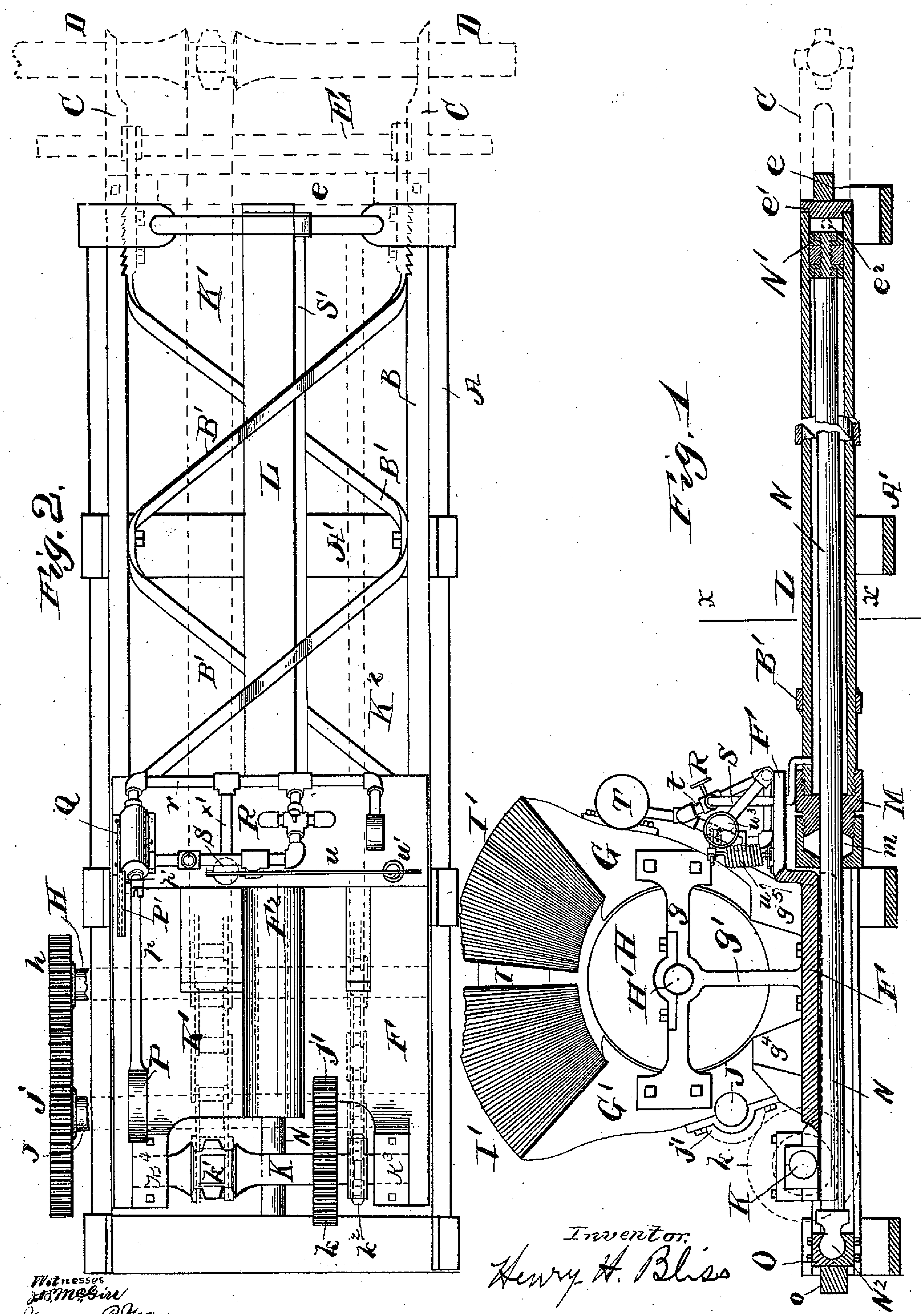
(No Model.) 4 Sheets—Sheet 1.

H. H. BLISS.

MINING MACHINE.

No. 547,836. Patented Oct. 15, 1895.



Witnesses
J. B. McGirr
Marcus B. May.

Inventor.
Henry H. Bliss

ANDREW B. GRAHAM, PHOTO-LITHO. WASHINGTON, D.C.

(No Model.) 4 Sheets—Sheet 2.

H. H. BLISS.

MINING MACHINE.

No. 547,836. Patented Oct. 15, 1895.

Fig. 5.

