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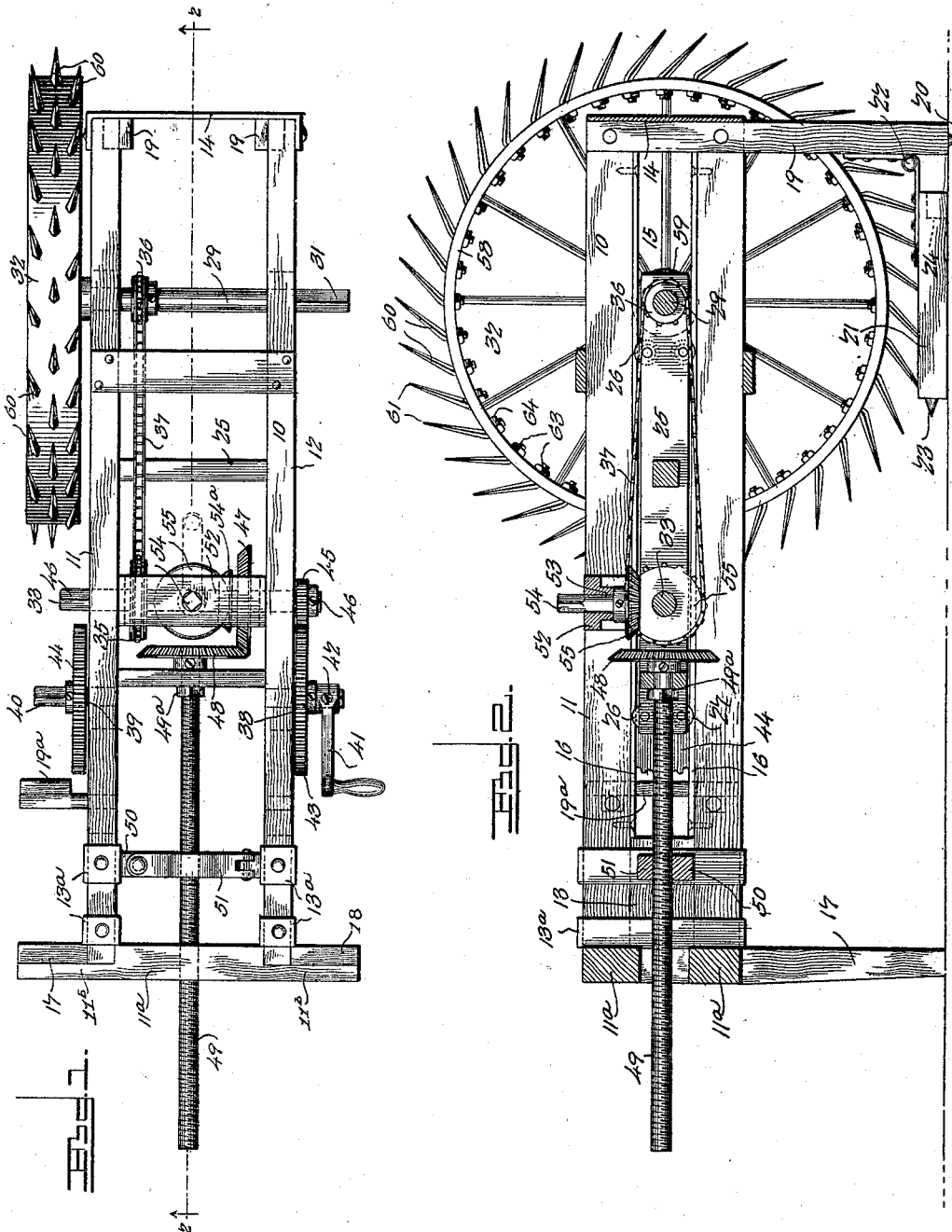
Patented Apr. 10, 1900.

