H. A. KUHN & W. W. MACFARREN.

MINING MACHINE.

APPLICATION FILED NOV. 30, 1908.

1,107,239.

Patented Aug. 11, 1914.

5 SHEETS—SHEET 1.

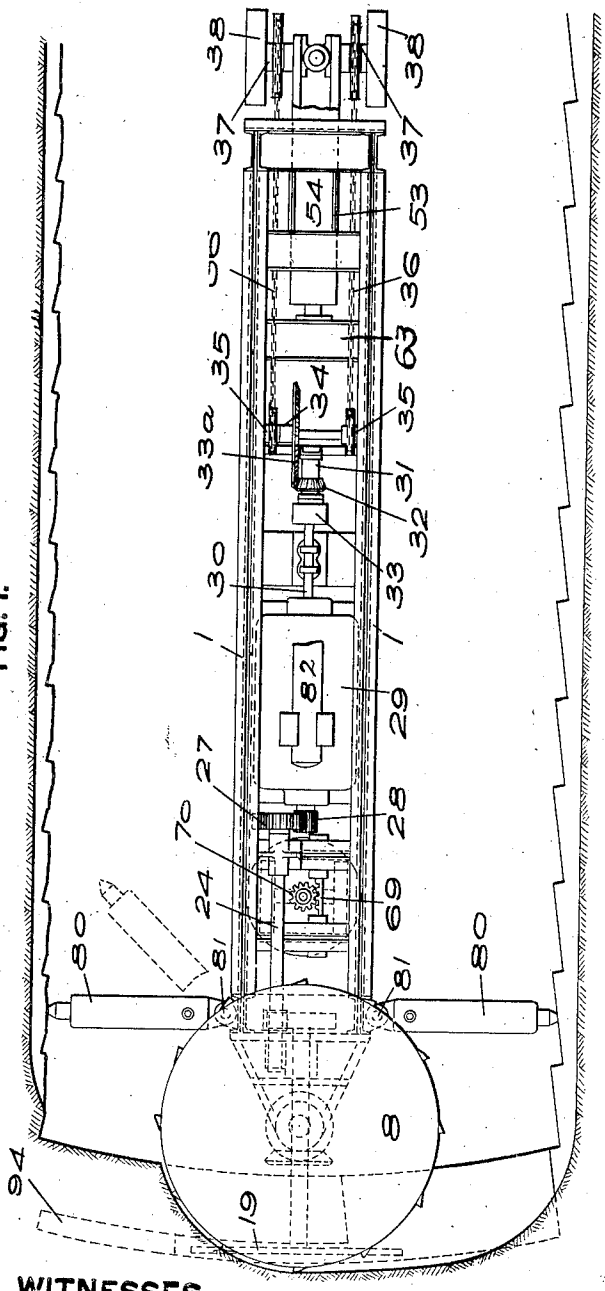


FIG. 1.

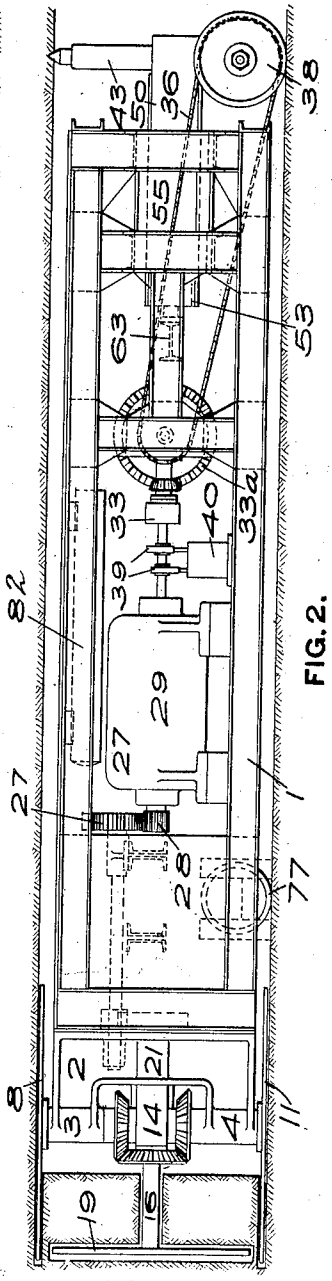


FIG. 2.

