(No Model.)

B. A. LEGG.

MINING MACHINE.

No. 347,813. Patented Aug. 24, 1886.

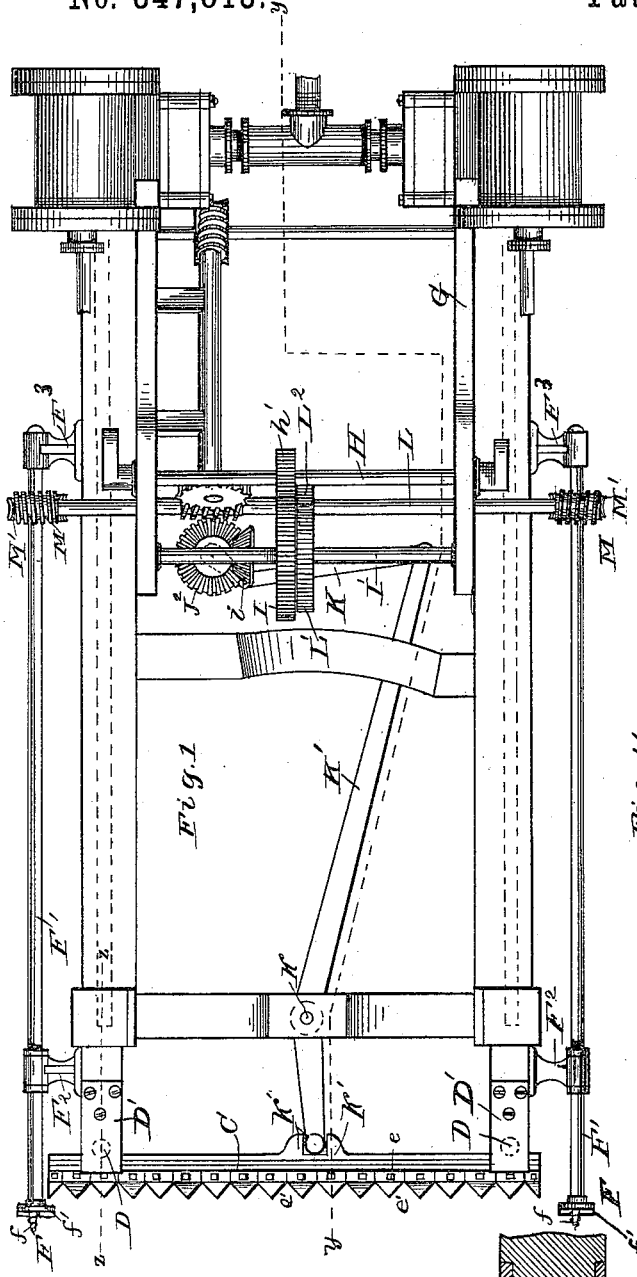

Fig. 1.

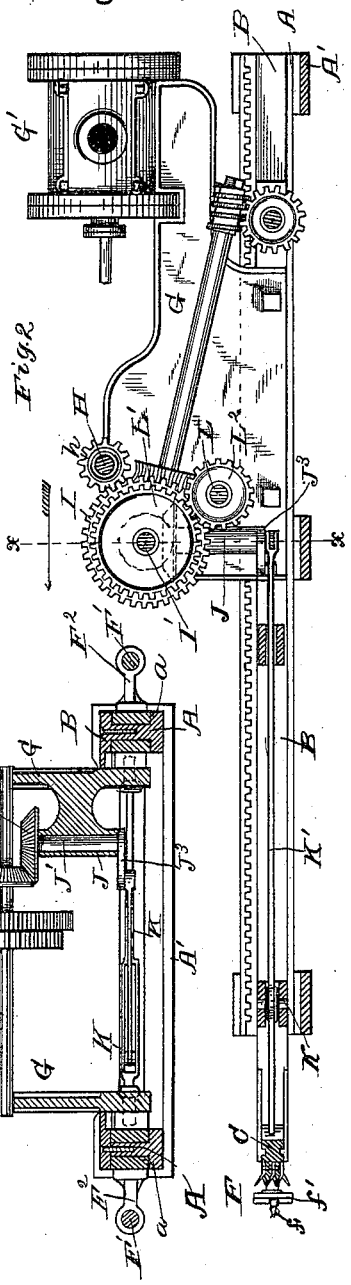

Fig. 2.

Fig. 4.