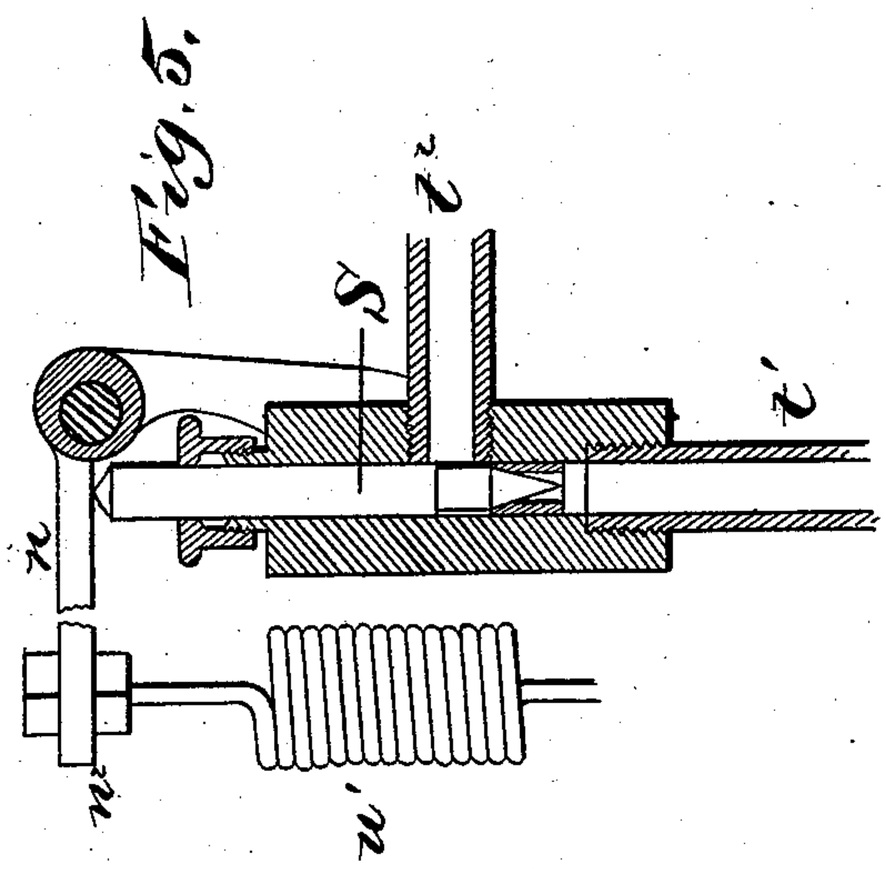


Fig. 4.

