A. U. DAVIS.

MINING MACHINE.

APPLICATION FILED JULY 27, 1909.

974,645.

Patented Nov. 1, 1910.

3 SHEETS—SHEET 1.

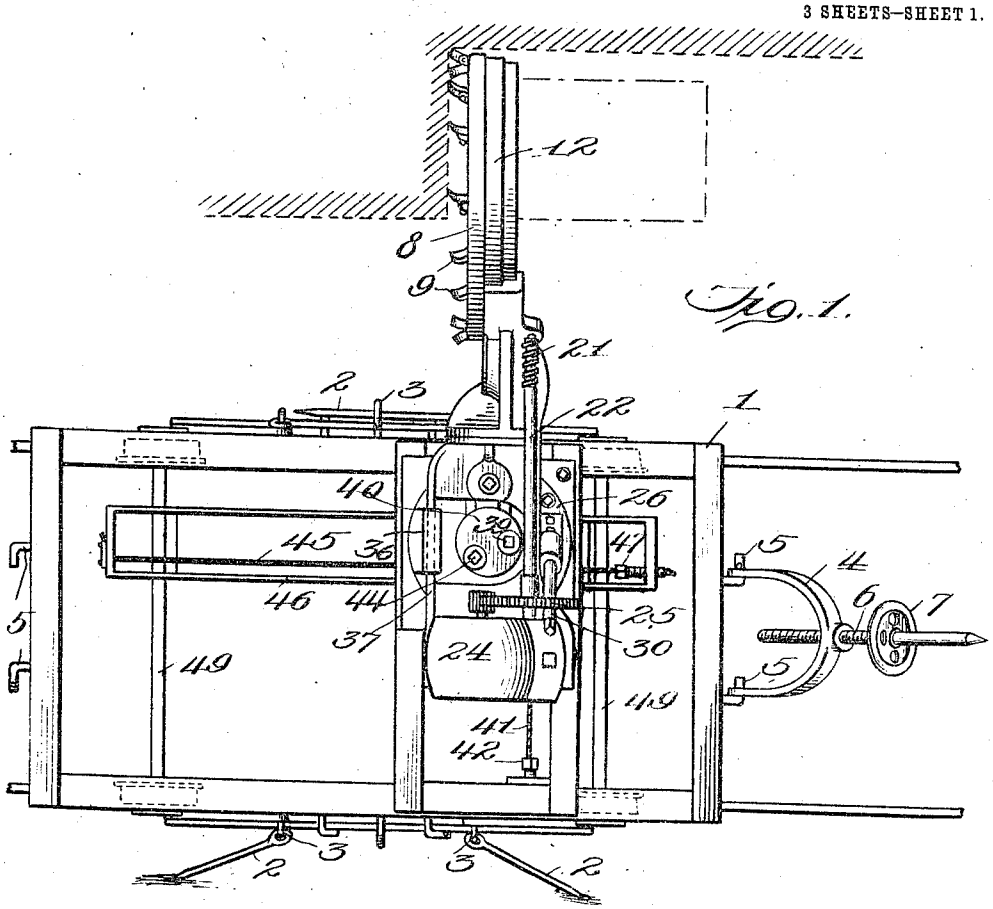

Fig. 1.