J. W. HAYES.  
MINING AND CUTTING MACHINE.

(Application filed June 24, 1899.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses  
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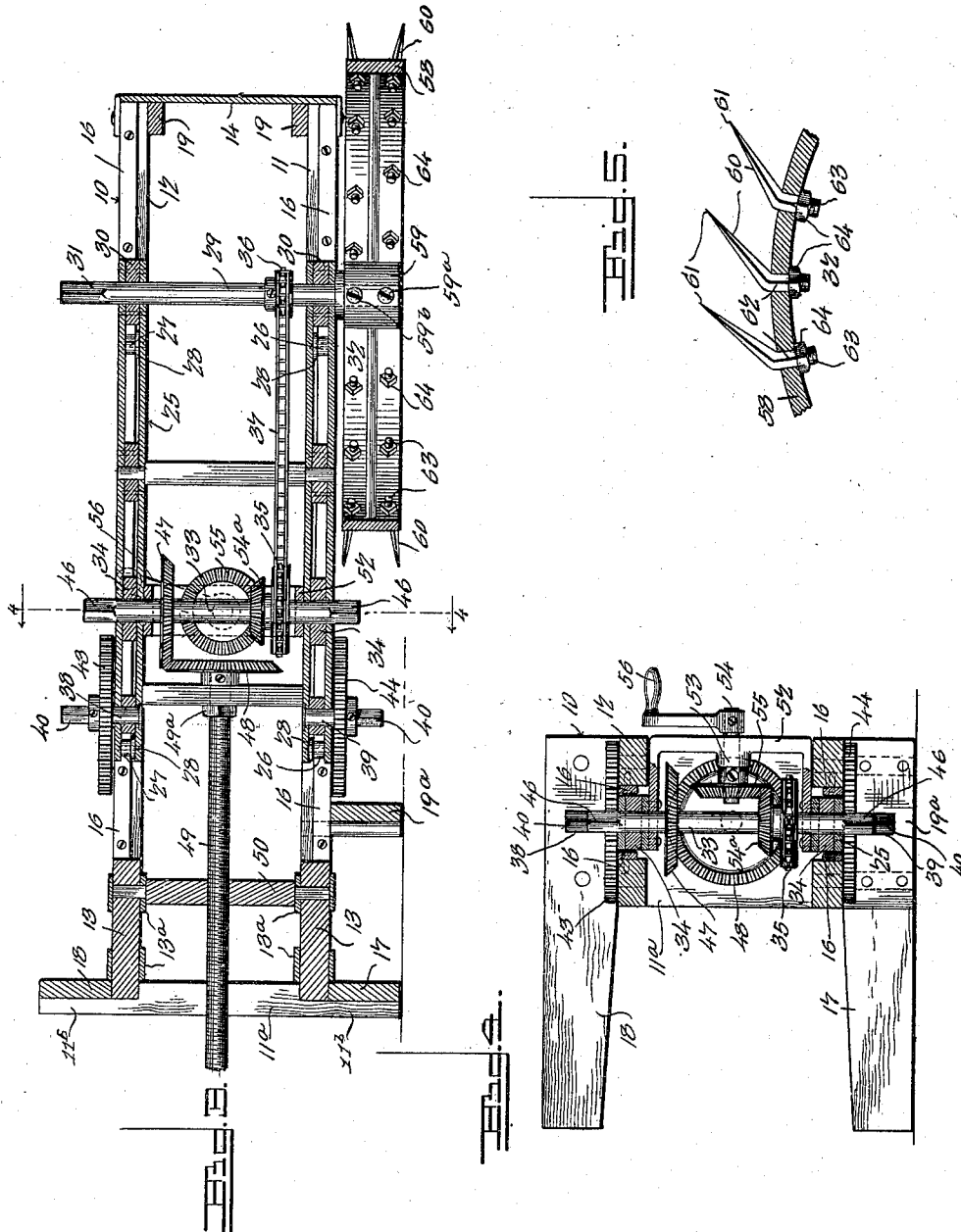
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# UNITED STATES PATENT OFFICE.