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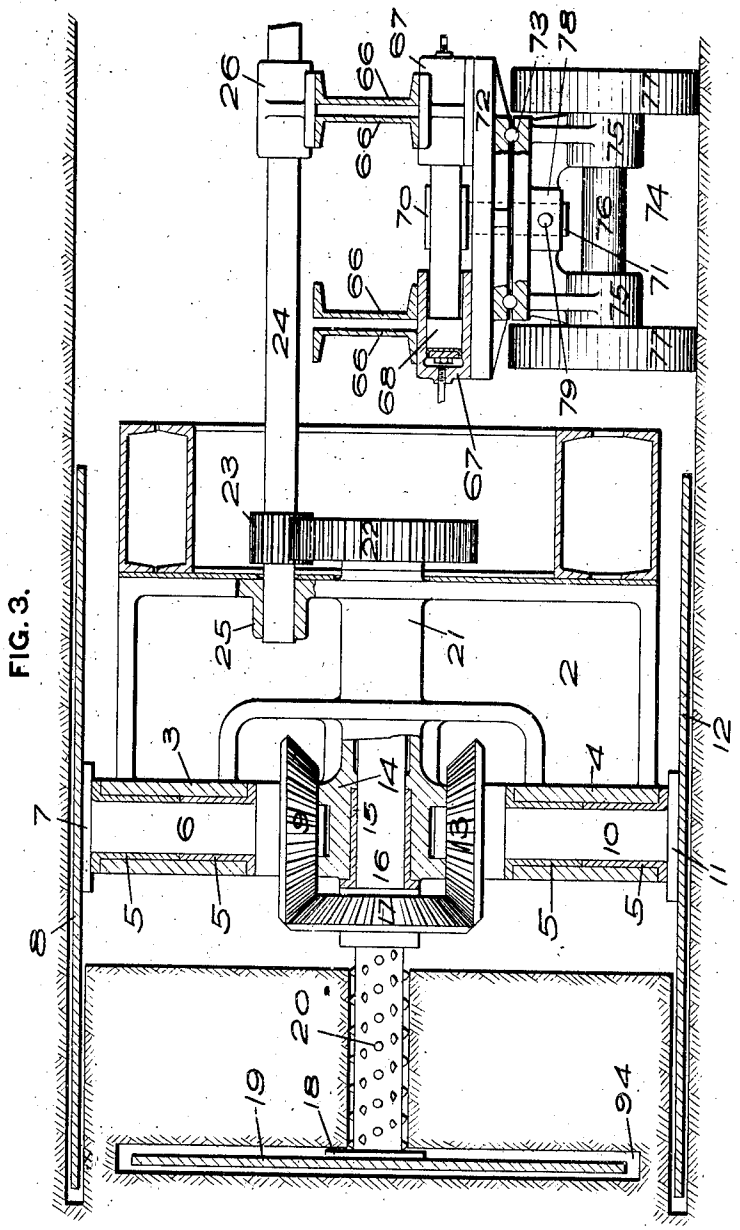
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FIG. 3.



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5 SHEETS—SHEET 3.

FIG. 4.

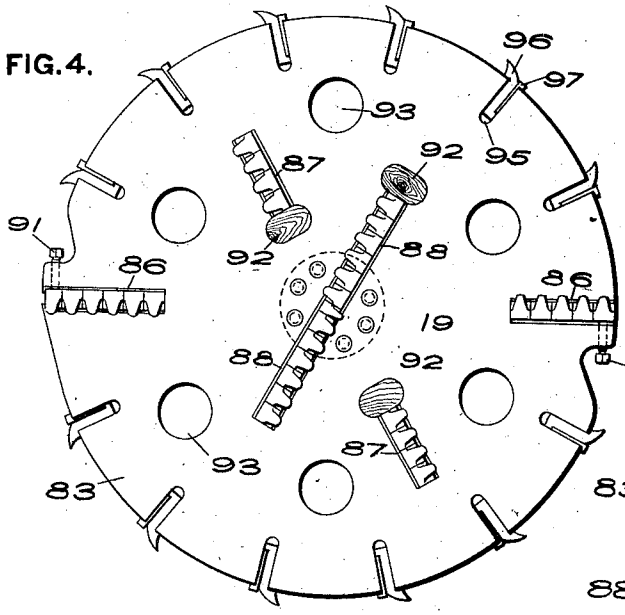


FIG. 5.