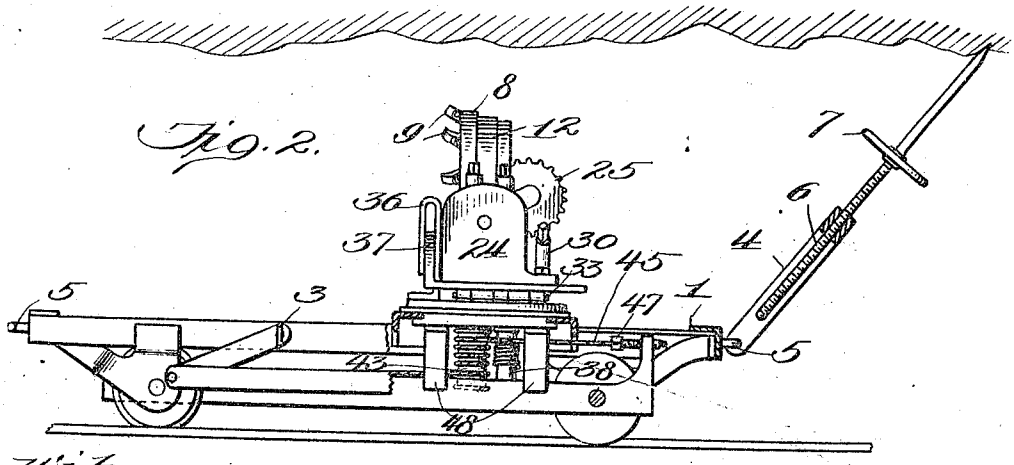

Fig. 2.

Witnesses:

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3 SHEETS—SHEET 2.

Fig. 3.

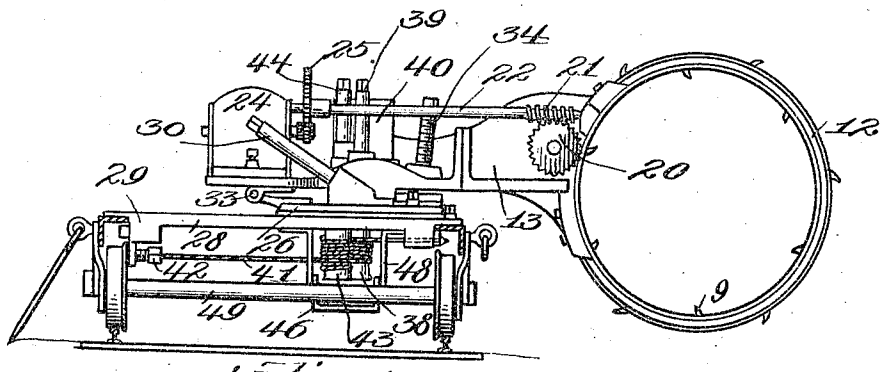


Fig. 4.

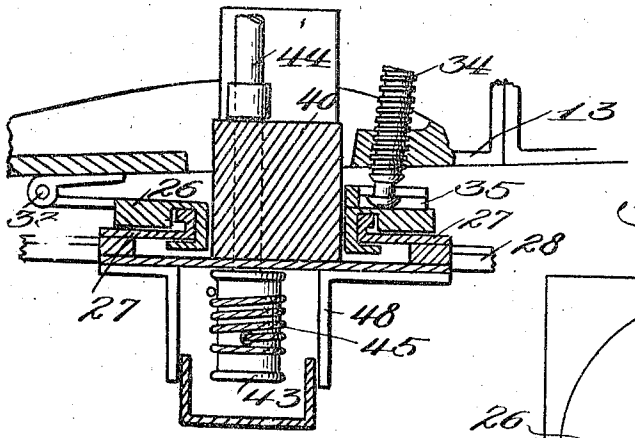


Fig. 6.

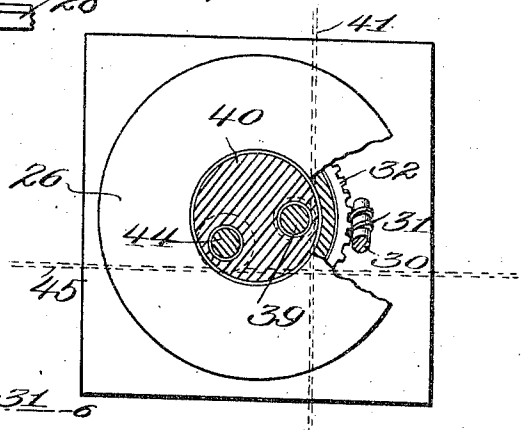
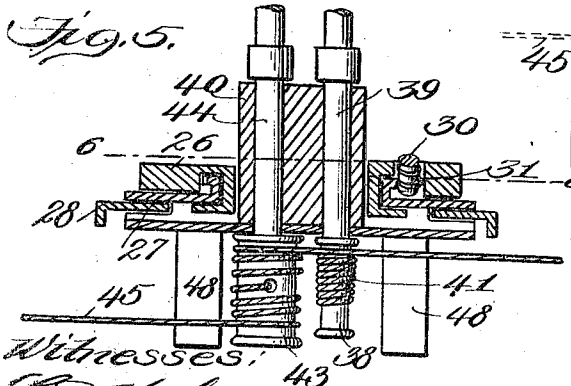


Fig. 5.