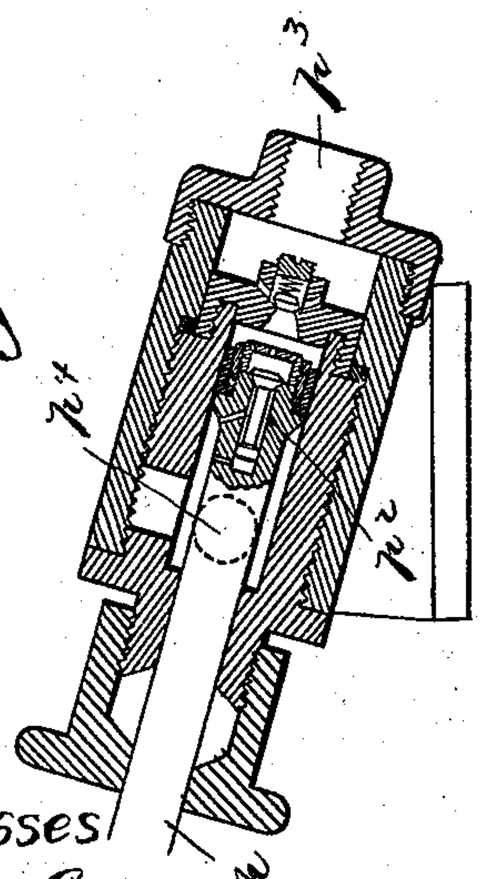
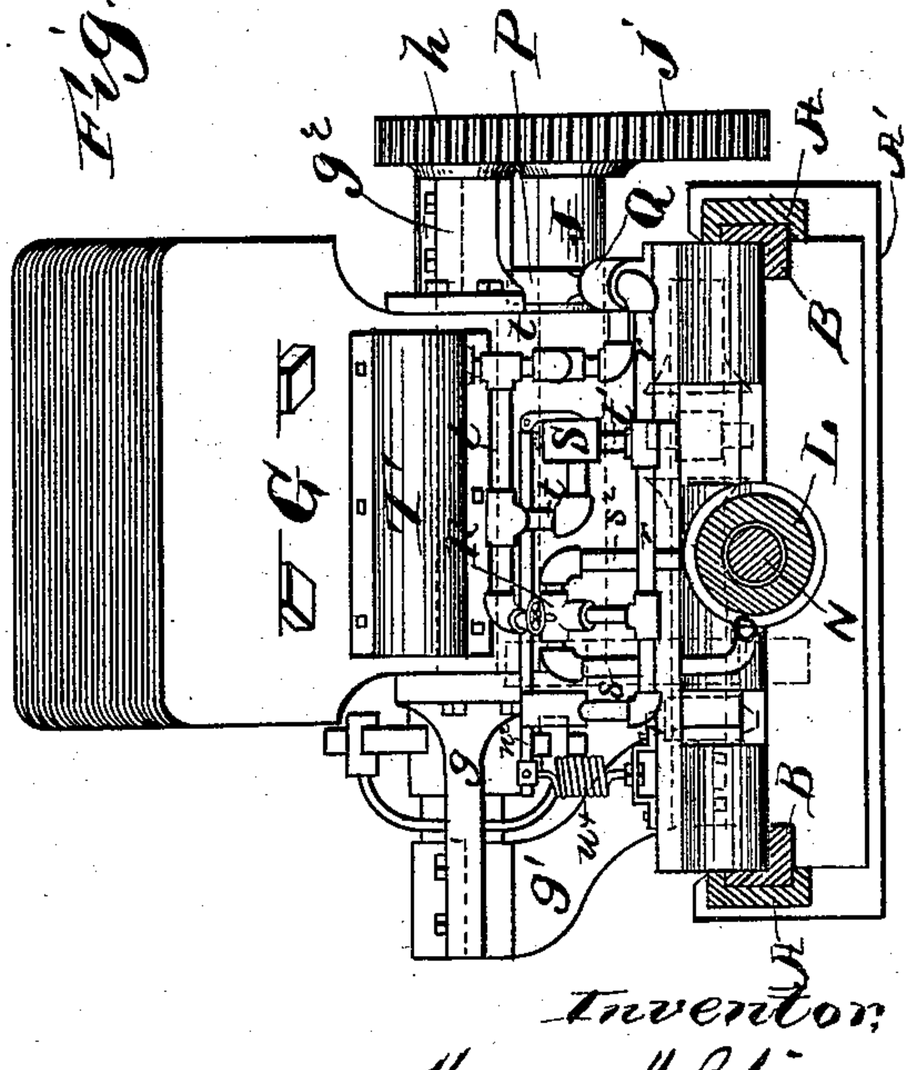