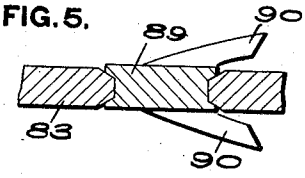
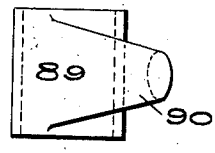


FIG. 6.



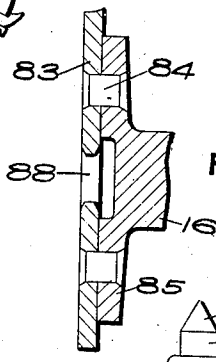
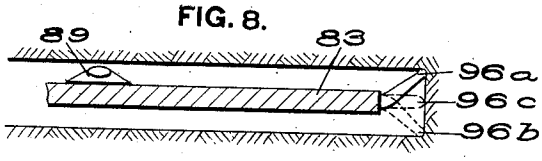


FIG. 7.

FIG. 8.



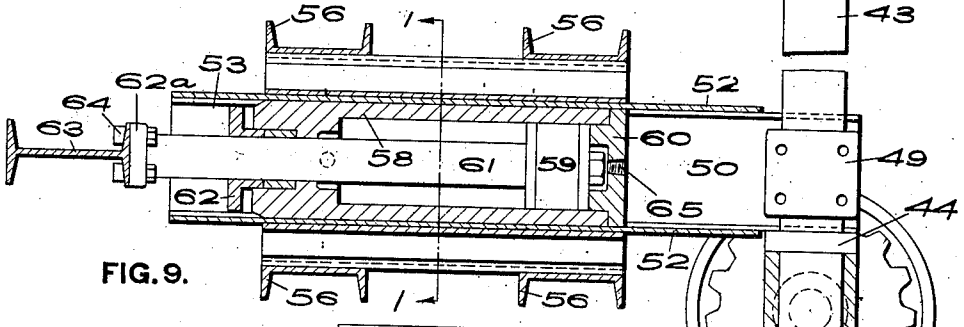


FIG. 9.

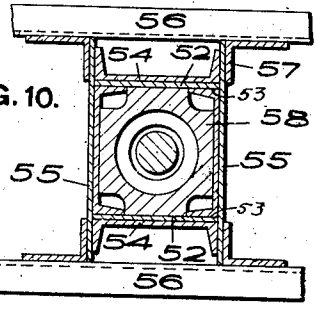


FIG. 10.

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5 SHEETS—SHEET 4.

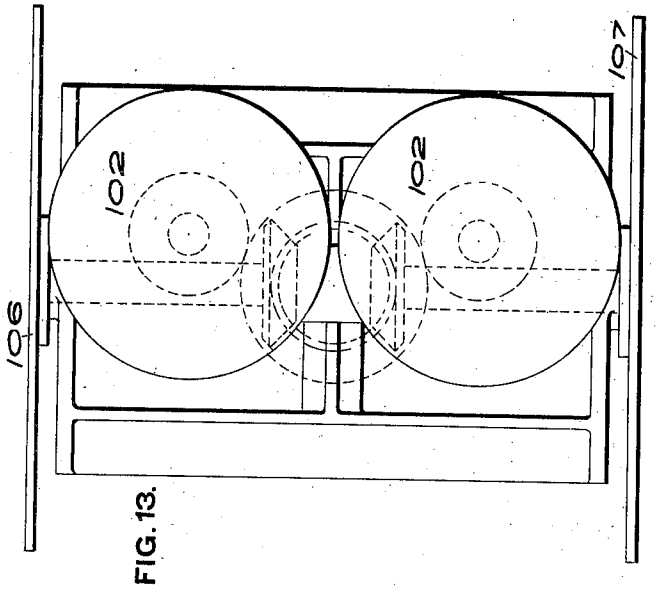


FIG. 13.