Witnesses:

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3 SHEETS—SHEET 3.

Fig. 7.

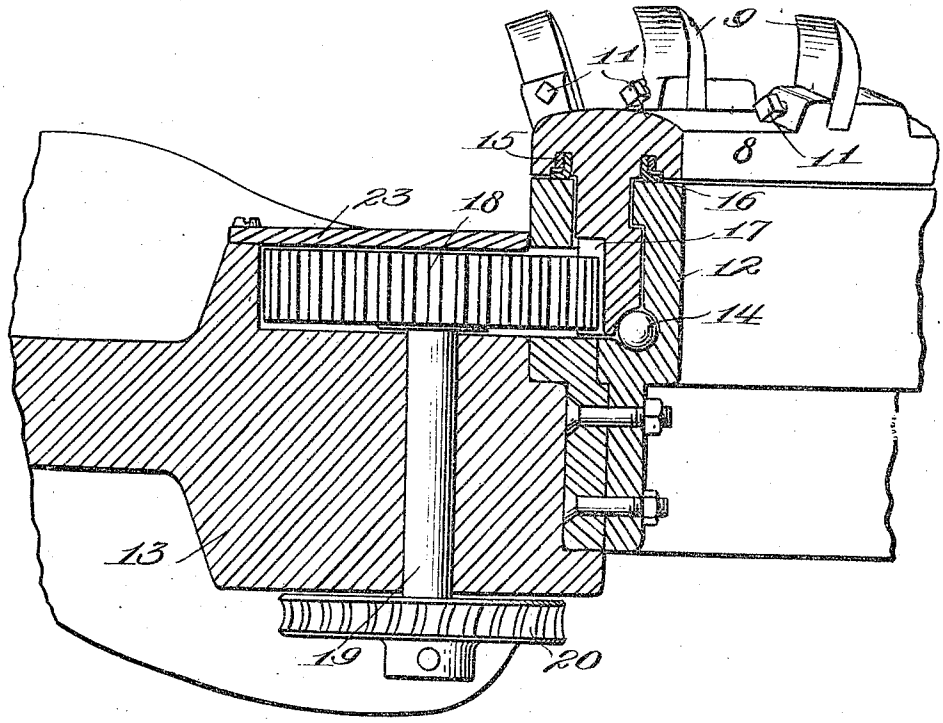
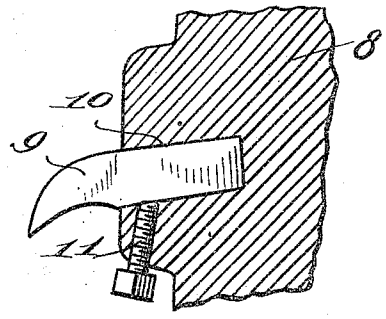


Fig. 8.



Witnesses:

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UNITED STATES PATENT OFFICE.

ALFRED U. DAVIS, OF LUTHERVILLE, MARYLAND.

MINING-MACHINE.

974,645. Specification of Letters Patent. Patented Nov. 1, 1910.

Application filed July 27, 1909. Serial No. 509,762.

To all whom it may concern:

Be it known that I, ALFRED U. DAVIS, a citizen of the United States, residing at Lutherville, in the county of Baltimore and State of Maryland, have invented new and useful Improvements in Mining-Machines, of which the following is a specification.

My present invention relates to improvements in cutting apparatus and more particularly to the class adapted for use in mining operations, and it has for its object primarily to provide a machine of this class having a cutter of an improved type whereby the substance to be mined may be removed in the form of a core or pillar, thus avoiding the necessity of blasting in order to loosen or remove the substance and also obviating the objections incident to the handling of ores or substances when reduced to comparatively small lumps as is common to the modes of mining as heretofore practiced.