Fig. 3.



Witnesses
J. B. McGirr.
Marcus B. Tway.

Inventor:
Henry H. Bliss

(No Model.)

4 Sheets—Sheet 3.

H. H. BLISS.

MINING MACHINE.

No. 547,836. Patented Oct. 15, 1895.

Fig. 9a

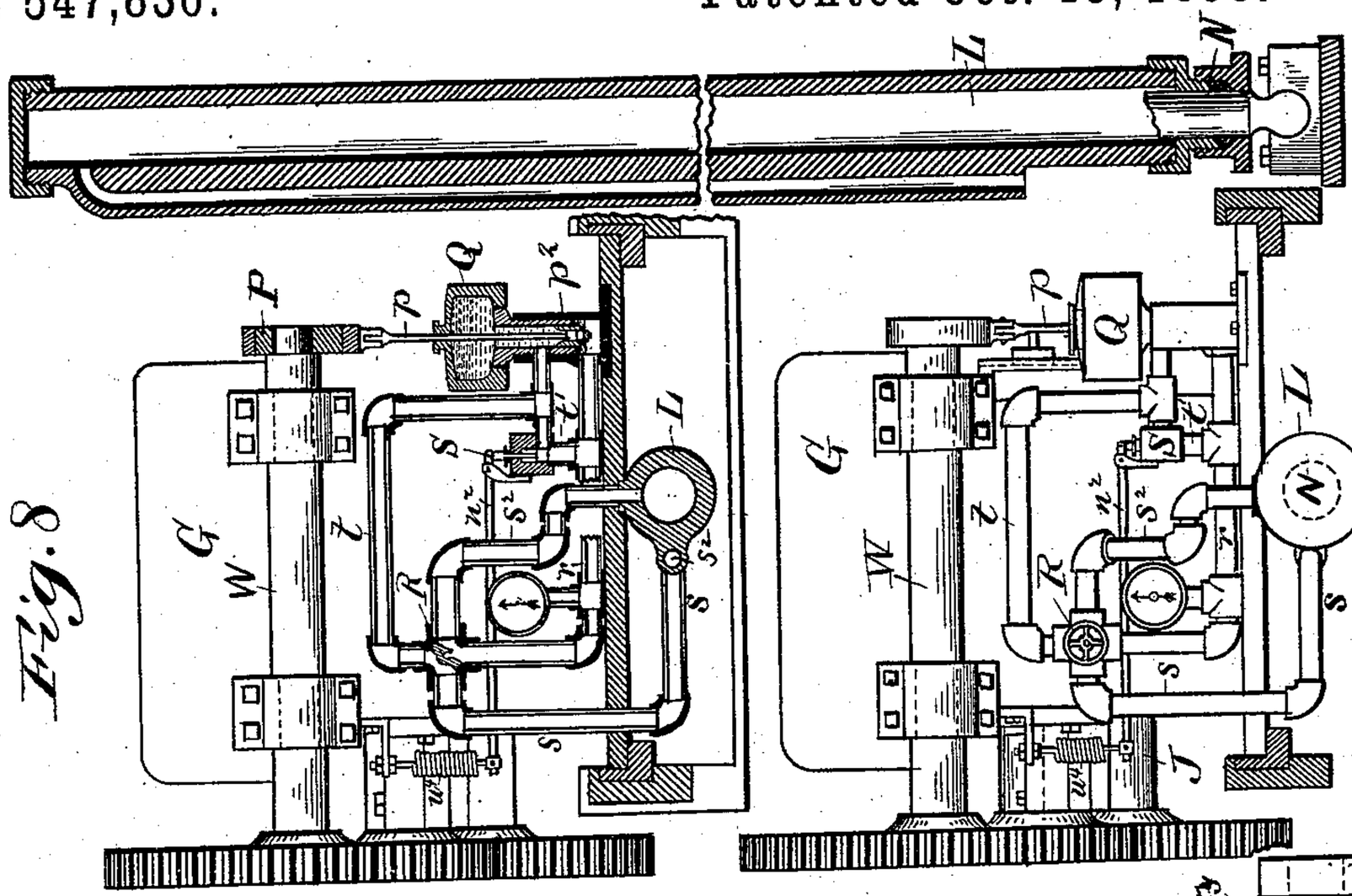


Fig. 8

Fig. 9.

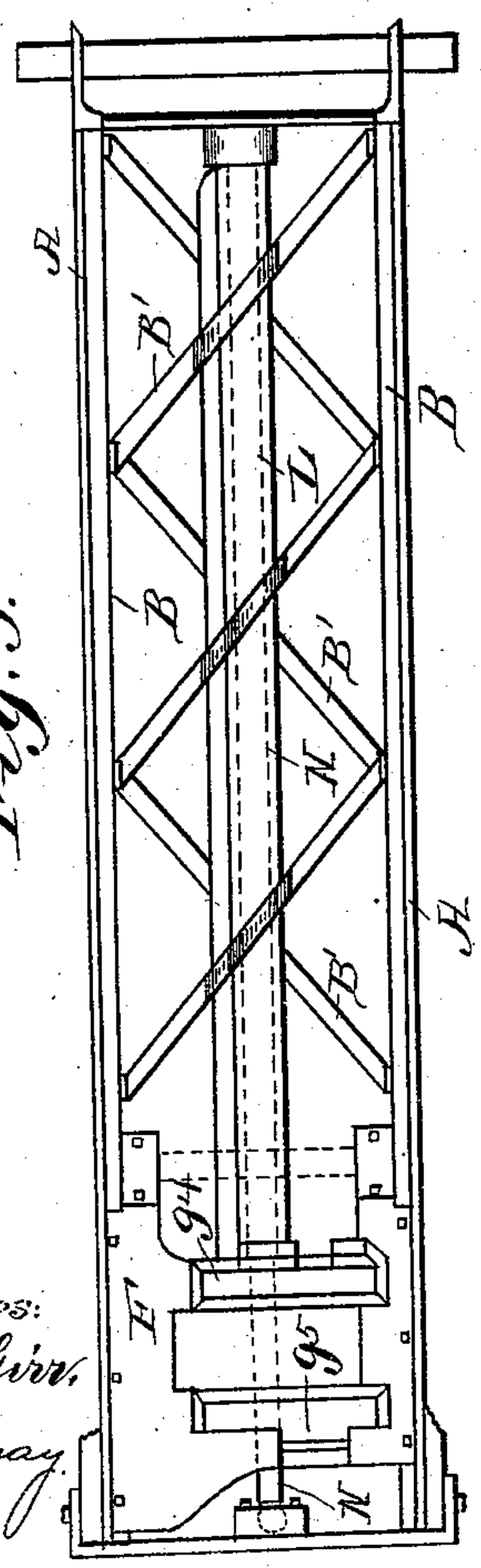


Fig. 6.