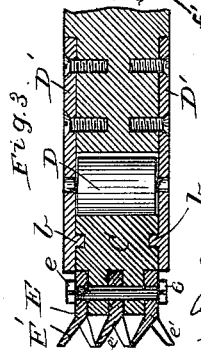

Fig. 3.

Fig. 5.

WITNESSES

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BENJAMIN A. LEGG, OF COLUMBUS, OHIO, ASSIGNOR TO JOSEPH A. JEFFREY, OF SAME PLACE.

MINING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 347,813, dated August 24, 1886.

Application filed May 27, 1885. Renewed February 4, 1886. Serial No. 190,847. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN A. LEGG, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, 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.

Figure 1 is a top plan view of a mining-machine embodying my improvements. Fig. 2 is a longitudinal section of the same on line *y y*, Fig. 1. Fig. 3 is a sectional view showing the cutting apparatus on a larger scale. Fig. 4 is a section on line *x x*, Fig. 2. Fig. 5 is a top view of one of the cutters detached.

This invention relates to an improved method of working rock, coal, &c., in mining, and also to improvements in mining-machines, more particularly to machines with which a kerf is formed directly ahead of the operative parts—that is to say, in which the cutters are thrust forward into the breast of coal or rock. Heretofore a rotary shaft has been employed, armed with teeth or cutters which revolve parallel to the lines of advance. There are difficulties met with in the construction and operation of machines of this latter class which I overcome by employing a reciprocating cutter, or series of cutters, at the front of the machine, the reciprocations being on lines transverse to the path of advance. I prefer to combine with the reciprocating cutter or series of cutters one or more drills, situated at the end or ends of the throw of the reciprocating cutters; also, I prefer to mount the cutting devices on one frame, which can slide toward and from the work, and combine therewith another stationary frame, to support and guide it.

The essential parts of my improved mechanism may be coupled with various mechanisms for operating them without departing from the peculiarities of the invention.

In the drawings I have shown that form of machine which I at present prefer to combine with the cutting devices proper, in order to move and operate them to good advantage. A stationary frame is shown, having side bars A A, which should be joined together by means of girts, as at A′ A′. The side bars are formed with ways at *a*, to receive and guide the sliding frame. The latter consists of side bars B B, joined together by means of cross braces or bars B′ B′, of which any suitable number may be employed. These two frames may be united in any of the ways now well known, and stops and guides of any suitable construction may be employed for keeping them in proper positions relative to each other.

C represents the cutter-bar, which is supported at the front end of the sliding frame in such way that it can freely reciprocate transversely to the path of said frame. It may be attached thereto in any suitable way, the one shown being, for many reasons, that which I at present prefer. The bar is shown as having grooves or ways formed therein—one upon the upper and the other upon the lower—and into these grooves there fit tongues *b*, carried by the sliding frame. In the drawings these tongues are represented as being formed upon plates D′, which are bolted to the forward ends of the side bars.

In order to reduce the friction to the lowest point possible, I employ anti-friction rollers D, which are mounted in the sliding frame, so as to have their peripheries engage with the rear face of the reciprocating bar. Of these any suitable number may be employed; but when the parts are arranged as shown one roller upon each side will be sufficient, if properly related to the bar.

To the front side of the bar C are secured the cutters. These also may be of any of many forms. It is advisable, however, to construct and arrange them so that they shall produce a kerf whose vertical dimension shall be greater than that of the cutter-bar and sliding frame, so that these parts can move without interference. The cutters are, when made as shown, formed with a horizontal plate or bar, E, and an inclined plate, E′. To receive the parts E, recesses or rabbets are formed, one in the upper face of the cutter-bar, another in the lower face, and the third in the front face, about halfway down. After these parts E of the cutters are placed properly in these recesses or seats, they are secured by means of screws or bolts, as shown at *e*. The front edges of the cutters are beveled, as shown at *e′*, and the positions

of these edges relative to each other when the cutters are in place will be readily understood by examining Fig. 3. Under some circumstances a cutting device of this character can be used alone; but I prefer to combine therewith drills, such as shown at F F. These have forwardly-projecting auger-like points *f*, and in rear thereof a cutter-head carrying rotary cutters *f'*. Each of these is mounted upon a shaft, F', which has bearings provided for it, as shown, at F^2, near the front end of the sliding frame, and at F^3, near the rear end.

Power is imparted to the rotary drills by means of devices to be described.