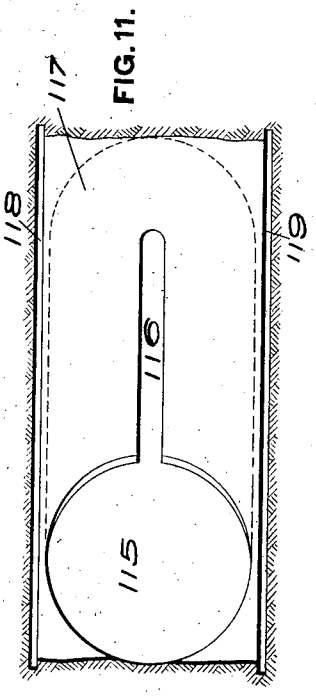


FIG. 11.

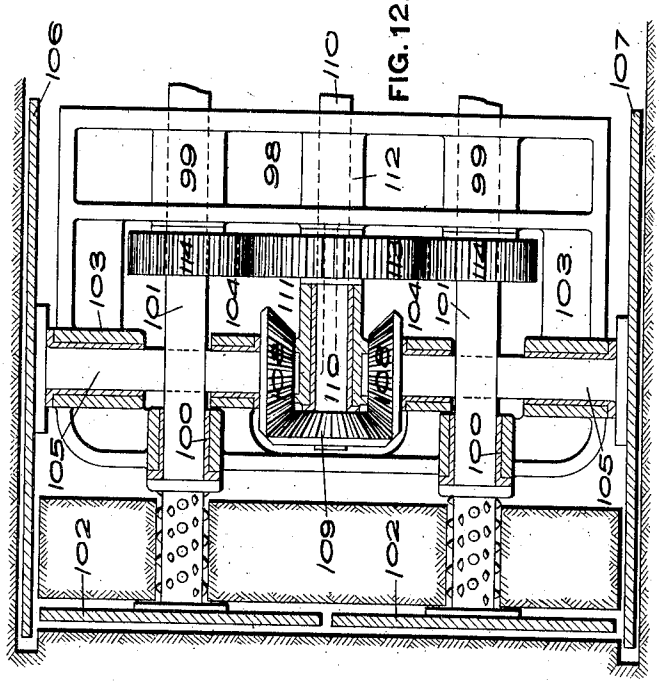


FIG. 12.

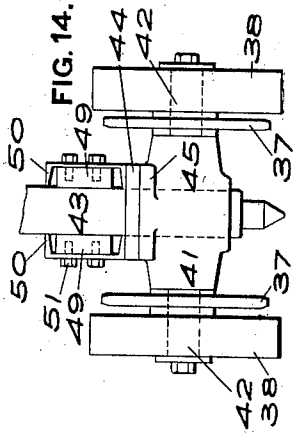


FIG. 14.

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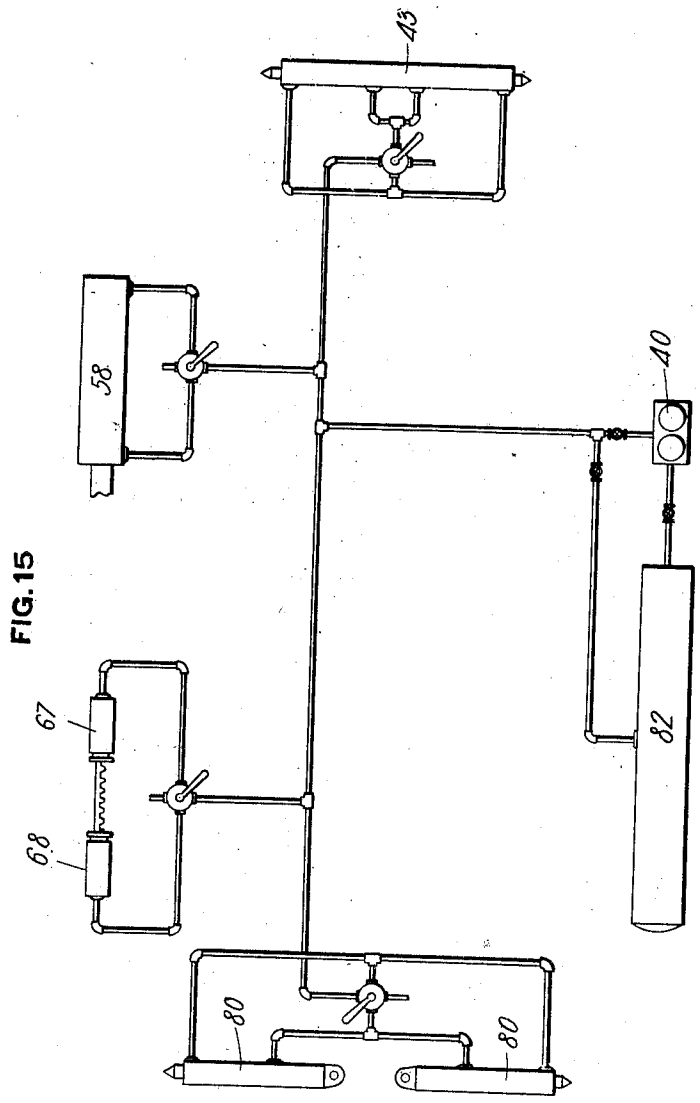