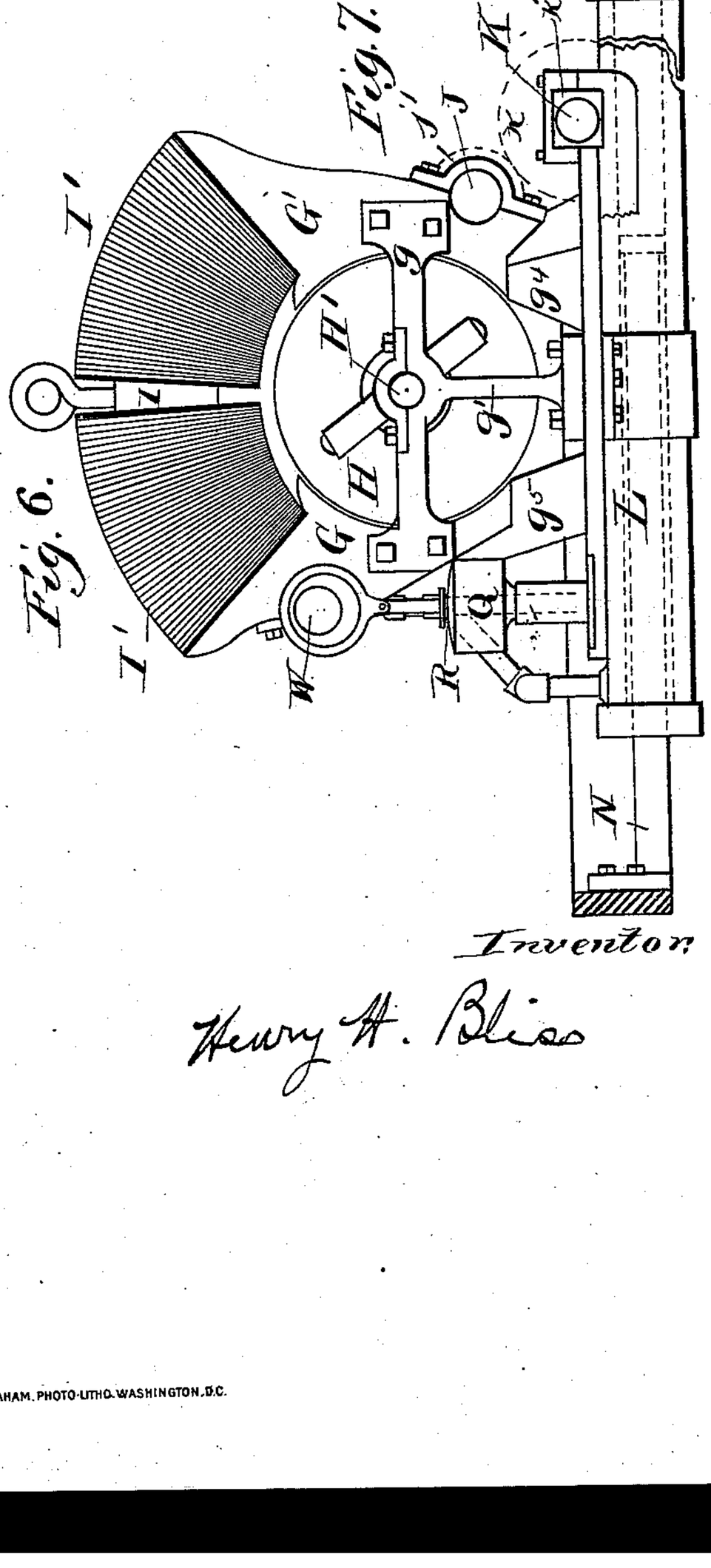


Fig. 7.

Witnesses:
J. B. McGirr.
Jno. B. Gray.

Inventor
Henry H. Bliss

(No Model.)

4 Sheets—Sheet 4.

H. H. BLISS.

MINING MACHINE.

No. 547,836. Patented Oct. 15, 1895.