JOHN W. HAYES, OF ELK GARDEN, WEST VIRGINIA, ASSIGNOR OF ONE-HALF TO THOMAS W. ASHBY, OF SAME PLACE.

## MINING AND CUTTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 647,093, dated April 10, 1900.

Application filed June 24, 1899. Serial No. 721,778. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN W. HAYES, a citizen of the United States, residing at Elk Garden, in the county of Mineral and State of West Virginia, have invented a new and useful Mining and Cutting Machine, of which the following is a specification.

My invention relates to improvements in machines for mining and cutting coal; and the object in view is to provide a simple portable structure adapted to be used successfully in either of the two positions requisite for performing the operations known to mining experts as "cutting the ribs" in coal-beds and for making the "mining cut" in said bed. It is proper to explain that the mining cut is first made in a horizontal line in the vertical face and to a proper depth in the bed of coal, and then the "ribs" are made by cutting in vertical lines in the bed of coal at opposite ends of the mining cut, so as to intersect therewith.

A further object of the invention is to provide an improved driving and feed gear by which the revoluble cutter may be driven and advanced automatically in the coal-bed for its knives or teeth to continuously act against the bottom of the incision or kerf, the crank of the driving-gear being shiftable to operate on either side of the machine according to the position of the cutter-head in making the right or left hand rib in the bed.

A further object is to provide an improved cutter in which the knives or teeth are disposed to transmit the thrust directly on the head, and said knives are arranged to make a cut or incision as wide as or a little wider than the face of the cutter-head, in order that the cutter may have clearance and work freely in the incision.

A further object is to provide means for supporting the cutter at variable heights and firmly in position.

With these ends in view the invention consists in the novel combination of elements and in the construction and arrangement of parts which will be hereinafter fully described and claimed.

To enable others to understand the invention, I have illustrated a preferred embodiment thereof in the accompanying drawings,

forming a part of this specification, and in which—

Figure 1 is a plan view of a mining and cutting machine constructed in accordance with this invention. Fig. 2 is a longitudinal sectional elevation on the plane indicated by the dotted line 2 2 of Fig. 1. Fig. 3 is a vertical sectional view of the machine arranged in horizontal position for the cutter-head to make the horizontal mining cut or incision in the bed of coal. Fig. 4 is a vertical transverse section through the machine shown by Fig. 3 and on the plane indicated by the dotted line 4 4 looking in the direction indicated by the arrow. Fig. 5 is an enlarged fragmentary view of the cutter-head with a series of knives or teeth thereon.

The same numerals of reference are used to indicate like and corresponding parts in each of the several figures of the drawings.

In carrying my invention into practice I employ a main frame 10, which supports all of the operative elements of the machine, and this frame is equipped with means, hereinafter more fully described, by which it may be supported to present the cutter-head in operative relation to the coal-bed at variable heights and to guide or direct the entire apparatus in a straight line in order that the cutter-head may be sustained at right angles to the substantially-vertical face of the coal-bed. The frame consists of the side rails 11, 12, arranged in pairs, and the rails forming each pair are parallel to each other, while the pairs of rails on opposite sides of the frame are also parallel for the purpose of supporting and directing a slidable carriage, which sustains the cutter-head and the driving and feed mechanism therefor. The members forming the pairs of rails are spaced and stayed at one end by means of the interposed stay-blocks 13, which are suitably secured to the rails and are strengthened by the attachment of stay-straps 13<sup>a</sup>, suitably secured to the rails and the blocks. At one end this frame has cross-rails 11<sup>a</sup>, fastened to the side rails thereon; but to the opposite end of the frame the rails are joined by the breastplate 14, preferably of metal, while the rails and legs of the frame are of wood, although this is not material. Each pair of side rails form-

ing a part of the main frame 10 are spaced to provide intermediate slots, which extend longitudinally of the frame substantially from front to rear thereof, and these slots provide the guideways 15 for the slidable carriage, metallic rails 16 being secured to the lower frame-rails and within the guideways 15.