FIG. 15

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MINING-MACHINE.

1,107,239. Specification of Letters Patent. Patented Aug. 11, 1914.

Application filed November 30, 1908. Serial No. 465,299.

To all whom it may concern:

Be it known that we, HARRY A. KUHN and WALTER W. MACFARREN, citizens of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Mining-Machines, of which the following is a specification.

Our invention relates to a class of mining machines which is adapted to mine the full thickness of the coal seam at once, and dislodge the coal from its native bed without the use of explosives.

The specific objects of our invention are to provide a machine which is adapted to work under a variety of conditions, such as cutting entries or rooms; which is strong and substantial, simple in operation, and readily controlled.

Further objects of our invention will be specifically pointed out hereinafter.

Referring to the drawings, Figure 1 is a plan view showing the machine making a cut across the end of an entry or narrow room. Fig. 2 is a side elevation of the same. Fig. 3 is a side elevation partly in section of the front end of the machine. Fig. 4 is an elevation of the vertical saw on the machine. Fig. 5 is a sectional elevation of one of the cutters of said saw. Fig. 6 is a plan view of the same. Fig. 7 is a sectional elevation through a portion of said saw and its driving shaft. Fig. 8 is a section at right angles to said saw, showing the width of cut made thereby. Fig. 9 is a sectional side elevation of the rear propelling jack, the clamping jack, and rear axle. Fig. 10 is a sectional end elevation on the line 1—1 of Fig. 9. Fig. 11 is a sectional elevation through the entry showing the cut made by the machine. Fig. 12 is a side elevation partly in section of a modified form of head for the machine. Fig. 13 is a front elevation of the same; and, Fig. 14 is a rear end elevation of the rear axle and part of the clamping jack. Fig. 15 is a diagram of the various pressure operated mechanisms and their pipe connections.

The machine consists of a structural frame 1, at the forward end of which there is mounted a casting 2, having the bearings 3 and 4, containing the bushings 5. Mounted in the bearing 3, is a shaft 6, having a flange 7, to which is secured the top saw 8. At the lower end of the shaft 6 there is secured a bevel gear 9. Within the bearing 4 is mounted a shaft 10, having a flange 11, to which is secured the bottom saw 12. At the upper end of the shaft 10 there is secured a bevel gear 13. Between the bevel gears 9 and 13 is the bearing 14, containing the bushing 15 and the shaft 16, upon which is mounted the bevel gear 17, which meshes with the bevel gears 9 and 13. Outside the bevel gear 17 on shaft 16 is supplied the flange 18, to which is secured the vertical saw 19. Between the flange 18 and the bevel gear 17, the shaft 16 is supplied with a number of cutters 20 inserted therein. These cutters 20 are preferably arranged in the form of one or more helices running around the shaft for a purpose which will be explained hereafter. The shaft 16 extends back through the bearing 21 and has secured to its rear end a spur gear 22, meshing with the pinion 23 on a shaft 24 supported in the bearings 25 and 26. Secured to the rear end of shaft 24 is a spur gear 27, which meshes with the armature pinion 28 of the motor 29. A shaft 30 is extended rearwardly from the motor to a bearing 31. This shaft has loosely mounted upon it the bevel pinion 32, which may be connected at will to the shaft 30 by the clutch 33. The bevel pinion 32 meshes with the bevel gear 33^a mounted upon a shaft 34, upon the ends of which are mounted the sprockets 35. These sprockets actuate the chains 36, which extend back and pass over sprockets 37 which are secured to the rear truck wheels 38. Between motor 29 and clutch 33 there are mounted on the shaft 30 a pair of eccentrics 39, which operate the pistons of an air compressor 40 secured to the frame 1. The rear axle 41 is preferably made of cast metal having the journals 42 to receive the truck wheels 38. The axle 41 has a hole through the center to receive the lower end of the jack cylinder 43 and a flange 44 on the jack cylinder 43 bears upon lugs 45 on the axle 41. The jack cylinder 43 is a fluid pressure cylinder of any suitable construction having an upper plunger 45^a with a pointed end 46 and a lower plunger 47 with a pointed end 48. Upon the application of fluid pressure the plungers 45^a and 47 move out of the jack cylinder 43 and the points 46 and 48 are embedded respectively in the roof and floor of the mine. Upon release of the fluid pressure,