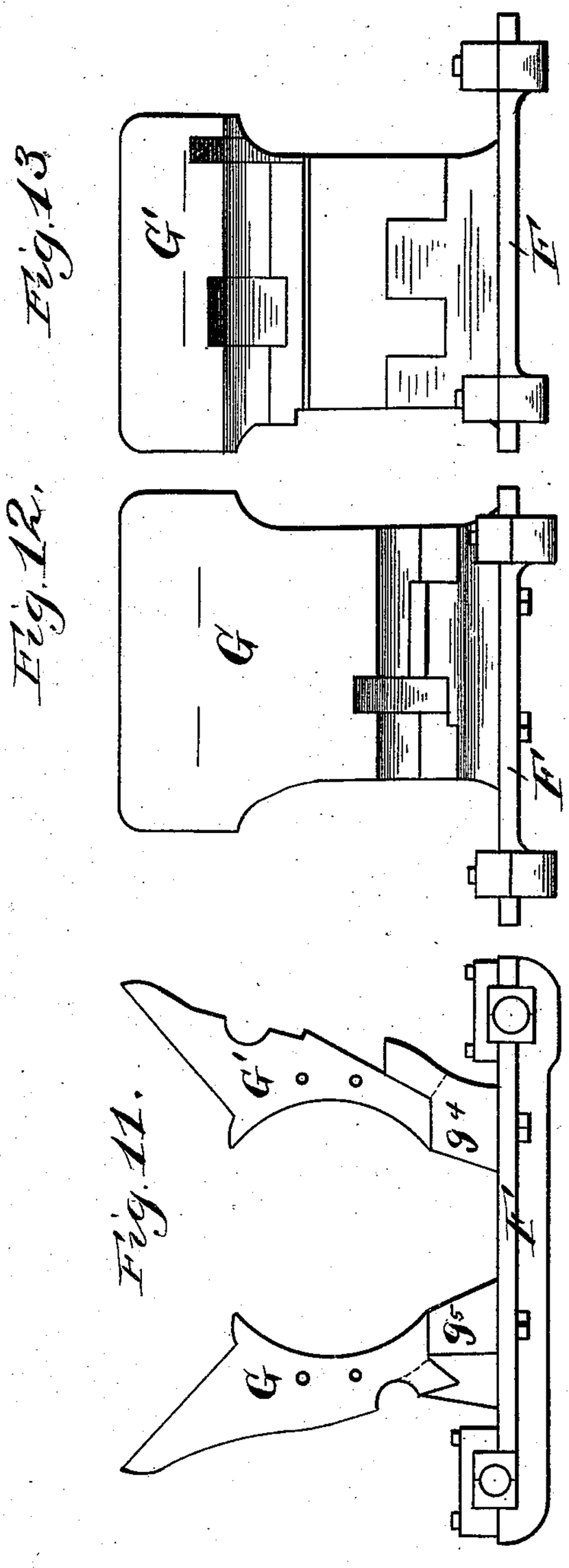


Fig. 13.

Fig. 12.

Fig. 11.

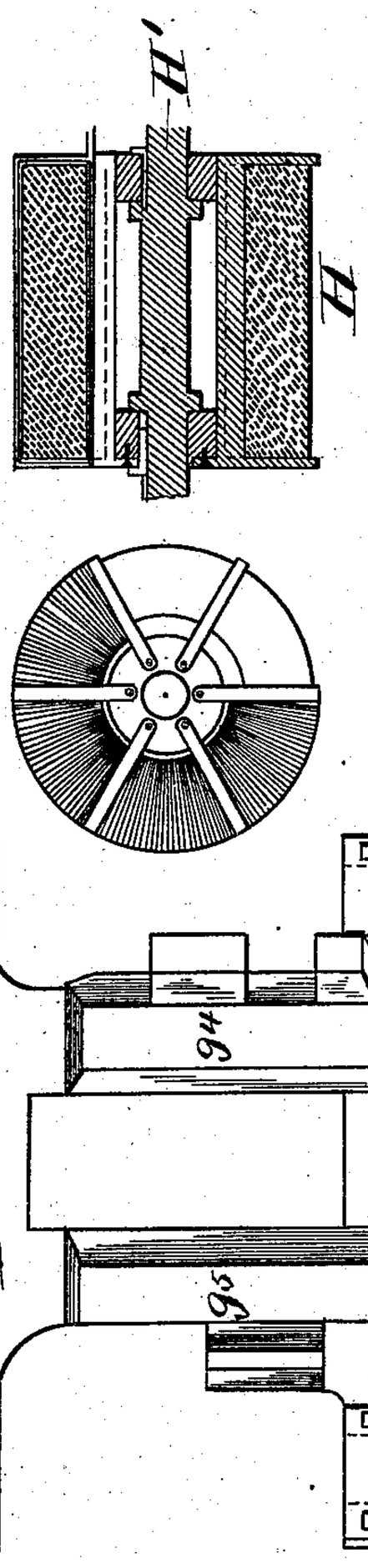


Fig. 15.

Fig. 14.

Fig. 10.

Witnesses:
J. B. McGirr.
Francis B. Shay

Inventor:
Henry 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. 547,836, dated October 15, 1895.

Application filed April 2, 1889. Serial No. 305,797. (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, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates especially to combining with the operative parts of mining-machines an engine or motor operated by electricity, together with a feed mechanism—that is, a mechanism for bodily moving the operative parts of such nature that the load carried by the engine or motor can be regulated. My experience with electric engines or motor in connection with machines of the kinds referred to has shown me that in cutting many materials, such as coal, there is such a frequent and wide variation in the character of the material being operated on that the speed of the motor is injuriously affected. There is especially a tendency for the motor to be slowed down when a harder material is attacked by the cutters. It is well known that one of the elements of successful action in the electric motor is that it should have a speed equal to or above a certain speed which is normal with each motor. One of the factors in the problem of efficiency is the counter electromotive force as it acts as one of the chief elements in the internal resistance of the machine. This counter electromotive force depends for its intensity, *ceteris paribus*, on the speed of revolution of the armature-shaft, which must be maintained at a certain point. If it falls below that point, not only is the power of the machine lowered, but there is at once danger of destruction of the conductors from their being overloaded with current on account of the diminished internal resistance; and in consequence of these facts it is now well known that such motors must be specially guarded in this respect and wide variations of load avoided; but in the field here involved it is impossible to avoid these variations in load, inasmuch as the material operated on varies in its consistency from a condition which is but a slight load to one of such hardness (and that, too, during one and the same cut) that it will stop the most powerful of the engines that have been heretofore commonly used—that is to say, portable engines for steam or compressed air and electric engines. One of the main objects of the present invention is to avoid this and so adjust the load on the motor or engine that its speed shall never fall below a certain point.