The cross-rails 11<sup>a</sup> at the rear end of the main frame are extended beyond the side rails to form the short arms 11<sup>b</sup>, (shown by Figs. 1 and 3,) and to the extended arms 11<sup>b</sup> of said cross-rails are firmly secured the permanent rear legs 17 18. The front legs 19 are secured to the side rails of the frame adjacent to the breastplate 14 thereof; but as the rear permanent legs are attached to the extended ends of the cross-rails the front and rear legs are disposed out of alinement, so that the rear legs occupy an offset position relative to the front legs. (See Fig. 1.) To assist in supporting the rear end of the frame and to serve as a guide for the frame in its endwise movement when adjusting the cutter to the face of the coal-bed, I provide a removable and shiftable bar 19<sup>a</sup>, which is adapted to be fastened detachably to either side of the main frame in front of and in line with one of the rear permanent legs thereof. As shown by Fig. 1, this removable bar is fastened to the rails 11 on the left-hand side of the machine and is arranged in alinement with the leg 17, so that the bar and the leg on the left-hand side of the machine occupy corresponding relation to ride against one face of the mining-drift, whereby the bar and the leg may ride against the wall to guide or direct the machine as it is slid along to present the revoluble cutter to the vertical face of the coal-bed. It is evident that this detachable bar may be removed from the frame-rails 11 and connected to the frame-rails 12 to occupy a corresponding relation to the rear leg 18. Any suitable means may be provided for fastening the detachable bar to the frame—as, for instance, by dowels, screws, or bolts. The legs 17 18, in connection with the front legs 19, are adapted to support the frame when it is arranged in the positions shown by Figs. 1 and 2 of the drawings; but the frame may be turned over on its side in either direction, so that one leg 17 or 18 and the detachable bar 19<sup>a</sup> may rest on their edges to support the frame in the position shown by Figs. 3 and 4 of the drawings. In this last-described position of the frame it is supported above the bottom of the mining-drift, so that the cutter may rotate freely for the purpose of producing the mining cut in the end face of the drift. The front legs 19 are equal in length to the rear legs 17 18, and said front legs are provided at their lower ends with spurs 20, adapted to penetrate the bottom of the mining-drift for holding the machine against slipping and in the position to which it may be adjusted.

For raising the front end of the machine-frame in order to present the cutter-head at

variable heights to the vertical face of the coal-bed I have provided the front legs 19 with foldable supplemental legs 21, each of which is connected to one of the front legs by means of a strap-hinge 22. (See Fig. 2.) It is evident that the supplemental legs may be unfolded to bring them in alinement with the legs 19, and the aggregate length of the legs 19 21 exceeds the length of the permanent rear legs in order to support the front end of the frame in an elevated position, said frame assuming a generally-inclined position when the supplemental legs 21 are employed in connection with the rear legs to support the machine. The front legs are provided at their free ends with the spurs 23, adapted to penetrate the bed and to hold the machine in position when the supplemental legs are used, and in order for the supplemental legs to unfold without interference from the spurs 20 on the permanent front legs 19 I provide the upper hinged ends of the supplemental legs with the recesses 24, adapted to receive the spurs 20 when the supplemental legs are unfolded. The supplemental legs are adapted to be folded at right angles to the front legs 19, as shown by Fig. 2, when the frame 10 is supported in a horizontal position.

25 designates the slidable carriage, which is arranged in the guideways 15 of the frame 10 and extends across from one side thereof to the other in order to span the space between the sides of the main frame. This carriage is equipped with rolls 26 27, suitably journaled at the ends thereof, with the rolls 26 arranged to ride against the upper edges of the guideways 15, while the rolls 27 ride against or upon the rails 16, said rolls 26 27 being flanged, as at 28, to travel against the frame-rails and the track-rails in order to confine the carriage against lateral displacement in the slots or guideways of the main frame.