By referring to Fig. 2 it will be seen that the hole drilled by each of the drills is of a diameter equal to or a little greater than the vertical dimension of the main kerf, and the parts which reciprocate the main cutter-bar C are so arranged that the ends of the bar shall move into the holes drilled by the part F, this latter being sufficiently in advance of the bar C. With parts operating in this way, the reciprocating bar can be prevented from striking against any resisting object at either end of its throw, and a perfect kerf will be formed.

I will now describe the devices which I have shown for imparting to the various cutters their required movements. G G represent standards or upright plates bolted to the sliding frame and adapted to carry and firmly support an engine. The latter may be of any of the well-known forms adapted to provide suitable connection between the cylinders G' and the engine-shaft H. On the shaft H there is a pinion, *h'*, which meshes with a spur-wheel, I, mounted upon a shaft, I', parallel to the engine-shaft H. J is a vertical shaft mounted in a tubular bearing, J', and which at its upper end carries a bevel-wheel, J^2, which meshes with a bevel-pinion, *i*, on shaft I'. Shaft J at the lower end carries a crank, j^3, with which is connected a pitman, K, pivoted to a lever, K'. This lever K' is at the forward end loosely or flexibly connected with the cutter-bar, and is pivoted at *k* to one of the cross bars or braces of the sliding frame. It will be seen that when the engine-shaft H is rotating it will, through the above-described chain of devices—namely, the wheels I *i*, the shaft J, crank J^3, pitman K, and lever K'—impart reciprocations to the cutter-bar, whereby the cutters are caused to form a kerf, which may be carried into the breast of coal or rock to the desired depth. The shaft I' in turn rotates a supplemental shaft, L, by means of a spur-wheel, L', on the former, and a pinion, L^2, on the latter. At the ends shaft L is provided with worms M M, which engage with worm-wheels M' M' on the shafts or shanks F' F' of the rotary drills, and it will be seen that when the other parts are in motion the drills will be simultaneously rotated by means of the last-described mechanism, extending from the wheel L' to the worm-wheels M'. The sliding frame and the cutters carried thereby may be advanced into the breast of coal or rock, and may be withdrawn therefrom by means of any of the now well-known mechanisms, or by any other deemed suitable. In a previous patent of mine, No. 299,655, June 3, 1884, I have shown and fully described devices for accomplishing these purposes, which devices are as fully applicable to the machine herein set forth, and which need not, therefore, be herein described in all their details.

A mining-machine whose cutting mechanism is constructed and operated in the manner I have devised and herein made known is in many respects superior to those first above alluded to, wherein the cutting was effected by means of a rotating bar carrying cutters. A construction like that herein is much simpler, it dispensing with the chains or other devices necessary with the rotary cutters, and simpler in other respects. So, too, there is no necessity of providing the advancing frame with stationary cutters, such as are necessary for the bearings of the rotary shaft in machines of the other style, nor is there necessity for the cutters heretofore required for the chain-wheel mounted upon the rotary shaft.

The lever by which the reciprocating of the cutters is effected is a device much more easily constructed and arranged, more durable, and less liable to get out of repair than are the numerous parts ordinarily used in transmitting the power from the engine to the rotary cutter heretofore employed. The lever may be connected with the cutter-bar by means of lugs *k'*, between which the end of the lever will have a bearing, said end being in such case preferably rounded or disk-like or ball-like, and the lugs or bearing-pieces *k'* may be adjustable, in order to take up any wear that may occur; but so long as the other characteristic features are preserved I do not wish to be limited to this specific way of mounting the power-lever and connecting it to the cutters.

Of course it will be understood that in many respects modifications may be made in the construction shown. I have selected the present form for the sake of illustration, in order that one of the many ways of embodying this feature of my invention may be clearly understood. The sliding frame, it will be seen, is in function essentially a "cutter-carrier"—that is to say, is that part of the mechanism which projects and also withdraws the cutters and connects them with their abutment or resistance. This resistance or abutment, in the construction shown, is provided by the frame, which is adapted to be made stationary at any desired point, it remaining thus stationary while the operative parts are in motion.

Those mining-machines which have employed reciprocating cutters prior to my invention have been very disadvantageous, and unless made exceedingly heavy and cumbersome are impracticable in this respect—namely, that the cutter-carrier has moved parallel with the face of the material being operated upon and the cutters have projected laterally from the carriage. As a result the side-thrust

has been a great obstacle, in addition to the fact that the cutter-bar has had at the end of its throw no relief from the resisting material. In my case the cutter-carrier is advanced directly against the material operated upon, and the reciprocating cutter is carried thereby in such way that the backward pressure on the cutters is distributed uniformly from end to end, so that there is no side-thrust whatever.