Another object of the invention is to provide a mining machine with a cutter of the class just described and also with novel means for supporting the cutter whereby the same may be adjusted so as to enter the wall or vein and cut its way through it, the adjustable support for the cutter also enabling it to swing in an annular path about the car or support whereby the cutter may operate efficiently at either or both sides of the car or support.

Further objects of the invention are to provide a mining machine of the class described with simple and improved adjusting devices whereby the cutter may be conveniently adjusted so as to feed it as the cutting operation progresses, as well as to position the cutter both horizontally and vertically.

To these and other ends, the invention consists in certain improvements, and combinations and arrangements of parts, all as will be hereinafter more fully described, the novel features being pointed out particularly in the claims at the end of the specification.

In the accompanying drawing:—Figure 1 is a plan view of a mining or cutting machine constructed in accordance with the present invention, the position of the cutter with reference to the ore or substance to be mined being shown diagrammatically; Fig. 2 is a side elevation of the apparatus as shown in Fig. 1; Fig. 3 is an end elevation of the apparatus as viewed from the right in Fig. 1, this view being shown partially in section so as to illustrate the gearing between the motor and the revoluble cutter; Fig. 4 is a detail sectional view showing the adjusting means for varying the elevation of the cutter as well as for feeding it longitudinally of the car or support on which it is mounted; Fig. 5 is a detail sectional view of the turn-table carrying the cutter showing the means for revolving the cutter and also the means for feeding the cutter in a direction longitudinally of the car or support; Fig. 6 represents a transverse section on the line 6—6 of Fig. 5 showing the gear and pinion for revolving the turn-table; Fig. 7 is a detail sectional view of the mounting for the revoluble cutter and the gearing for turning it; and Fig. 8 is a detail sectional view showing means for removably mounting the cutter teeth in the cutter ring.

Similar parts are designated by the same reference characters in the several views.

In the accompanying drawing, I have shown one embodiment of the invention as an example. It will be understood, however, that the invention is not limited to the precise construction shown, as certain modifications and changes may be made therein in order to adapt the invention to the best advantage in each particular case. In the present instance, the machine embodies a suitable support which is preferably portable in order to permit the cutter to be readily moved from place to place. A car 1 is shown in the present instance which is provided with wheels whereby it may travel upon rails such as are commonly employed in mines. In order to enable the car to be rigidly held from movement during the operation of the cutter, the car may be provided with suitable devices which are capable of obtaining a firm hold upon the walls and roof of the passageway. In the present instance, a pair of sprags 2 are pivotally attached to hooks or eyes 3 fastened to the opposite sides of the car, these sprags being preferably pointed whereby they may obtain a firm hold against the side walls of the passage, the sprags when not in use being capable of folding against the respective sides of the cars, they being supported by the hooks or eyes. At each end of the car there may also be provided a jack which in the instance shown consists of a yoke 4 having its ends pivotally attached to the car by means of a pair of pivot lugs 5, and a screw 6 is connected to the yoke and pro-

vided with a hand-wheel 7 whereby the end of the screw may be caused to jam against the ceiling or any other convenient part of the mine and thus firmly hold the car in proper position, the jack in Fig. 2 being shown as engaging the roof of the mine passage so as to firmly hold the car down upon the rails.