29 designates a cutter-shaft arranged in a transverse position across the front end of the slidable frame and journaled in suitable bearings 30 thereof, the ends of the shaft being extended or prolonged beyond the bearings of the slidable carriage, so as to protrude beyond the sides of the main frame 10. Said protruding ends of the shaft 29 are square or polygonal, as at 31, to enable the revoluble cutter to be fitted on either end of said shaft according as it is desired to cut the right or left hand rib in the vertical face of the coal-bed. This revoluble cutter is designated in its entirety by the numeral 32, and the preferred construction of the cutter will be hereinafter described in detail.

The slidable carriage 25 supports a counter-shaft 33, journaled in bearings 34 of the frame to occupy parallel relation to the cutter-shaft, and to this counter-shaft is fixed a sprocket-gear 35, that is disposed in alinement with and is of larger diameter than a sprocket-pinion 36, which is fixed to the cutter-shaft. A sprocket-chain 37 engages with the alined

sprockets on the counter-shaft and the cutter-shaft for the purpose of transmitting the motion of the counter-shaft to said cutter-shaft to rotate the cutter 32 at the required rate of speed; but I do not desire to strictly confine myself to this specific type of gearing, as I am aware that spur-gearing may be substituted therefor. The counter-shaft is adapted to be positively driven by the miner stationed on either side of the machine, and this is one of the meritorious features of my machine, which is adapted to be operated for producing the right and left hand ribs or vertical cuts in the face of the coal-bed. Stub-shafts 38 39 are journaled in the slidable carriage 35 at or near the rear end thereof, and one shaft is arranged to project beyond the right-hand side of the machine, while the other stub-shaft extends beyond the left-hand side of the machine. Each stub-shaft terminates at its outer extremity in a polygonal stud 40, and to this end of either shaft may be fitted the socketed end of an operating-crank 41, the latter having a clamping-screw 42, adapted to bind against the polygonal stud of the shaft, to which the crank may be fitted for the purpose of holding the crank against removal accidentally from the shaft to which it may be fitted. On the stub-shaft 38 is permanently secured a driving-gear 43, and a similar driving-gear is secured in like manner, as at 44, to the stub-shaft 39, it being understood that said gears 43 44 remain permanently fixed to the shafts, while the crank 41 may be secured detachably to the polygonal stud of either shaft. A gear-pinion 45 may be secured removably to either polygonal end 46 of the counter-shaft 33, said ends of the counter-shaft being extended or prolonged beyond the bearings 34 in the slidable carriage for the purpose of permitting the removable gear-pinion 45 to be fitted to either end of said counter-shaft in position to mesh with one or the other of the driving-gears 43 or 44 on the stub-shafts 38 39.

The counter-shaft 33 is operatively connected with the cutter-shaft for the purpose of positively driving said shaft and the cutter 32 thereon, and with this counter-shaft is geared a feed-screw which serves to automatically advance the carriage and the cutter to the work, thus maintaining said cutter in position for its knives or teeth to penetrate the coal-bed without any attention on the part of the operator. A bevel-gear 47 is secured fast to the counter-shaft 33 in position to mesh with a beveled gear 48, which is secured to the front end of the feed-screw 49, said feed-screw being arranged longitudinally of the main frame 10 and preferably in a central position between the side rails thereof. The forward end of this feed-screw is journaled idly in a bearing 49<sup>a</sup> on the rear end of the carriage 25, and this feed-screw is arranged to have engagement with the threads of a two-part feed-nut 50. Said nut is arranged transversely between the side rails of the main

frame to be supported in a fixed position thereby, and the nut furthermore is divided so that its section 51 may be connected by a hinge or pivot to the permanent section 50, whereby the nut may be opened for the feed-screw to move freely through the same in sliding the carriage 25 in a backward direction for the withdrawal of the revoluble cutter from the coal-bed. I do not consider it essential to particularly illustrate or describe this feed-nut, because it is similar to devices common in coal-mining drills. Hence I reserve the right to employ any proper construction of nut for the operation of the feed-screw.

