs v^2 v^3. The spring v^4 tends to push the bar V backward. When the carriage is advancing, the bar V' ultimately strikes the lug v^3 and pulls the trip-bar V forward, causing the lug v' at its rear end to swing the lever M' from the position shown in Fig. 5 to its opposite position. Thereupon the current to the armature is reversed, the feed-nut is reversed, and the carriage is drawn backward. It moves back until the arm V' strikes the lug v^2, whereupon the bar V is pushed backward and its arm v strikes the switch P' and pushes it away from the contact p', which results in cutting the current from the machine entirely and both the carriage and the cutters are brought to rest.

The arm v on the bar V can be moved thereon against the spring v^5, (see Figs. 6 and 7,) so that the operator can, when he sees fit, move the switch P' back to the contact p' to admit current to the machine. Before this is done the switch M' should be moved to the contacts m' m^4 to admit current to the armature in such way as to cause the advance of the carriage and the rotation of the cutters. The spring v^4 insures that the trip-bar V shall be held normally in a neutral position. Thus it will be seen that after the machine is started forward it automatically reverses the travel of the carriage after the latter has reached the front end of its movement, and also that the machine is automatically stopped when it reaches the rear end of its movement. As before stated, these results have been accomplished by two more or less independent mechanisms, one for advancing the carriage and the other for retracting it, and both actuated by an engine-shaft or power-shaft revolving continuously in one direction; and there are some features of the present construction which are independent of the particular form of carriage moving and reversing devices.

I do not herein claim any of the matters presented in the claims in my application, Serial No. 222,524, filed December 26, 1886, from which the present subject-matter was withdrawn, preferring to therein claim all matters incident to the changing or reversal of the current by the moving carrier; all matters incident to the employment of a solenoid or equivalent as part of the devices for moving the carrier; all matters incident to a yielding feed device for a cutter-carrier; all matters incident to a drilling mechanism in contradistinction to an undercutting mechanism, and restricting the present application to the novel features that may be present incident to an undercutting mining-machine having, in combination with a bed and the carriage which supports the cutting apparatus, an electric motor on the carriage and moving therewith, and the positively-acting gearing for moving the carriage and for actuating the cutters when said gearing is constructed and arranged as herein set forth. Nor do I herein claim any of the matters set forth in the claims in my application, Serial No. 305,797, filed April 2, 1889, or in application, Serial No. 482,866, filed August 5, 1893, as a division of the said application, Serial No. 305,797; that is to say, I do not herein claim the combination of a portable bed, the horizontally-traveling carriage, continuously-moving cutters on the carriage, a continuously-moving chain for actuating the cutters, an electric motor on the carriage having a revolving armature adapted to generate momentum and connected by slowing-down gearing with the said chain, together with carriage-moving mechanism, and suitable power-transmitting devices between the motor and cutters and carriage-moving mechanism, having made that the subject-matter of claims in the said other application, but, as aforesaid, restrict myself herein to claims for the novel features which may be incident to the peculiar arrangement of the gearing, shafting, and electric motor by which the cutters are actuated and the carriage is moved.

It will, of course, be understood that in many respects the drawings herein present more or less conventionally a number of the parts, such as the cutting apparatus, the chain which actuates it, the construction of the bed, and the form of the carriage; but mechanics in this line are now well acquainted with the fact that the ends and purposes aimed at can be accomplished by variations in each of these respects, that is to say, by using cutting apparatus of other sorts and different details for the carriage and the bed, so long as the main features are maintained of a front-thrust uniformly-supported carriage having cutters at the front end of it adapted to form a relatively shallow horizontally-elongated kerf, and provided

that, so far as the present construction goes, the motor and its armature-shaft be arranged as described, in combination with cutter-actuating gearing and carriage-moving devices arranged substantially as described.

In the machines shown in my said other applications the slowing-down gearing was arranged so as to overhang the sides of the carriage or of the bed, and while that is a matter of advantage under some circumstances it is desirable in many places to have the gearing removed from the sides, so as to avoid the necessity of supplemental boxing or housing for the gearing and so that the energy of the motor can be economically applied at the central parts longitudinally of the machine; and this is attained by mounting the armature, as herein provided, in longitudinal vertical planes and between the sides of the carriage, and taking the power directly therefrom at the said central parts.