According to the present invention, a cutter is provided which is capable of entering the ore or other substance and cutting its way into the same in such a manner as to remove a core or pillar which may be broken off in convenient lengths as the cutter advances. In the present instance, this cutter comprises a revoluble ring 8 of a suitable size one face of which is provided with a suitable number of sharpened teeth 9. This ring is rigid in the sense that it is so constructed that it has an inherent power to maintain a true circular form whereby it may effectually sustain strain imposed upon the cutters and it will fit truly within its supporting housing which will be hereinafter described, the ring being distinguished by the term "rigid" from such known machines in which cutters are carried by flexible chains. These teeth may be set in the ring in any appropriate manner, although it is generally preferable to removably mount them in order that they may be removed and sharpened or renewed, the ring in the present instance being provided on one of its faces with recesses 10 into which the ends or shanks of the teeth are inserted at the proper angle, and a set-screw 11 is provided for locking each tooth firmly in position. These teeth are also set in the ring so as to provide sufficient clearance for the cutter as it advances, the teeth in the present instance being shown as arranged in staggered relation, the two extreme rows of teeth being set in circles, the inner circle being less than the diameter of the bore through the ring while the outer circle is of a size greater than the external diameter of the ring and its housing whereby the ring and its housing may pass freely through the cut made by the cutter. These teeth, it is to be observed, extend in a direction approximately axially of the ring whereby they may cut away the material while the ring is advanced by an axial movement.

As the material is to be removed as a core or pillar, it is necessary that the center of the ring should be unobstructed to accommodate the core. For this purpose the ring in the present instance is both supported and driven from its periphery or circumference, an annular housing 12 being provided which is rigidly supported by an arm 13, and the cutter ring is revolubly mounted with reference to the housing preferably by an annular row of balls 14 which travel in raceways formed in the housing and ring, respectively. In order to prevent the entrance of dust or chippings to the bearing thus provided between the ring and housing, dust-excluding packing rings 15 and 16 may be interposed between these parts.

In order to revolve the cutter ring, this ring in the present instance is provided on its circumference with gear teeth 17 with which a gear 18 meshes, this gear being carried by a shaft 19 which may be journaled in the supporting arm 13, and the shaft 19 in turn is provided with a worm wheel 20 to engage a worm 21 carried by a driving shaft 22. Either or both of the gears 18 and 20 may be housed in order to protect them from wear, a cover plate 23 being shown in the present instance to protect the gear wheel 18 and the gear teeth on the cutter ring. Any suitable means may be employed for operating the shaft 22 to drive the cutter, a motor 24 being shown in the present instance which is preferably mounted on and movable with the arm 13, the motor being connected to the shaft 22 by suitable gearing 25. By mounting the motor 24 on the same arm 13 which supports the cutter, these parts are maintained in proper driving relation, irrespective of the various adjustments of the cutter.

In order to permit the cutter to be revolved so as to bring it into action, the arm 13 which supports the cutter is mounted on a turn-table 26, the turn-table being revolubly supported on a carriage 27, and this carriage is slidably supported on the transverse rails 28 of a second carriage 29, the carriage 29 being shiftable longitudinally of the car.

In order to revolve the turn-table so as to turn the cutter, the turn-table is provided with an upwardly extending shaft 30 which carries a worm 31, and this worm meshes with a worm wheel 32 formed on the transversely shiftable carriage 27, the upper end of the shaft 30 being shaped to receive a crank or wheel whereby it may be revolved conveniently

In order to vary the elevation of the cutter, the arm 13 which carries the cutter is pivotally connected to the turn-table at 33 whereby the cutter may swing in a vertical plane. Any suitable means may be provided for elevating or depressing the cutter and for retaining it in the different adjusted positions. In the present instance, a screw 34 is carried by the arm 13, and its lower end is provided with a head which coöperates with a slotted bracket 35 formed on the turn-table, a turning of this screw in the appropriate direction serving to elevate or depress the cutter and to retain it in the adjusted position. The upper end of the screw 34 may also be shaped to receive a crank or wheel whereby it may be conveniently operated. A guide 36 is also preferably attached

rigidly to the turn-table to slidingly engage a flange or rib 37 which is formed at one side of the cutter-supporting arm 13 whereby the thrust upon the cutter may be effectually communicated between the turn-table and the cutter-supporting arm, this bracket however permitting the cutter-supporting arm to be elevated and depressed freely.