the plungers 45ª and 47 move down and up respectively so as to disengage the points 46 and 48 from the coal. We have not illustrated or described the construction of this jack in detail as it may be of numerous forms. A construction suitable for this purpose is shown in a co-pending application filed by ourselves and Herbert K. Knopf November 21st, 1908, bearing Serial No. 463,899.

The jack cylinder 43 is supplied with the lugs 49, to which are bolted one end of the channels 50 by bolts 51. The rear lower surfaces of these channels 50 bear on flange 44, which in turn rests on lugs 45 on the axle 41. The channels 50 are combined with plates 52 to form a box-shaped section or slide, which may be designated as a whole by the numeral 53. This slide 53 is adapted to move longitudinally of the machine within another box formed of the channels 54 and the plates 55, which are secured to the cross channels 56 by angles 57, these cross channels being in turn secured to the frame 1 of the machine. Within the slide 53 is secured the fluid pressure cylinder 58, having the piston 59, cylinder head 60, piston rod 61, and the stuffing box 62. The forward end of the piston rod 61 is flanged as at 62ª, and bolted to a cross beam 63 by bolts 64. The cross beam 63 is secured to the frame 1 of the machine. It will be obvious that when fluid pressure is admitted to the cylinder 58 between the piston 59 and cylinder head 60, as by the opening 65, the slide 53, the clamping jack 43, the rear axle 41, and truck wheels 38 will be shoved bodily away from the frame of the machine, 1, and that if the clamping jack 43 is also under fluid pressure at the same time so that it resists the thrust of the cylinder 58, then the whole machine, except the clamping jack and connecting parts, will be moved forward. The drive chains 36 are adapted to propel the machine from place to place in the mine and are to be taken off when the machine is fed against the coal by the action of the cylinder 58.

At the front end of the machine, adjacent to the main casting 2, there are placed four channels 66, secured to and forming a part of the frame 1. These channels support the weight of the front end of the machine and transfer the same to a pair of cylinders 67 containing the double ended plunger 68, the central part of which is provided with rack teeth 69, meshing with a pinion 70 keyed to the upper end of a pin 71. The cylinders 67 are secured to the upper face of a turn-table 72 resting on a series of balls 73, which transfer the weight to an axle-housing 74, having the bearings 75. Within these bearings is mounted the axle 76, to the outer ends of which are secured the front truck wheels 77, and a boss 78 is formed on the axle-housing 74 to receive the lower end of the pin 71, which is firmly secured thereto by a smaller pin 79. It is evident from the above construction that the admission of fluid pressure to either of the cylinders 67 will cause the plunger 68 to actuate the pinion 70, and cause the pin 71 to twist the axle-housing 74 and truck wheels 77 in a circle centered on the pin 71. The construction of the cylinder 67 is so arranged that when the plunger 68 is at one end of its stroke, the axle 76 stands transversely to the machine; and when the plunger 68 is at the other end of its stroke, the axle stands longitudinally with the machine. The above arrangement provides the necessary position for the front truck wheels 77, so that the forward end of the machine may be moved transversely across the entry to make the cut, or the machine may be moved longitudinally from place to place in the mine. Secured to the forward end of the frame 1, we provide a pair of feeding jacks 80, which are pivoted to the frame 1 at 81. These jacks 80 may be of any desired construction and similar to the jack 43.