I do not wish to be limited to the precise arrangement of parts shown for providing a bearing for the reciprocating cutter—that is to say, to a construction in which these bearings are directly at or near the ends of the cutter-carrier—as these bearings may be brought nearer to the central longitudinal line of the machine. It is better, however, to have them so arranged as that the back-pressure shall be distributed uniformly, as above said. It will be seen, also, that in order to accomplish the ends which I attain it is not necessary to have the rotary drill or drills either constructed or arranged exactly as they are shown, so long as one or another of the functions of these drills is accomplished. Thus the drills may be advanced first and the reciprocating cutters be caused to follow. So far as this feature is concerned it will be seen that I have provided an improved method of working the rock, coal, or other material, which consists in first drilling apertures and subsequently cutting (by reciprocating cutters) a kerf between them, and this method can be followed even when the drill and the reciprocating cutters are used independently. A drill of the character I have shown in my other application, No. 149,498, filed December 4, 1884, or one of another suitable character, may be employed for forming a series of apertures at suitable distances apart, and then a machine having those parts of the construction in this case which relate to the reciprocating cutters can be brought to bear to form a kerf between the apertures produced by the drill, the said parts being so related that the throw of the cutter shall be of the proper length. The throw can be adjusted in any preferred way—as, for instance, by having the pivot or fulcrum *k* carried by an adjustable block or bearing, so that that leg of the lever which runs towards the cutter may be made longer or shorter relatively. As to the cutters, it will be seen that one knife or cutter can be so arranged as to accomplish more or less of the work—that is to say, either a serrated or other cutter can be substituted for the separable cutters shown. While I am led to believe that the greatest number of advantages are attained by forming this part of the mechanism as shown in Figs. 1 and 3, particularly in section in Fig. 3, yet the holder or bar and the knives or cutters may be made integral, if preferred, especially where the material to be operated upon is soft; but under ordinary circumstances it is preferable to have the cutters removable independently of each other, in order to permit them to be sharpened or replaced by others. By referring to said figure it will be seen that the cutting-edges *e'* of the parts E' are each arranged at an inclination to each of the adjacent cutters, this arrangement producing, as I am led to believe, the best results. Still referring to said figure, it will be further noticed that, as said above, the cutters are arranged in three series transversely of their holder or bar. Instead of this number, any other that is suitable might be employed, although it is better to have two or more, in order that the inclined cutting-edges *e'* may be so related as to make a clean kerf of a depth equal to or greater than the through dimension of the cutter-bar and the sliding frame. As the bearing-plates D' are detachable from the sliding frame they may be readily withdrawn and replaced by others when worn to disadvantage, and by having one of these plates detachable (whether the other is or not) the roller D can be introduced or withdrawn to advantage.

I am aware that reciprocating cutters have been used in various mechanisms—as, for instance, in saw-mills, harvesters, &c—and do not broadly claim such a cutter as my invention; but I am not aware of the fact that a reciprocating cutter has ever been arranged in the way which I have devised for cutting directly into a breast of coal or rock. In my case the reciprocating cutters project in front of the non-cutting parts, which are in the same vertical longitudinal planes as the cutters, it being necessary that the cutters should form a path for the non-cutting parts.

I do not in this case claim anything beyond what is set forth in the claims appearing hereinbelow, and especially do not herein claim any of the features which I have shown or described with respect to the cutters and cutter-bar, by themselves considered, but reserve to myself the right to claim in another application the novel and patentable features not herein claimed; nor do I herein claim the method of dealing with rock, coal, &c., consisting in first forming apertures running directly into the natural bed thereof, but I reserve to myself the right to claim said subject-matter in another application.

What I claim is—

1. The combination, with a reciprocating bar having non-cutting parts and carrying one or more cutters which project forward of the non-cutting parts, of a carriage for said bar having bearings therefor situated one on each side of the central line of thrust of the bar, substantially as set forth.

2. The combination of a cutter-carrier, means, substantially as described, for holding the said cutter-carrier, and adapted to be made stationary while the cutting parts are in operation, a reciprocating cutter mounted upon the said cutter-carrier and connected therewith, substantially as set forth, on both sides of the central line of action and moving on lines transverse to the path of the carrier, substantially as set forth.

