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

MINING MACHINE.

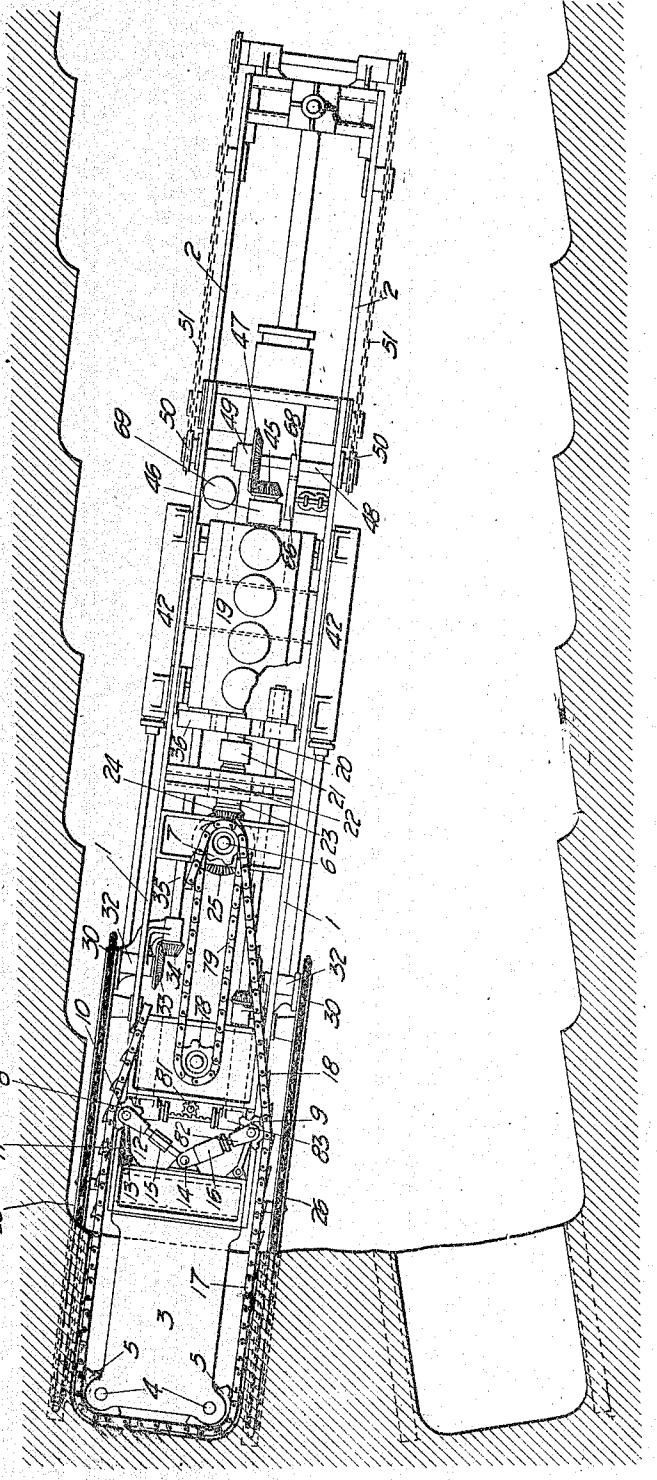
APPLICATION FILED MAR. 27, 1909.

1,184,358.

Patented May 23, 1916.

5 SHEETS—SHEET 1.

FIG. 1.



WITNESSES

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5 SHEETS—SHEET 2.