At the center of the machine, we provide a reservoir 82 for the compressed air supplied by air pump 40, from which reservoir the air may be led to jacks 43 and 80 by suitable flexible pipe connections, which we have not shown in detail. Vertical saw 19 is adapted to be forced sidewise into the coal, and then traversed endwise through the coal, so that it is supplied with a double set of cutters to permit of this action. The saw consists of a blade 83, secured by the rivets 84 to the flange 85 on the shaft 16. A series of radial slots 86, 87, and 88 are formed in the blade 19. The slots 86 occupy the outer third of the radius of the saw. The slots 87 occupy the middle third of the radius and the slots 88 the inner third of the radius. The slots 86, 87, and 88 are at approximately equal angles to each other as shown. The shape of the slots is shown in section in Fig. 5, which also shows the cutters 89, which have the cutting points 90. At the outer end of slots 86, a set screw 91 is provided to lock the outer cutter in position. The cutters in slots 87 and 88 are introduced through the holes 92, which are plugged with a piece of wood after the introduction of the cutters. The saw blade 83 is provided with holes 93 to facilitate the egress of the cuttings through the slot 94 which is cut in the coal by the saw 19.

Around the circumference of the blade 83 there are formed a series of slots 95, containing the cutters 96, which are held in place by the wedges 97. These cutters 96 are preferably formed on the right hand, left hand, and center as shown at 96ª, 96ᵇ, and 96ᶜ. The height of the cutting point

90 of cutter 89 measured from the face of the saw blade 83 is less than the height of the cutting points on cutters 96, measured from the same face, so that when the saw is cutting edgewise, the cutters 89 are not in action. In Figs. 12 and 13, we have shown a modified construction, consisting of two vertical saws and two horizontal saws instead of two horizontal saws and one vertical saw as shown in Fig. 3. The object of this modification is to lessen the amount of slack which is made when the vertical saws are forced sidewise into the coal in order to begin their cut. When this modification is used, the casting 98 will replace the casting 2.

Supported in bearings 99 and 100, forming part of the casting 98, are the shafts 101 carrying the vertical saw 102. The bearings 103 and 104 forming part of the casting 98 support the shafts 105, which carry the top and bottom saws 106 and 107 respectively. Secured to the shafts 105 are the bevel gears 108, which mesh with a third bevel gear 109 secured to the shaft 110, which is supported in the bearings 111 and 112. Mounted on the shaft 110 is the spur gear 113 meshing with the spur gears 114 on the shafts 100. It is obvious that power being applied to the shaft 110, same will be transmitted to the spur gears 113, and 114 of the vertical saws 102 and through the bevel gears 109 and 108 of the horizontal saws 106.

The operation of our improved machine is as follows:—The machine is made to propel itself to the desired location in the mine by means of the drive chains 36. Upon arriving at the working place, the front end of the machine is placed close to the side of the entry or room with the vertical saw close up against the coal. The clamping jack 43 is then put under the influence of fluid pressure so as to rigidly fasten the rear end of the machine to the roof and floor of the mine. Fluid pressure is then admitted to the cylinder 58, which by the action of the connecting parts causes the front end of the machine to travel into the coal, the top and bottom saws 8 and 12 cutting slots at the top and bottom of the coal seam, and the vertical saw 19 acting like an end milling cutter, grinding up the coal into slack. As the saw 19 is further advanced into the coal, this slack falls through the holes 93 in the saw blade 83 to the inside of the saw. After the saw 19 has been advanced into the coal a distance equal to the stroke of the cylinder 58, or any other convenient distance, the cylinder 58 is relieved from the action of the fluid pressure and one of the jacks 80 is swung against the wall so as to be in position to push the front end of the machine sidewise. The application of fluid pressure to this jack 80 then swings the front end of the machine across the room or entry, the machine being pivoted rigidly by the jack 43, and the front truck wheels 77 being in the position shown in Fig. 3. This action results in the cutting of parallel horizontal slots across the face of the entry by the top and bottom saws 8 and 12, and a curved vertical slot by the vertical saw 19; at the same time the cutters 20 on shaft 16 dig out the coal in advance of the shaft 16 so as to make clearance for the same. The result of thus swinging the machine across the entry is shown in Fig. 11, in which 115 is the hole bored by the vertical saw 19; 116 is the slot cut by the cutters 20 on the shaft 16, and 117 is the vertical slot cut by the saw 19 when swung across the face of the entry.

