(No Model.) 2 Sheets—Sheet 1.

A. KEIL & A. R. WESTERDAHL.

MINING MACHINE.

No. 472,363. Patented Apr. 5, 1892.

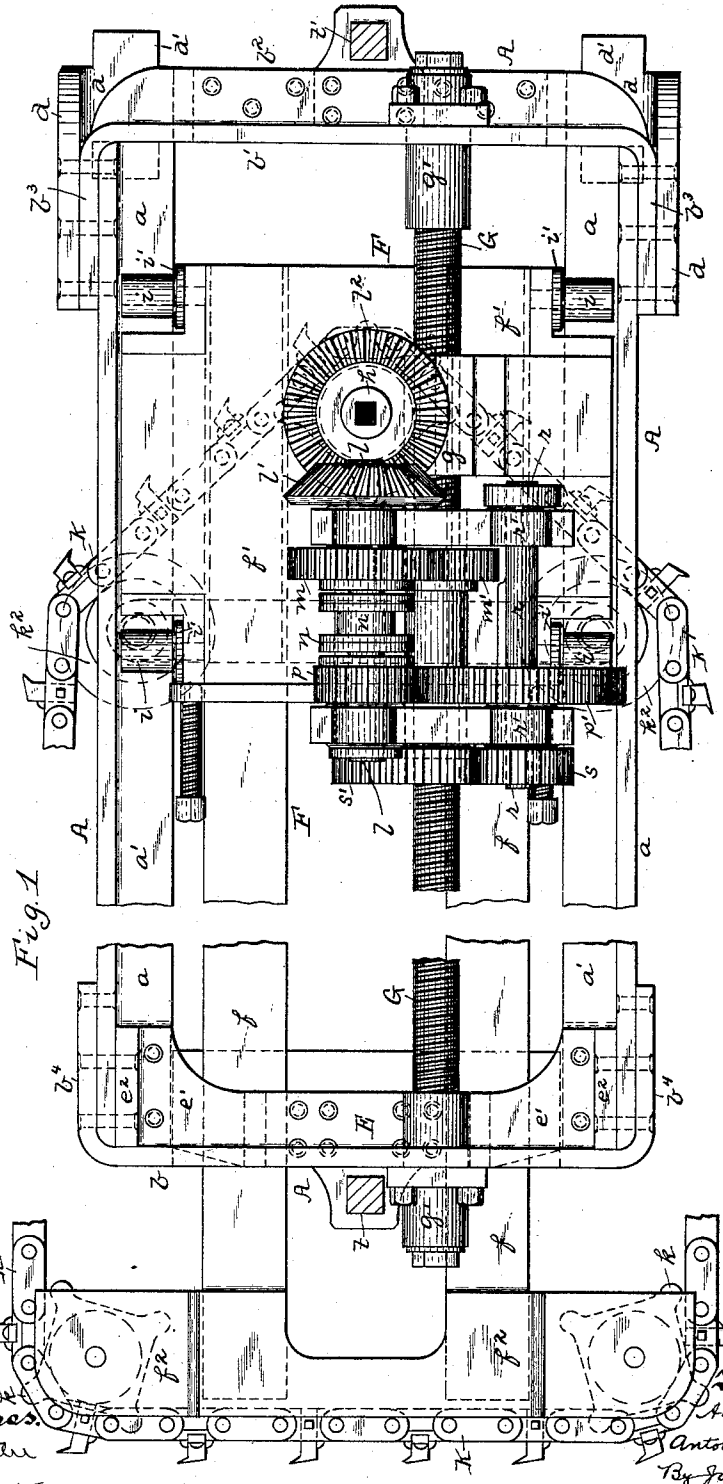

Fig. 1

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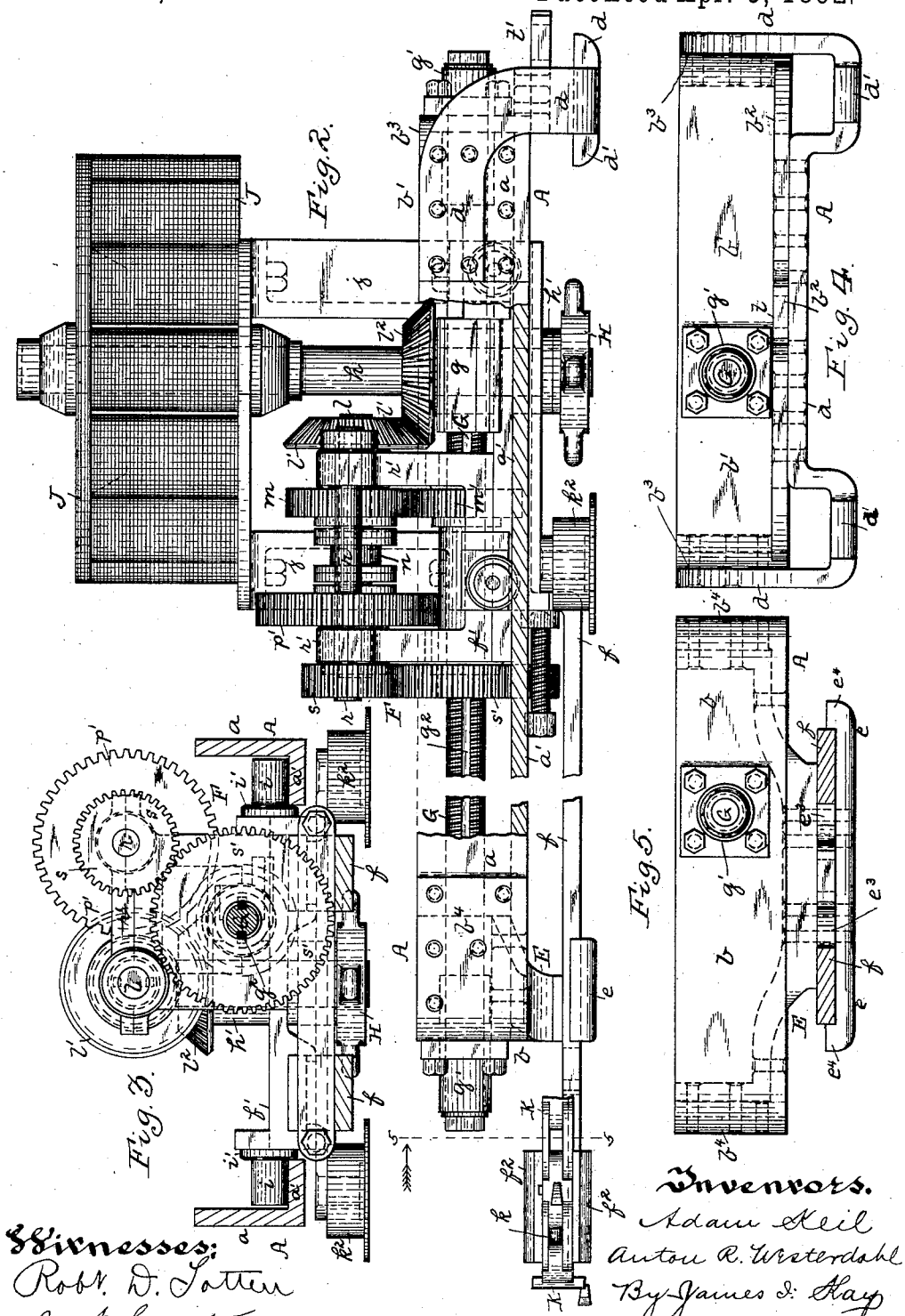

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UNITED STATES PATENT OFFICE.

ADAM KEIL, OF McKEESPORT, AND ANTON R. WESTERDAHL, OF PITTSBURG, ASSIGNORS TO SAMUEL S. BROWN, OF PITTSBURG, PENNSYLVANIA.

MINING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 472,363, dated April 5, 1892.

Application filed August 4, 1891. Serial No. 401,694. (No model.)

To all whom it may concern:

Be it known that we, ADAM KEIL, a resident of McKeesport, in the county of Allegheny and State of Pennsylvania, and ANTON R. WESTERDAHL, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Mining-Machines; and we do hereby declare the following to be a full, clear, and exact description thereof.

Our invention relates to mining-machines, the special object of the invention being to obtain a machine for the direct cutting into the face of the coal by cutter-chains, by means of which the base of the kerf may be formed close to the surface of the ground—that is, on the same plane as the floor of the mine, so that after the coal is removed there is no necessity of chipping or removing the floor-surface before making the next cut.

Other objects of the invention are to apply the electric power to drive the cutter-chain without any intermediate gearing and to provide a simple form of cog-gearing for the feeding and retracting of the machine.

The special points of the invention will be hereinafter more particularly set forth and claimed.

To enable others skilled in the art to make and use our invention, we will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a plan view, the motor being removed. Fig. 2 is a side view, partly broken away, showing the motor. Fig. 3 is a front view, the forward end of the cutter-frame being removed. Fig. 4 is a rear view of the frame; and Fig. 5, a cross-section on the line 5 5, Fig. 2.