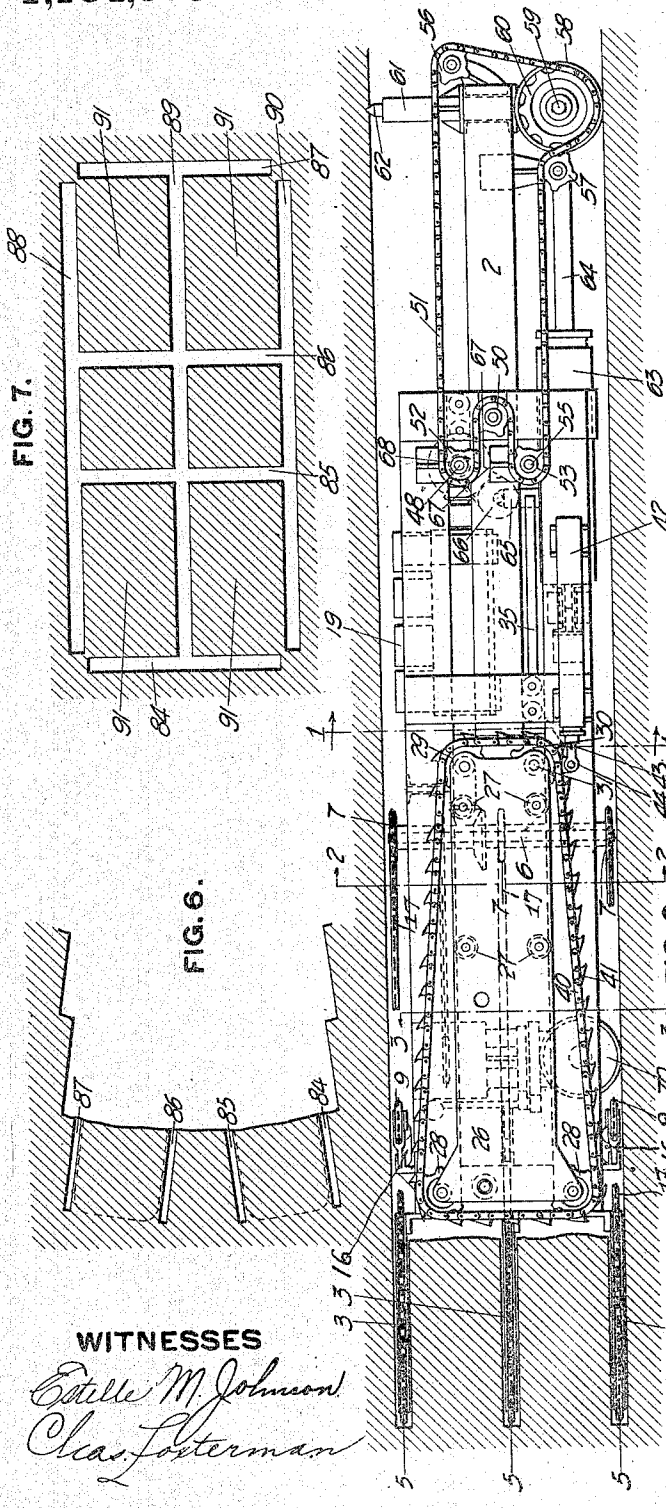


FIG. 2.

FIG. 7.

FIG. 6.

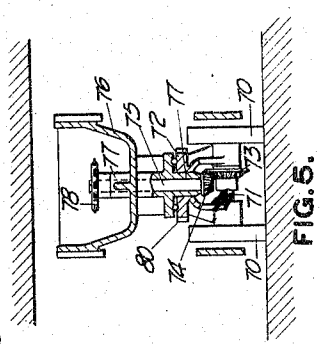


FIG. 5.

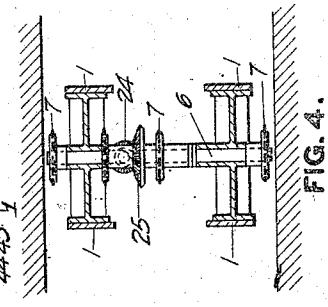


FIG. 4.

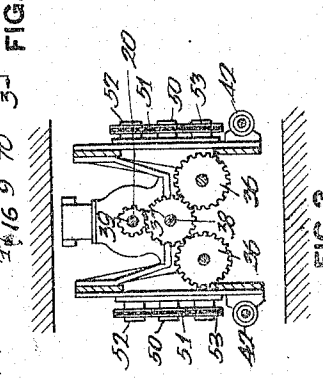


FIG. 3.

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MINING MACHINE.

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5 SHEETS—SHEET 3.