3. In a machine for mining rock, coal, &c., the combination, with a cutter-carrier, of a re-

ciprocating cutter-bar, cutters thereon which project forward of the non-cutting parts, a bearing at or near one end of said bar, another bearing at or near the other end of said bar, and a power-transmitter connected with said bar at points between the said bearings, substantially as set forth.

4. In a mining-machine, the combination, with a cutter-carrier, of a reciprocating cutter-bar mounted upon the front of said carrier, and anti-friction abutments or bearings for said bar.

5. In a machine for mining rock, coal, &c., the combination, with a cutter-carrier, and means, substantially as described, for supporting the cutter-carrier, and adapted to be made stationary while the cutters are in operation, of a reciprocating cutter mounted at the front end of said carrier, a bearing for the cutter on one side of the central longitudinal line of the carrier provided with retaining devices to hold the cutter in place, and a bearing for the other end of the cutter situated on the other side of said central longitudinal line, and also provided with retaining devices to hold the cutter in place, substantially as set forth.

6. In a mining-machine, the combination, with a cutter-carrier, of a reciprocating cutter-bar mounted upon said carrier, cutters upon said bar projecting forward of the non-cutting parts, the lever-support secured to the cutter-carrier, and the power-lever mounted upon said support and loosely connected with the cutter-bar, substantially as set forth, whereby it causes the reciprocating of said bar.

7. In a mining-machine, the combination, with a reciprocating cutter, of a rotary drill advancing on a line transverse to the line of reciprocation of the aforesaid cutter, and means, substantially as described, which support in common both the said reciprocating cutter and rotary drill, substantially as set forth.

8. In a mining-machine, the combination of a rotary drill or cutter and a reciprocating cutter arranged, substantially as set forth, to reciprocate on lines transverse to the path of advance of the rotary drill, and means, substantially as described, which support in common both the said reciprocating cutter and rotary drill, and behind the latter, substantially as set forth.

9. In a mining-machine, the combination of a rotary drill and a cutter reciprocating on lines transverse to the path of advance of the drill, and arranged, substantially as set forth, to move into the aperture formed by the drill at the end of each reciprocation, and means, substantially as described, which support in common both the said reciprocating cutter and rotary drill, substantially as set forth.

10. In a mining-machine, the combination, with the reciprocating cutter, of a rotary drill the diameter of whose cutters is as great as the depth of kerf produced by the reciprocating cutters, and arranged to advance on lines transverse to the lines of reciprocation of the reciprocating cutter, and means, substantially as described, which support in common both the said reciprocating cutter and the rotary drill, as set forth.

11. In a mining-machine, the combination, with the cutter-carrier and mechanism, substantially as set forth, for advancing said cutter-carrier directly against the material, of the reciprocating cutter supported upon said carrier, a rotary drill mounted on a line transverse to the throw of the reciprocating cutter and at one end thereof, and a rotary drill mounted similarly at the other end of said throw, substantially as set forth.

12. The combination, with the cutter-carrier, of the reciprocating cutter mounted thereon, the rotary drill mounted in a bearing which is fixed relative to the cutter-carrier, with its cutters in advance of the reciprocating cutter, and arranged, substantially as set forth, to advance on a line transverse to the line of reciprocation of the reciprocating cutter, and a main frame which supports all of the aforesaid parts, substantially as described.

13. The combination of the cutter-carrier, a rotary drill carried thereby, the reciprocating cutter-bar mounted thereon having cutters of a vertical diameter as great as the depth of the cutter-carrier, whereby the latter is permitted to move freely in the kerf, substantially as set forth.

14. The combination, with the cutter-carrier and a reciprocatiag bar or holder which carries the cutters, of the detachable bearing-plates D′, secured to the cutter-carrier and adapted to be removed when worn, and replaced, substantially as set forth.

15. The combination, with the cutter-carrier and the reciprocating bar or holder for the cutters, of the anti-friction roller D, and a detachable plate connected with said roller, with said cutter-bar, and with said cutter-carrier, substantially as set forth.

16. The combination of the stationary frame, the sliding frame, the reciprocating cutter-bar mounted on the front end of the said sliding frame, the rotary drills each mounted at one side of the sliding frame, and the hangers [or brackets F^2, whereby the drills are supported on the frame, substantially as set forth.

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

BENJAMIN A. LEGG.

Witnesses:
D. C. WELLING,
H. E. WILLIAMS.