Figure 1 is a longitudinal section of the lower parts and a side elevation of the upper parts of a machine embodying my improvements. Fig. 2 is a plan view of the carriage and bed, the other parts, including the motor, being removed, except that some are shown by dotted lines and some by full lines. Fig. 3 is a view looking rearward from the line $x\,x$ of Fig. 1. Figs. 4 and 5 show details. Fig. 6 is a view looking from the side opposite to that in Fig. 1 and showing a modified arrangement of the carriage-feeding devices and of the chain-shaft. Fig. 7 is a front view, and Fig. 8 is a similar view, partly in section, of the carriage-moving devices in Fig. 6. Fig. 9 is a top plan view of the bed and carriage. Fig. 9^a shows the longitudinal tube in section. Fig. 10 is a plan view of the carriage-plate. Figs. 11, 12, and 13 are a side elevation, a front view, and a rear view, respectively, of the carriage-bed plate and of parts of the motor and shaft-support thereon, these figures showing the arrangement in Figs. 6, 7, and 8. Fig. 14 is an end view, and Fig. 15 a section of the armature.

In the drawings, A A represent the side bars of a stationary frame joined by suitable cross-connecting pieces A′. In or upon this bed there is mounted a sliding frame or carriage having the flanged side bars B braced by suitable bars, as at B′, and at the front having shoes C C, which support a revolving cutter-bar D and a slack-chain bar E.

The engine or motor, together with the parts which transmit the power for actuating the operating parts and for moving the carriage to and fro, are supported upon a frame or plate, (indicated as a whole by F,) I now having more particular reference to Figs. 1, 2, and 3.

G G′ represent the pole-pieces of the motor, they converging downwardly for the purpose of shortening the space on the carriage occupied by the power mechanism and its acces-

sories. Between them is situated the armature H, it being supported on a shaft H′, mounted in bearing-arms g 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 a 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 k^3 k^4, 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. The shaft K may be either in front or in rear of the motor. As shown in Figs. 1 and 2, it is in the rear, in order that the driving-chains can be allowed to freely enter the cut produced by the bar D, it being desirable, for reasons about to be set forth, to elevate the chain-driving shaft K somewhat from the position occupied in the ordinary machines, and to allow for this it is situated somewhat back of the ordinary line, so that the chain will, because of its own weight, sag sufficiently at forward points to enter the cut. In the construction shown in Fig. 6 this chain-driving shaft is in front of the motor and somewhat lower. 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 crow-bars and similar implements, and hence nothing could 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.

I will now proceed to describe the devices I have above referred to in more general terms as those by which I effect the movements of the carriage in the bed in such way that I can regulate the amount of the resistance experienced by the motor.

L represents a tube situated longitudinally of the carriage and at the front part thereof—that is, I prefer to have it extend only part way back, although it may extend the whole way, if desired. It is situated as near as possible in the plane of the cutter-bar D, so that it can pass freely into the cut produced thereby. As shown, it is supported at points midway of its ends by the braces B′. In this tube is fitted a piston N′, the rod N of which extends back and bears against a suitable abutment. Preferably it extends to the rear bar of the bed and is connected to the part it abuts against by a hinge or ball-and-socket joint at N^2 O, the abutment being shown at o. Upon the carriage-plate F, or on a projection F′, are supported the following: Q is a hydraulic pump operated by an eccentric P on shaft J, the rod p being hinged to a slide in guide p'. The slide is connected to piston p^2 of the pump Q. The water is drawn by the piston through passage p^4 and is forced through outlet p^3. It passes through pipe r to a four-way cock R, and when the valve therein is in one position the water goes through pipes s and s' to the forward end of tube L, which it enters through port e^2. When so entering the pressure on the front end of the tube forces the carriage forward, the reaction being against the piston N′. When the valve R is turned to its other position, the water is withdrawn from the front end of the tube and delivered to the rear end through pipe s^2, whereupon the carriage will be drawn back by reason of the pressure at the rear end of the tube. The exhaust from the four-way cock passes through the pipe t to the inlet of the pump Q.

T is a reservoir wherein is kept a charge of surplus water. This reservoir is a matter of considerable importance. I store therein a surplus body of water—that is to say, water supplemental to the quantity necessary to normally fill the feed-tube and the supply-ducts. However tight the packing and the joints may be at the several places where they are used, there is an unavoidable leakage. By providing a comparatively large body of surplus water I insure that there shall always be sufficient to provide the requisite pressure, and also provide means for readily ascertaining the amount of water which may at any time be remaining in the apparatus. It will be seen that the movement of the carriage can be reversed by changing the valve at R when the pump is running, so that the machine need not be stopped. It will also be seen that if the speed of the pump be kept constant (or so as not to fall below a certain point) only as much water is pumped in as may be required; but if

the speed of the pump be increased beyond that point more water than necessary is forced in, whereupon valve S opens to relieve the feed-tube of the surplus pressure, over seven hundred pounds. The cutters continue to revolve at a high speed and are held to their work with the last said pressure, and if it be supposed that they are temporarily working against a relatively hard material they will continue to revolve until they have passed through said material. Thereupon they will cut more easily, the resistance to their advance will be decreased, as will also the pressure in tube L, and the pump will force through more water into said tube.