I am aware that a machine having parts more or less similar to some of those herein, such as the bed, the carriage, the cutting apparatus, the threaded feed-shaft, the nut, and the gearing, had been devised prior to my invention by H. B. Dierdorff, use having been made in said machine of two of the reciprocating engines hereinbefore referred to, the engines having been arranged remote from each other, one at each side of the machine, and I disclaim in favor of the said H. B. Dierdorff any matters of invention incident thereto; but I believe myself to have been the first to have devised a mining-machine of the present class, to wit, the class having heavy chains for actuating the cutters, wherein use is made of a relatively large electric motor compactly arranged above and secured to the rear end of the carriage in such way as to economize substantially the entire space across the carriage, and having its armature-shaft in the longitudinal planes of the machine, and connected approximately centrally to power-transmitting devices, some of the latter being arranged directly beneath the motor for the further economizing of space at the rear end of the carriage, so that the motor can be powerful, as aforesaid, and apply the force uniformly in relation to both sides of the bed and of the cutting apparatus.

What I claim is—

1. In a mining-machine, the combination of the bed, the carriage sliding thereon, the cutters on the carriage, arranged to operate across the front end thereof, the chain for actuating the cutters, the slowing-down gearing for imparting motion to said chain, the positively-acting carriage-feeding mechanism having the stationary member secured to the bed, and the rotary member mounted on and traveling with the carriage, the electric motor secured to and traveling with the carriage and extending across the space above the carriage substantially from side to side thereof and having its armature-shaft arranged in a longitudinal vertical plane between the sides of the carriage, the armature on said shaft being adapted to generate momentum and apply it to the chain-links, a gear-wheel on said armature-shaft in front of the motor and engaging with the slowing-down gearing, and a longitudinally-arranged power-transmitting shaft beneath the motor geared to the gearing in front of the motor and extending backward to the carriage-moving mechanism, the said parts being arranged substantially as described whereby a relatively large and powerful electric motor can be arranged with economy of space above and from side to side of the rear end of the carriage and the overhanging of gearing at the sides of the motor is avoided, substantially as set forth.

2. In a mining-machine, the combination of the bed, the carriage sliding thereon, the cutters on the carriage arranged to operate across the front end thereof, the chain for actuating the cutters, the slowing-down gearing for imparting motion to the said chain, the positively-acting carriage-feeding mechanism having the stationary member secured to the bed, and the rotary member mounted on and traveling with the carriage, the electric motor secured to and traveling with the carriage, and extending across the space above the carriage substantially from side to side thereof and having its armature-shaft arranged in a longitudinal vertical plane between the sides of the carriage, a pinion on the said shaft connecting it to the slowing-down gearing, the armature carried by said shaft being adapted to generate momentum and apply it to the chain-links, and to the carriage-feeding mechanism and the power-transmitting mechanism directly beneath the motor, the said parts being arranged substantially as set forth to apply the power from the traveling motor to the gearing and to the carriage-feeding mechanism in the central vertical planes of the machine, and transmit power downward and backward under the motor whereby a relatively large and powerful motor can be arranged to extend across the rear end of the carriage and the employment of laterally-overhanging gearing is avoided, substantially as set forth.

3. In an undercutting mining-machine, the combination of the stationary bed, the carriage sliding thereon, the cutters on the carriage arranged to operate across the front end thereof and to be advanced directly forward, the chain for actuating the cutters, the positively-acting carriage-moving mechanism mounted on the carriage and traveling therewith, the slowing-down gearing for transmitting power to the cutter-actuating chain, the electric motor in front of the carriage-moving mechanism, and extending across the space above the rear end of the carriage and behind the gearing which actuates the cutting mech-

anism, said motor having a continuously-revolving armature mounted in the longitudinal vertical planes of the carriage and between the sides thereof and adapted to generate and apply momentum to the chain-links to maintain a continuous motion thereof, a power-pinion on the armature-shaft connected with the aforesaid gearing, and means situated directly beneath the motor for connecting the said gearing with the carriage-moving mechanism substantially as set forth.

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

HENRY H. BLISS.

Witnesses:
ARTHUR L. BRYANT,
HOWARD D. ORR.

Correction in Letters Patent No. 568,329.

It is hereby certified that in Letters Patent No. 568,329, granted September 29, 1896, upon the application of Henry H. Bliss, of Washington, District of Columbia, for an improvement in "Mining Machines," an error appears in the printed specification requiring correction, as follows: In the heading the words and figures "Application filed August 6, 1895, Serial No. 558,409," should read *Original application filed December 26, 1886, Serial No. 222,524. Divided, and this application filed August 6, 1895. Serial No. 558,409;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 6th day of October, A. D., 1896.

[SEAL.]

JNO. M. REYNOLDS,
Assistant Secretary of the Interior.

Countersigned:

JOHN S. SEYMOUR,
Commissioner of Patents.