FIG.10

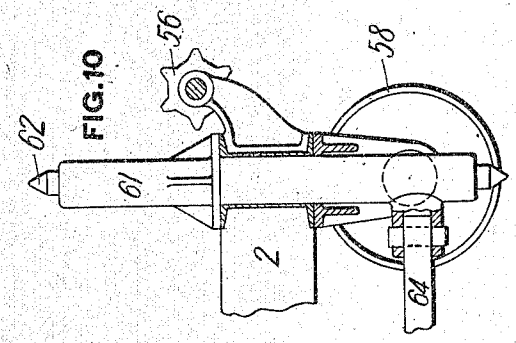


FIG.9

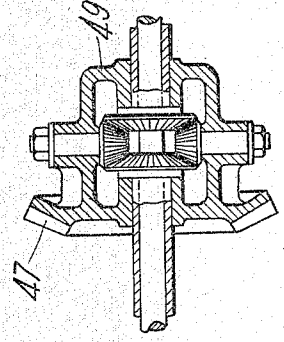


FIG.8

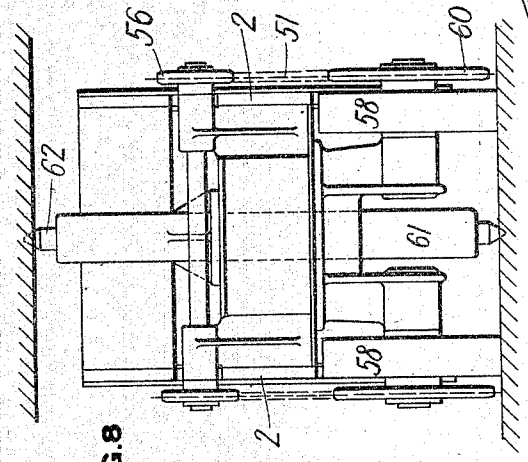
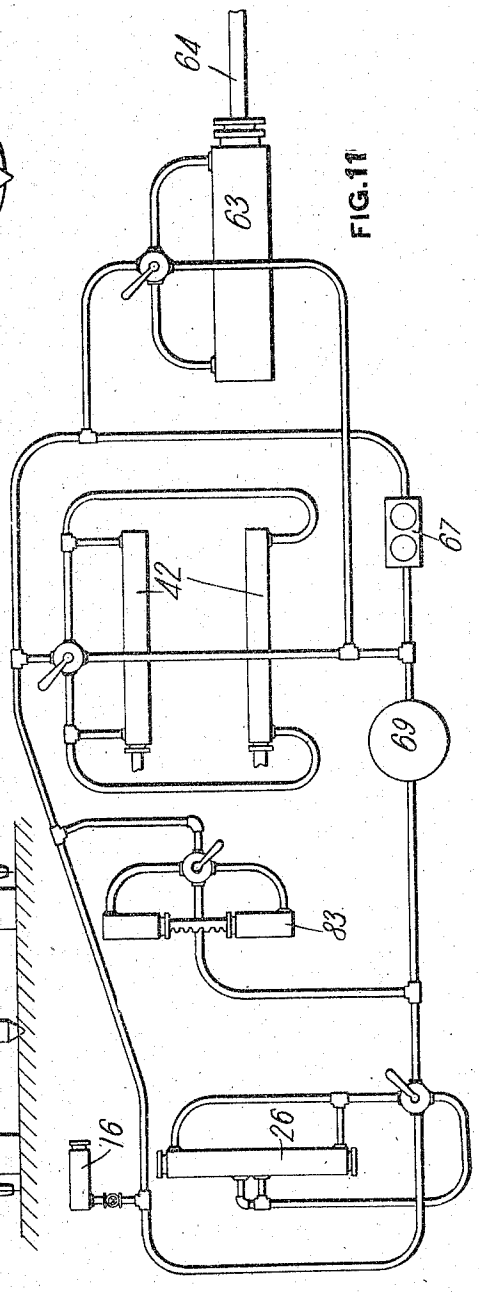


FIG.11



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APPLICATION FILED MAR. 27, 1909.

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5 SHEETS—SHEET 4.