When an electric motor is used, the essentially-electric parts are so adjusted in relation to each other—that is to say, wires of such gage and of such length and of such disposition relatively to each other are used—that their armature will always revolve with an adequate speed against the desired pressure—here, for instance, seven hundred pounds to the inch—and therefore it is not ordinarily possible to slow it down or cause a heating of its wires. This part of the invention, therefore, consists in providing the machine with an electric motor secured to it and a yielding carriage feeding mechanism by which the speed of advance of the carriage will be automatically lowered independently of the rotation of the armature when the coal increases in hardness, together with means for varying the normal force of the advancing pressure.

The above-mentioned valve S is shown as seated at S′ in a duct S^3, communicating with the pipe p^3 on the pressure side of the pump and the pipe t on the exhaust side. The valve is further shown as being held in place by a rod S^4, hinged to a suitable support and provided with a spring S^5, having a stem S^6, provided with nuts at S^7, by which the spring can be held in the desired place. In Figs. 1, 3, and 5 this spring draws downward on the rod. In Figs. 7 and 8 the rod presses upward against the spring; but with respect to these devices there can be any desired modification, so long as means are provided by which the valve can be held in place under the desired force, permitting it to be "set" as wanted. In Figs. 6, 7, and 8 the pumping mechanism is situated behind the motor and has a shaft J for actuating it, the cutter-driving shaft K having another intermediate shaft J′ in front of the motor for imparting motion thereto from the armature. The pump is here arranged more nearly vertical, but in other respects the mechanism is substantially the same as in Figs. 1, 2, and 3. I do not limit myself to the details shown, as there can be much variation. The relief-valve may be changed. For instance, one depending on two opposing pressure surfaces of diffent area can be used. The pump can be operated from any suitable shaft.

I know that water, air, and other fluid materials have been used for moving the carriages of such machines, and I do not broadly claim the means adapted to effect such movement; but I believe myself to be the first to have invented several of the essential features of construction and arrangement herein set forth, as will be more fully described.

I am not aware of the previous use of the combination with a feed-tube of a pump on the machine and a mechanism for allowing the pump to work directly from one side of its piston to the other after a predetermined pressure has been reached, or that the load upon an armature has been regulated in a way similar to that herein set forth.

I restrict myself herein to the matters incident to a carriage-moving mechanism substantially such as I have shown, and do not make claim to matters incident to the construction or arrangement of the electric motor, either considered by itself or in relation to the other parts of the machine, having made these the subject-matter of another application, Serial No. 482,866, filed August 5, 1893. Nor do I herein claim any of the matters shown or described in the Patent No. 457,887, dated August 18, 1891, to E. S. McKinlay and W. A. McKinlay, or in any patent or applications of the said parties filed as divisions thereof.

What I claim is—

1. The combination, in a mining machine, of the bed, the carriage, the cutting apparatus on the carriage, the electric motor mounted on the carriage and moving therewith, and having a continuously rotating armature connected with the cutting apparatus; the feed tube secured to the carriage centrally for moving it and lying between the top and bottom planes of the kerf or cut whereby it can enter the same with the carriage; the pump mounted on the carriage in fixed relations with the feed tube and the motor, the pump piston and means connecting it directly with the cutter driving armature the piston in the feed tube extending backward and having its rear end bearing against an abutment on the bed, and the traveling pipe or conductor on the carriage communicating with the pump and with the ends of the feed tube, substantially as set forth.

2. In a mining machine, the combination of the bed, the carriage, the cutting apparatus at the front of the carriage, the electric motor mounted on the rear of the carriage and traveling therewith and having a rotating armature, a feed tube secured to the carriage and situated on a line below the motor, a stationary piston in the said feed tube extending backward under the motor and having its rear end bearing against an abutment on the bed, the pump upon the carriage, the pipes or conductors which connect the pump with the ends of the feed tube, a relief valve S, adapted to return the water from the pressure side of the pump to the receiving side when a predetermined pressure has been reached, whereby the armature is relieved and means for regulating the pressure of said valve, substantially as set forth.

3. The combination of the bed or stationary frame, the carriage supported on the stationary frame, the cutting apparatus at the front end of the carriage, the electric motor secured to the machine, the automatically variable carriage feeding mechanism whereby the speed of advance of the carriage will be automatically lowered independently of the rotation of the armature when the coal increases in hardness, means actuated by the armature for operating said feed mechanism, and means substantially as set forth independent of the armature for varying the normal force of the advancing pressure, substantially as set forth.

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

HENRY H. BLISS.

Witnesses:
A. M. MAGRUDER,
MARCUS B. MAY.