The transversely movable carriage 27 in the present instance is shifted by means of a drum 38, this drum being fixed to a shaft 39 which is journaled in a hub 40 which is carried by the transversely shiftable carriage 27, the upper end of this shaft being preferably shaped to receive an operating crank or wheel. Around the drum 38 is wound or convoluted a cable 41, the opposite ends of the cable being secured to the opposite sides of the longitudinally shiftable carriage 29. In order to maintain the cable at the proper tension, a screw 42 may be provided whereby any slack that may develop in the cable can be taken up. The intermediate part of this cable may pass through an opening in the drum, thereby avoiding the necessity of cutting the cable. By turning the shaft 39 in the appropriate direction, the drum will act to wind one end of the cable and unwind the opposite end, and as both ends of the cable are secured, the result will be that the carriage 27 will be shifted in a direction transversely of the car, producing a horizontal or lateral adjustment of the cutter ring. A similar means may be provided for adjusting the carriage 29 in a direction longitudinally of the car. In the present instance, I have shown a drum 43 which is fixed to the lower end of a shaft 44 which may also be journaled in the hub 40 and the upper end of this shaft may be shaped to receive an operating crank or wheel. A cable 45 is wound upon the drum 43, its intermediate portion preferably passing through a transverse opening in the drum, and the opposite ends of the cable 45 are fixed to the ends of a frame 46, an adjusting screw 47 being preferably provided for removing the slack from this cable. The frame 46 is designed to shift transversely of the car simultaneously with the transverse shifting of the turn-table and its carriage 27, a suitable number of arms 48 depending from the transversely movable carriage 27 so as to effect this movement of the frame, and the frame may be supported or guided in any suitable manner, axles 49 for the car wheels passing through the frame in the present instance and serving to guide or support it.

In practice, the motor operates through its gearing to revolve the cutter ring and as this ring is advanced to the ore by an axial movement, the teeth which project from the face of the ring in an approximately axial direction operate upon the ore or substance so as to cut an annular groove which is of sufficient dimensions to provide the necessary clearance for the ring and its housing and leaving a central uncut portion of the ore or substance as a core or pillar which projects through the central opening of the ring and may be broken off in lengths convenient for handling. As the cutter is supported on the turn-table, it may be readily turned or swung so that it may enter a wall of the mine passage, and after cutting through the same for a sufficient distance, it may be removed by a swinging or turning movement it being, therefore, unnecessary to prepare the ore or substance preliminarily for the reception of the cutter. The turn-table also permits the cutter to be revolved completely around the car so that the maximum amount of material may be removed for each given position of the car. The longitudinal adjustment of the turn-table upon the car also enables the cutter to be advanced without changing the position of the car, and the cutter may also be adjusted either vertically or horizontally with facility.

I claim as my invention:—

1. A mining machine comprising a support, a rigid annular housing mounted on said support, a ring having its periphery inclosed and revoluble within such housing, the ring having an unobstructed central core-receiving opening extending therethrough, cutting devices carried by a lateral face of the ring and occupying an area sufficient to cause a clearance for the ring and housing, means supported by the housing support and coöperative with the inclosed periphery of the ring for revolving the latter, and means for feeding the housing and the ring in the direction of the axis of the latter.

2. A mining machine comprising a support, a rigid annular housing mounted thereon, a rigid ring having its outer circumference inclosed and journaled within said housing, the periphery of the ring being also provided with a gear face which is inclosed within the housing, cutting teeth projecting from one face of the ring in a direction approximately axially thereof and arranged to form a clearance for the housing and ring as such parts are fed in an axial direction, driving mechanism carried by said support and coöperative with the gear face on the inclosed ring for revolving the latter, and means for feeding the housing and ring in the direction of the axis of the latter.

3. A mining machine comprising a support, a turn-table mounted thereon and carrying a radial arm, a rigid annular housing fixed to said arm, a rigid ring having its outer circumference inclosed and journaled within said housing, the ring having a central unobstructed core-receiving opening extending therethrough, cutters fixed to one

face of the ring and operative to cut away material to form a clearance for the housing and ring, driving means carried by the housing and coöperative with said ring to revolve the latter, means for turning the arm and housing about the axis of the turn-table as a center, and means for feeding the housing and ring in the direction of the axis of the latter.