As shown by Fig. 1 of the drawings, the revoluble cutter 22 is fitted to the left-hand end of the cutter-shaft 29, while the leg 19<sup>a</sup> is connected to the left-hand side of the frame 10. The driving-crank 41 is fastened to the stub-shaft 28 on the right-hand side of the machine, and the gear-pinion 45 is attached to the right-hand end of the counter-shaft 33 in position to mesh with the gear 43. It will thus be seen that the machine is adapted to be slid along one face of the mining-drift for the legs 17 19<sup>a</sup> to guide the machine into position for the cutter 32 to make the left-hand rib or incision in the face of the coal-bed. The operator is stationed on the right-hand side of the machine to operate the crank 41 and drive the gear 43, which in turn propels the pinion 45 to rotate the counter-shaft. This counter-shaft operates the gearing 35 36 37 to rotate the shaft 29 of the cutter, and at the same time the gears 49 48 operate the feed-screw which advances the carriage and thus keeps the cutter up to the bed. In making the other cut or the right-hand rib in the coal-bed the cutter 32 and the leg 19<sup>a</sup> should be detached from the left-hand side of the machine, the gear-pinion 45 and the crank 41 detached from the right-hand side of the machine, and the parts transposed—that is to say, the cutter-head 32 should be fastened to the right-hand end of the cutter-shaft, the detachable leg fitted to the right-hand side of the frame in line with the rear leg 18, the gear-pinion 45 secured to the left-hand end of the counter-shaft 33, and the crank 41 fastened to the stub-shaft 39 on the left-hand side of the machine. With the parts interchanged, as described, the legs 18 19<sup>a</sup> may direct the machine-frame in position to present the cutter 32 for proper operation on the coal-bed to make the right-hand rib or incision therein, and it will be evident that the operator should be stationed on the left-hand side of the machine in order to operate the crank 41 for driving the counter-shaft 33.

In Figs. 3 and 4 of the drawings I have represented the machine arranged to present the revoluble cutter 32 in a horizontal position to make the mining cut in the coal-bed, and in this connection it is observed that additional elements are provided for operatively connecting a driving-shaft to the counter-shaft in order that the operator may conveniently apply power to the counter-shaft. A sup-

porting-bracket 52 is secured firmly to the slidable carriage 25 in a position to extend through one slot or way 15, as clearly shown by Fig. 4, said bracket 52 being fastened in place detachably on the carriage by any suitable means. This bracket is provided at a point intermediate its length with a journal-bearing 53, that accommodates the horizontal driving-shaft 54, said shaft having a bevel-gear 55 at its inner end and a hand-crank 56 at its outer end. When the machine is adjusted to present the revoluble cutter for operation in a horizontal plane, it is desirable to shift the position of the gearing 35 36 37 close to the lower side of the frame 10, as shown by Fig. 4, and a bevel-gear 54<sup>a</sup> is fixed to the counter-shaft 33 in position to mesh with the bevel-gear 55 on the horizontal driving-shaft 53. The elements of the machine when adjusted to the position shown by Figs. 3 and 4 are the same as in the construction shown by Figs. 1 and 2, with the addition of the bracket and the horizontal driving-shaft, and this shaft may be rotated by hand for the operation of the counter-shaft 33, which in turn propels the shaft 29 and cutter thereon as well as the feed-screw that advances the carriage to present the cutter to the coal-bed. It is evident that the yoke and the driving-shaft 54 may be detached when the machine is adjusted as in Figs. 1 and 2 to present the revoluble cutter in a vertical position, and to enable the machine to be used in either of its positions the main frame 10 is simply turned one-quarter way around to change the position of the cutter 32 from a vertical to a horizontal, or vice versa.