Like letters of reference indicate like parts in each.

The machine differs from the ordinary construction of mining-machines, in which the cutter-frame has a movement directly into the coal and out from the same, in that the stationary frame is raised entirely above the mine-floor and the cutter-chain and part of the sliding frame travel down at such level that the lower edge of the cutters of the chain are on the same plane as the floor-level on which the machine is placed. In so constructing the machine the main frame A is formed of the side angle-beams a, which are connected at the ends by the cross-beams b b', while below said cross-beams at each end of the machine are the supporting shoes or feet. At the rear end of the machine the cross-beam b' is preferably an angle-beam, the horizontal flange b^2 of which extends out rearwardly in order to brace that part of the machine, while the end portions of such horizontal flange are removed, so that the vertical straps b^3 so formed may be bent parallel with the main beams a and secured thereto by riveting.

In order to form the depending feet at the rear end of the machine, we employ the plate or bar d, which is riveted to the horizontal flange b^2 of the rear beam b' in the center thereof, and then extends down at the ends to form the foot portions d' and then upwardly along the sides of the main frame and forwardly outside the straps b^3 of the said beams b', being bent into horizontal position and riveted with said straps b^3 to the main or side beams a. At the forward end of the machine the same construction is employed, except that the depending frame E, on which the frame is supported, is placed centrally in the front of the frame, so as not to interfere with the movement of the cutter-chain, such frame E or its shoe e being always within the cutter-chain, which travels in a course which always incloses such shoe. As the main frame is supported above the floor, the upper part of the cross-frame E is secured to the main frame, the cross-frame E having the arms e', which rise at each end at an upward curve to and rest upon the upper surfaces of the horizontal flanges a' of the said side beams a, said arms having at the ends thereof the vertical bars e^2, fitting against the vertical portions of said side beams, the cross-frames being secured to the said beams by riveting through said arms e' to the horizontal flanges a' and through the vertical bars e^2 to the body of the side beams a. In order to form the frame sufficiently rigid at the forward end, we rivet to the outside of said side plates a the cross-beam b, before referred to, said cross-beam being formed of a bar or heavy plate bent at the ends, as at b^4, parallel with the vertical plates of the side beams a

and riveted thereto. As above stated, the frame E depends from the main frame, and in order to form the guides for the two longitudinally-extending plates or bars f of the movable frame F it has the shoe e, above referred to, which is connected to the main body of the frame E by the blocks e^3, the edges of which form the inner edges of the guideways for said plate f. At the outer end of said shoe e' are lugs e^4, which act as the outer guides for said bars f, while the shoe supports the bars, and the main body of the frame E extends out over the bars to hold them down in place.

For feeding and retracting we prefer to employ a screw-bar G, which is mounted in the end beams b b' of the machine, and for this purpose the bearings g' are secured to the end plates just at one side of the center line of the machine, it being desirable to get the feed as close as possible to the center thereof. This screw-shaft G has one or more longitudinal grooves g^2 formed in it, and is rotated by the gearing hereinafter referred to to feed it back and forth through the nut g on the sliding frame F. The sliding frame F is formed of the carriage f', the bars f extending forward therefrom, and the sprocket or front cross-frame f^2, around which the chain passes in forming the cut, said cross-frame having sprocket-wheels f^3 at each end thereof, so as to direct the cutter-chain in its course across the front face. The carriage f' is supported on flange-wheels or rollers i, which travel on the horizontal plates or flanges a' of the side beams of the stationary frame, the flanges i' of said wheels i fitting along the inner edges of the said beams a and the carriage being held in proper line thereby. The longitudinally-extending plates f are secured to the carriage f'; but the ends of said plates preferably enter along seats formed for them in the carriage, so that the rear ends of the plate f are directly supported by the carriage which runs upon the track formed by the side beams of the main frame. In the center of said carriage is the boss h', in which is mounted the sprocket-wheel shaft h, carrying at the lower end thereof the sprocket H, which depends below the frame close to the floor and imparts the necessary motion to the cutter-chain K, which chain travels around the sprockets k in the front cross-frame f^2 and around the guide-wheels k^2, depending from said carriage.