The slots cut by saws 8 and 12 are shown at 118 and 119. It is obvious that the coal having been cut from its original bed on three sides may be easily dislodged by wedging, or with a pick, or by any suitable machinery, and that an entry or room of indefinite length can be mined by the above process entirely without the use of explosives. It will be further obvious that although a considerable portion of the coal is ground up into slack by the action of the saw 19, yet the remaining coal is in such a condition that it may be readily removed in large lumps. It is also obvious that many other arrangements and parts might be substituted by a skilled designer for those shown by us, without departing from the spirit of our invention, which is covered by the following claims:—

1. In a mining machine, a circular saw mounted in a horizontal shaft, said shaft being movable forward and sidewise, teeth on one side of the saw to cut when the saw is fed forward in a direction parallel to the shaft, teeth on the edge of the saw to cut when the saw is fed sidewise at right angles to the shaft, means for driving said saw, means for feeding it forward and means for feeding it sidewise.

2. In a mining machine, a circular saw mounted on a horizontal shaft, said shaft being movable forward and sidewise, teeth on one side and the edge of the saw, teeth on the shaft adapted to cut clearance therefor, means for driving the shaft, means for feeding it forward, and means for feeding it sidewise.

3. In a mining machine, a vertically arranged saw, teeth on one side and the edge of said saw, means for advancing the saw bodily into the coal, and means for moving the saw laterally therein.

4. In a mining machine, two vertical shafts one above the other, a saw on each of said shafts, a horizontal shaft in the same plane as the said first two shafts, a saw on said horizontal shaft, means for advancing

the above elements into the coal in a direction parallel to the horizontal shaft and means for moving the same laterally therein.

5. In a mining machine, a frame pivoted at its rear end, a vertical saw and two horizontal saws mounted on the front end of said frame, means for advancing said saws into the coal, means for driving said saws, and means for swinging said frame about said pivot.

6. In a mining machine, a frame, a vertical and two horizontal saws mounted thereon, said saws having their axes in a common vertical plane, and a fluid pressure cylinder for feeding said frame forward to carry said saws into the coal.

7. In a mining machine, a frame, a guide secured thereto, a slide working in said guide and supporting the rear end of the machine, an axle secured to said slide and wheels on said axle.

8. In a mining machine, a frame, a horizontal shaft carried thereby, a vertical saw thereon, a vertical shaft mounted above said horizontal shaft and in the same vertical plane, a horizontal saw thereon, a second vertical shaft below said horizontal shaft and in line with said first vertical shaft, a horizontal saw thereon, means for driving said horizontal shaft and bevel gears connecting said horizontal and vertical shafts.

9. In a mining machine, a frame pivoted to its rear end, a plurality of saws carried thereby to cut the coal, a clamping jack adjustably connected to said frame, means for clamping said jack, means for pushing said frame forward against the resistance of said jack when clamped, means for drawing said jack toward the machine when not clamped, and means for swinging said frame about its pivot.

10. In a mining machine, pivoted frame, a motor mounted thereon, an air pump driven thereby, saws for cutting the coal, means for driving said saws, a pneumatic cylinder for feeding the machine forward, and a pneumatic cylinder for swinging the frame about its pivot.

11. In a mining machine, a frame, a horizontal shaft, a vertical saw and a bevel driving gear thereon, two vertical shafts each having a horizontal saw thereon, and a driven bevel gear on each vertical shaft meshing with said bevel driving gear, means for driving said horizontal shaft and means for moving said frame to feed said saws to make their cuts.

12. In a mining machine, a frame, a guide secured thereto, a slide working in said guide and supporting the rear end of the machine, an axle secured to said slide, wheels on said axle, a motor and connections from said motor to said wheels to drive the latter.

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