I will now proceed to describe the preferred construction of the revoluble cutter shown by the drawings and desire to preface this description with the statement that the cutter is of large diameter to contain a large number of teeth which are arranged thereon to act successively on the bottom of the cut or incision in the coal-bed. This cutter consists of an annular head 58, a hub 59, and a plurality of series of teeth 60. The head 58 is of plate metal, rectangular in cross-section, and bent to the angular form shown by the drawings. The hub 59 is united to the head by radial arms or spokes, and said hub is provided with a polygonal socket or opening and with set-screws 59<sup>a</sup> 59<sup>b</sup>, disposed, respectively, on opposite sides of the spokes. When the cutter is fitted to the left-hand end of the shaft 29, one set-screw is adjusted to hold said cutter on said end of the shaft; but the application of the cutter to the opposite end of the shaft 29 requires the other set-screw to be adjusted to hold the cutter in place on the shaft. The teeth 60 are arranged to protrude beyond the circumference of the head 58, and said teeth are preferably disposed in three series, although the number of series of teeth is not important. Each series has its teeth disposed in the same vertical plane around the circumference of the head, and the two

outside series of teeth are set slanting in opposite directions, as shown by Fig. 1, in order to make the points of the teeth extend or protrude beyond the plane of the edges of said head 58. The middle series of teeth may be in the plane of the axis of the head or set obliquely thereto in either direction. Each tooth is inclined to a radius of the head in order to project in a forwardly and outwardly inclined direction, and the teeth are arranged in staggered or alternate relation across the face of the head 58, so that they will operate successively on the bottom of the cut or incision in the coal-bed. Each tooth consists of a tapered body terminating in a sharp or pick-shaped point 61, and said tooth is furthermore provided with a squared shank 62, fitted in a correspondingly-shaped opening in the head 58, the inner extremity of the shank terminating in a threaded tenon 63, which receives a nut 64, adapted to bind against the inner face of the annular head, as shown by Figs. 3 and 5. The employment of the square shank on each tooth secures the latter to the head in a manner which will prevent the tooth from turning out of position. The opposite inclination or set given to the teeth to produce a cut or incision which is wider than the head, so that the latter will have ample clearance in the cut to rotate freely therein. The angular disposition of the teeth to the head transmits the thrust directly on the head, thus minimizing breakage of the teeth.

The operation may be summarized briefly as follows: The miner first adjusts the machine for producing the mining cut or horizontal incision in the coal-bed, and this is effected by turning the machine on its side, as shown by Figs. 3 and 4, and by fastening the yoke or bracket 52 to the carriage, so that the shaft 54 may operate the counter-shaft. The machine is brought into position adjacent to the coal-bed, so that it may be stayed, if found necessary, to counterbalance the overhang of the cutter-wheel, and the crank 55 is rotated to drive the horizontally-disposed cutter and rotate the feed-screw which advances the carriage and keeps the teeth of the cutter up to the work. During this operation the front end of the frame is further supported by a chain or rope engaged with a hook in the face of the coal-bed and attached to the front portion of the frame of the machine. After the mining cut shall have been produced the machine is withdrawn, the bracket detached, and the main frame turned one-fourth way around to bring the cutter to a vertical position, the legs 17, 18, and 19 serving to support the frame and the various devices thereon in the proper horizontal position. (Shown by Figs. 1 and 2.) The crank 41 and gear 45 are fitted to one side of the machine, while the cutter and detachable bar 19<sup>a</sup> are adjusted to the opposite side of the machine. The structure is thus equipped to produce one rib or

vertical cut in the coal-bed at one end of the mining-cut; but to produce the other rib at the opposite end of the mining cut the crank 41 and gear 45 are reversed, and in like manner the detachable bar 19<sup>a</sup> and the cutter are changed to the opposite side of the machine.

The machine of my invention, while especially adapted for mining operations, may also be employed by the substitution of a rotary saw for the revoluble cutter to the work of sawing wood; but I have not considered it necessary to particularly illustrate or describe an adaptation of this part of the invention, because any ordinary rotary saw may be attached to the cutter-shaft.