The machine may be operated either by a slow-running motor, which connects directly by an angular pin and socket-joint with the shaft h, in which case the motor J is supported on the carriage directly above said armature-shaft h, the motor shown being circular in form and being supported by the brackets j, extending up from the carriage. In such case, in order to provide for the feeding forward and retracting of the machine, we mount in suitable bearings on the carriage the horizontal shaft l, having at its rear end the beveled pinion l', which meshes with the beveled pinion l^2 on the vertical sprocket-shaft h, the trains of gears for feeding and retracting being driven by this horizontal shaft l. In case a fast-running motor is employed the motor may engage by suitable gearing with the shaft l, and may either be arranged with its armature-shaft in a horizontal position, in which it will be geared by straight cog-gearing with said shaft l, or with a vertical armature-shaft, as shown in an application filed July 11, 1891, in which case the motor may be supported in the manner shown in said application and connect by the same straight gear with the sprocket-shaft, or by bevel-gearing with said horizontal shaft l.

To provide for the feeding and retracting of the machine, we employ two trains of straight gears, employing this form of gearing in preference to worm or like gearing on account of the strength obtained, as these machines are expected to stand very heavy strains, (especially in cutting the coal in the vicinity of Pittsburg, Pennsylvania.) For this purpose we mount on the shaft l the pinion m, which is connected to said shaft by the clutch n, and this pinion m meshes with the pinion m', which fits around and slides upon the screw-bar G, and is connected thereto by feathers fitting in the grooves g^2 of the screw-bar. This gives the necessary rapid motion for retracting the machine.

For feeding the machine forward, a much slower and more powerful motion is required, and for this purpose we employ the following gearing: Mounted on the horizontal shaft l is the pinion p, which is caused to engage with said shaft by the clutch n, above referred to, this pinion meshing with the gear-wheel p', which is secured upon the shaft r, mounted in bearings r' on the carriage, said shaft carrying at its forward end the pinion s, which meshes with the gear-wheel s', fitting around and sliding upon the screw-bar, it also having feathers fitting within the grooves g^2 of the screw-bar. The said pinion m' and pinion s', which slide upon the screw-bar, have suitable collars fitting within suitable bearings on the carriage to support them properly around the screw-bar. It will be noticed that the screw-bar fits as closely as possible to the boss h', in which the shaft h is mounted, the screw-bar being thus brought very close to the center line of the machine, so that as direct a longitudinal motion as possible is obtained.

In order to secure the machine in place, suitable jacks are employed, brackets having angular passages being secured to the stationary frame at the ends thereof, as at t t', through which the jacks pass, so that they may take into the floor of the mine and may be screwed up against the roof.

As so constructed the machine is operated in the following way: The machine is placed in position, with the front cross-frame f^2 parallel with the face of the coal, so that as the

sliding frame is advanced it will cut into the same, and is secured into place by the jacks above referred to. Connection is made by suitable flexible conductors between the motor and the wires carrying the electric current through the mine and the motor is started, and through the connections with the vertical shaft *h*, whichever arrangement is employed, the vertical sprocket-shaft *h* is driven at the proper speed, and by means of its sprocket H it imparts the necessary motion to the cutter-chain K, which carries cutters *k'* at suitable intervals for cutting the kerf as the cutter-frame is fed forward. This chain travels from the sprocket H over one guide-wheel k^2, and then around the sprocket-wheels *k* at the forward end of the front cross-frame f^2, traveling across the face of said cross-frame and back along the other side of the machine to the other guide-wheel k^2, and then back to the sprocket-wheel H. As the vertical shaft *h* turns, the horizontal shaft *l* turns with it, either driving it or being driven by it; but as the clutch *n* is not in engagement either with the pinion *m* or pinion *p* no motion is imparted to move the sliding frame longitudinally. The operator then throws the clutch into engagement with the pinion *p* and through the said pinion turns the gear-wheel *p'* and pinion *s* and the gear-wheel *s'*, which engages with the screw-bar by the sliding connection above referred to, and in this way he turns the screw-bar so as to cause it to screw through the nut *g* upon the carriage, so feeding the machine forward at the desired speed. During this operation the pinions *m* and *m'* will be turned by the screw-bar; but as the pinion *m* is simply mounted upon the shaft *l* it will turn independent thereof. As the cutter-chain is supported so that its lower cutters are even with the floor on which the machine is supported as the sliding frame advances, the cutter-chain will cut the kerf with its lower surface on the same horizontal plane as the floor of the mine, and as the chain is thus suspended entirely below the body of the main frame it will travel forward under the said main frame, the machine being supported on the feet d^2 at the rear and on the shoe *e* at the forward end thereof, a free course being thus provided for the forward movement of the chain under the main frame. It will be noticed that the front shoe *e* rests upon the floor in the space inclosed by the chain and occupies such position throughout the entire course of the chain while cutting the kerf. This is an important point in the construction of the machine, as it enables the shoe to support the raised frame and gives the cut on the same horizontal plane as the floor and at the same time permits of the cutting of as wide a kerf as desired, according to the strength of the machine, and permits the chain to carry out the cuttings with the cut drawing them in contact with the operative parts of the machine. The cutting operation is continued until the cut is completed, the sliding frame traveling forward and the longitudinally-extending horizontal plates *f* supporting the front cross-frame f^2 at the proper level until the carriage travels to the forward end of the main frame, and the cut is completed. The operator then withdraws the clutch from the pinion *p* and throws it into engagement with the pinion *m*, so causing the rotation of the pinion *m* with the horizontal shaft *l*, and said pinion will, through the pinion *m'*, engaging with the screw-bar, cause the screw-bar to screw in the opposite direction through the nut *g* on the carriage, and so retract the sliding frame, carrying it back to its original position at the rear end of the frame. During the operation of retracting the machine the screw-bar will turn the train of gears *p p' s s'*; but as the pinion *p* is simply mounted upon the shaft *l* it simply turns thereon independent of and in the opposite direction to the movement of said shaft. By thus supporting the main frame of the machine on the feet at the rear end thereof and on the toe in the central part of the forward end of the machine we are enabled to make the cut on the same level as the floor of the mine, leaving the cutter-chain free to travel under the main frame, the toe at the forward end of the main frame being within the cutter-chain and in no way interfering with the forward advance of the same.