4. A mining machine comprising a support, a turn-table mounted thereon, an arm projecting radially from the turn-table and turnable about the axis of the latter as a center, a motor supported on said arm, a rigid annular housing fixed to the outer end of said arm, a rigid ring having its outer circumference inclosed by and journaled within said housing, cutting teeth on one side of said ring and arranged to form a clearance for the housing and ring when the latter is fed in an axial direction, driving means carried by the housing and cooperative with the periphery of said ring for revolving the latter, said driving means being operatively connected to said motor, means for rotating the turn-table to alter the angle of said arm and housing, and means for feeding the housing and ring in the direction of the axis of the latter.

5. A mining or cutting machine comprising a support, a turn-table thereon, a vertically movable arm carried by the turn-table, a revoluble ring carried by said arm and having an unobstructed core-receiving opening extending therethrough, cutting devices projecting from a face of said ring and operative during an axial feed movement of the ring, means for rotating the ring, a housing supporting said ring solely by its periphery, and means connected to the support for feeding the housing and the ring in the direction of the axis of the ring.

6. A mining machine comprising a support, a turn-table mounted thereon and turnable about a vertical axis, an arm turnable with said table and pivoted thereon to move in a vertical plane, a revoluble ring carried by said arm, means for revolving said ring, means connected to said support for feeding the arm and ring in the direction of the axis of the ring, and cutting devices arranged on one face of said ring and operative to remove the material while the ring is fed in an axial direction.

7. A mining machine comprising a support, an arm pivotally mounted thereon, a motor mounted on and movable with said arm, a revoluble ring carried by said arm, having an unobstructed core-receiving opening extending therethrough, cutting devices arranged at one face of said ring and operative to remove material as said ring is revolved and advanced in a substantially axial direction, a housing supporting said ring solely at its periphery, a driving connection between the motor and ring and means for feeding said arm and ring in the direction of the axis of said ring.

8. A mining machine comprising a support, a carriage shiftable longitudinally thereon, a second carriage carried by the first carriage and shiftable thereon in a direction transversely of the support, a turn-table carried by said second carriage, a cutter mounted on and movable with the turn-table, means carried by said second carriage for adjusting the first-mentioned carriage longitudinally of said support, and means also carried by said second carriage for adjusting the latter transversely of said support.

9. A mining machine comprising a support, a carriage shiftable longitudinally of the support, a second carriage carried by the first carriage and shiftable thereon in a direction transversely of the support, a turn-table having an annular portion revolubly mounted on the second carriage, a cutter carried by and movable with the turn-table, means carried by said second carriage and arranged within the annular portion of the turn-table for adjusting the first-mentioned carriage longitudinally of said support, and means also carried by said second carriage for adjusting the latter transversely of said support.

10. A mining machine comprising a car, a carriage shiftable longitudinally thereon, a second carriage shiftable on the longitudinally movable carriage in a direction transversely of the car, a turn-table having an annular portion revolubly mounted on the second carriage, an arm turnable with said table and pivoted thereto to swing in a vertical plane, a cutter carried by said arm, a driving motor also mounted on said arm, means mounted on said second carriage and arranged to turn within the annular portion of the turn-table for adjusting the first-mentioned carriage in a direction longitudinally of the car, means also carried by said second carriage for adjusting the latter transversely of the car, and means carried by the turn-table for adjusting the elevation of the cutter carrying arm.

11. A mining machine comprising a support, a carriage shiftable longitudinally thereon, a second carriage carried by the carriage first mentioned and shiftable thereon in a direction transversely of the support, a rotatable drum connected to each carriage, a cable coöperative with each drum and operative to shift the carriages in their respective paths, and a cutter mounted on and movable with one of said carriages.

12. In a mining machine, the combination of a support, a carriage shiftable longitudinally with respect to said support, a turn-table mounted to revolve on said carriage, a vertically adjustable arm mounted on said

turn-table, means carried by the turn-table for rotating it, means between the turn-table and said arm for adjusting the elevation of the latter, an annular cutter ring supported by said arm, and operating means carried by said arm for revolving the cutter ring.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ALFRED U. DAVIS.

Witnesses:
HERBERT DAVIS,
LUTHER M. LONGSHEW.