Changes may be made in the form and proportion of some of the parts, while their essential features are retained and the spirit of the invention embodied. Hence I do not desire to be limited to the precise form of all the parts as shown, reserving the right to vary therefrom.

Having thus described the invention, what I claim is—

1. In a machine of the class described, the combination with a frame, of a carriage slidably fitted thereto, a cutter-shaft mounted in the front end of said carriage, a revoluble cutter mounted upon the cutter-shaft and adapted for engagement with the ends thereof interchangeably, a transverse counter-shaft arranged parallel to the cutter-shaft and journaled in the rear end of the carriage, whereby the two shafts are held in the same relation at all times, sprocket-gearing between the counter-shaft and the cutter-shaft, a rearwardly-extending feed-screw movable with the slidable carriage and geared to the counter-shaft, a cross-bar fixed to the frame beyond the limit of rearward travel of the carriage, a feed-nut supported by said cross-bar in fixed relation to the frame and receiving the feed-screw, and means for driving the counter-shaft to rotate the feed-screw and the cutter-shaft, substantially as described.

2. In a machine of the class described, the combination with a main frame, a slidable carriage supporting a revoluble cutter, and a feed-screw traveling with said carriage, of the counter-shaft extending across the carriage to gear with the feed-screw and the cutter-shaft and having a polygonal projection at each end, separate stub-shafts mounted on the respective sides of the carriage and in parallel relation to the counter-shaft, said stub-shafts projecting from opposite sides of the main frame, gears fast with the stub-shafts, a single shiftable gear adapted to be fitted to either end of the counter-shaft, and a single crank adapted to be fitted to either stub-shaft, whereby the counter-shaft may be driven from either stub-shaft and is adapted to rotate the feed-screw and the cutter-shaft, substantially as described.

3. A mining-machine for producing horizontal and vertical cuts in a coal-bed and

comprising a frame having legs at its respective ends for supporting it in an upright position, the legs at one end projecting beyond the sides of the frame, and a shiftable bar adapted to be connected with the frame at either side thereof and adjacent a projecting portion of a leg to coöperate therewith in supporting the frame and to assist in guiding the frame to the face of the coal-bed, in combination with a slidable carriage having a cutter mechanism and means for propelling the cutter mechanism and advancing the carriage.

4. A mining-machine for producing horizontal and vertical cuts in a coal-bed comprising a frame capable of use on its side or to stand on its legs, said machine being adjustable bodily to work in either position, a cutter mechanism mounted on the frame and changeable from a horizontal to a vertical position, or vice versa, with said frame, said cutter mechanism comprising a cutter adapted for operation at opposite sides of the frame interchangeably, mechanism substantially as described for rotating and advancing the cutter mechanism in either of its adjusted positions, and means for supporting the frame in operative relation to the work in either of the bodily-adjusted positions of the entire structure, as set forth.

5. A machine of the class described comprising the frame having the offset legs serving as guides to the frame, said frame being capable of standing on the legs in one position and to rest on its side in another position, a slidable carriage, a cutter mechanism on said carriage, comprising a cutter adapted for adjustment to operate at opposite sides of the frame interchangeably, a counter-shaft mounted on the carriage for propelling the cutter mechanism, driving devices substantially such as described for rotating the counter-shaft in either position of the frame, and means for advancing said carriage, all of said parts being adjustable with the frame and adapted for operation in either position thereof, substantially as described.

6. In a machine of the class described, a slidable carriage, a bracket or yoke secured removably to said carriage, a counter-shaft passing through said bracket or yoke, and a crank-shaft supported by the bracket or yoke and geared to the counter-shaft, said yoke and crank-shaft being removable from the slidable carriage, in combination with a main frame in which the carriage is slidably mounted, a cutter mechanism on said carriage, and means for advancing the carriage, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

JOHN W. HAYES.

Witnesses:

J. ROSS COLHOUN,  
THEODORE DALTON.