The machine can be made very strong and durable, which is necessary, especially for cutting the harder grades of coal to which this machine is particularly adapted. At the same time a very simple form of gearing for feeding and retracting the machine is obtained, and one on which plain cog-gearing may be employed which can be made very strong, and in case of fracture can be quickly and easily replaced. The screw-bar may also be located close to the center line of the machine, so that a direct longitudinal motion free from strain is obtained in moving the sliding frame backward and forward. Where the motor is arranged to connect directly with the vertical sprocket-shaft, as shown in Fig. 2, the gearing of the machine may be much simplified and the direct application of the power generated obtained.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. In a mining-machine, the combination of a main frame supported above the floor at the rear and forward ends, the forward end being supported on a central shoe having guideways therein, and a sliding frame having a carriage supported on the main frame and provided with a sprocket-wheel depending below the main frame, the sliding frame having forwardly-extending bars moving in the guides of said shoe and supporting a cross-frame below the main frame, and a cutter-chain driven by the sprocket and passing around the cross-frame, substantially as and for the purposes set forth.

2. In a mining-machine, the combination of

a main frame, a sliding frame moving therein and having a vertical sprocket-shaft mounted therein, and a motor mounted on the sliding frame and having a vertical armature-shaft in line with said vertical sprocket-shaft and engaging directly therewith, substantially as and for the purposes set forth.

3. In a mining-machine, the combination of a main frame having its side portions formed of angle-beams forming tracks and having guideways in a depending transverse bar at its forward end, and a sliding frame having a carriage provided with flanged wheels traveling on the horizontal flanges of said angle-beams and having their flanges traveling along the inner faces thereof and provided with bars supported at their rear ends by the carriage and extending forward from the carriage and moving in the guideways at the forward end of the stationary frame and supporting the cutting mechanism at the forward end, substantially as and for the purposes set forth.

4. In a mining-machine, the combination of the main frame having its side portions formed of angle-beams, and the depending cross-frame E, having arms resting upon and secured to the horizontal flanges of the angle-beams, and vertical bars secured to the vertical portions of said cross-beams, substantially as and for the purposes set forth.

5. In a mining-machine, the combination of the main frame having its side portions formed of angle-beams, and the depending cross-frame E, having arms resting upon and secured to the horizontal flanges of the angle-beams, and vertical bars secured to the vertical portion of said cross-beams, and the shoe *e*, depending from said cross-frame E and having guideways formed therein for the longitudinally-extending bars of the sliding frame, substantially as and for the purposes set forth.

6. In a mining-machine, the combination, with the main frame having a grooved screw-bar mounted therein, of a sliding frame having a nut engaging with the screw-bar, a vertical shaft mounted in said sliding frame, the horizontal shaft *l*, connected by beveled gearing with the vertical shaft, the horizontal shaft *r* at one side of said shaft *l*, and the pinions and gear-wheel *p p' s s'*, said gear-wheel *s'* sliding on and connected to the screw-bar by a feather, substantially as and for the purposes set forth.

In testimony whereof, we, the said ADAM KEIL and ANTON R. WESTERDAHL, have hereunto set our hands.

ADAM KEIL.
ANTON R. WESTERDAHL.

Witnesses:
J. N. COOKE,
ROBT. D. TOTTEN.