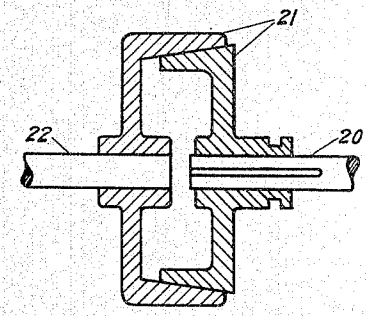


FIG. 13.

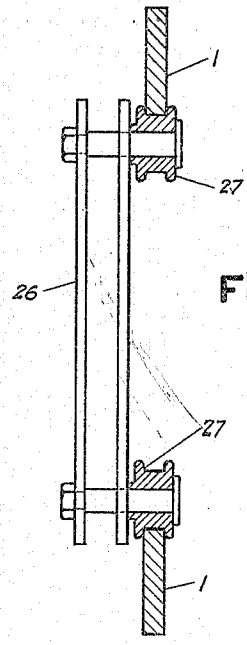
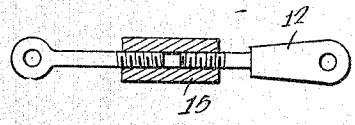


FIG. 14.

FIG. 12.



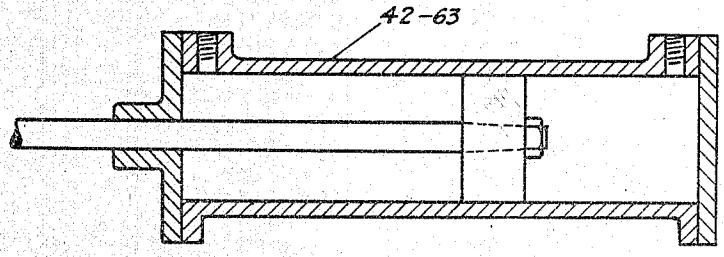


FIG. 15.

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MINING MACHINE.

APPLICATION FILED MAR. 27, 1909.

1,184,358. Patented May 23, 1916.

5 SHEETS—SHEET 5.

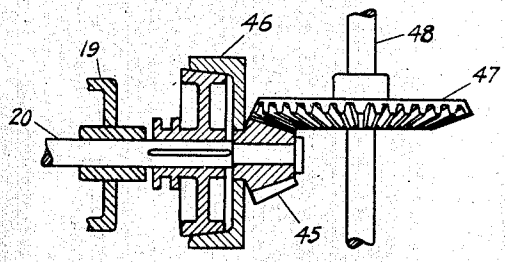


FIG. 16.

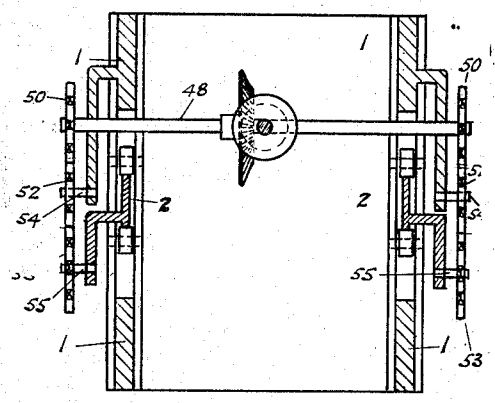


FIG. 17.

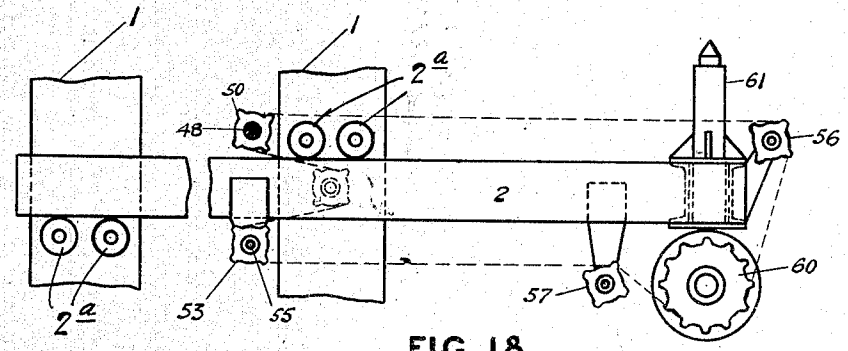


FIG. 18.

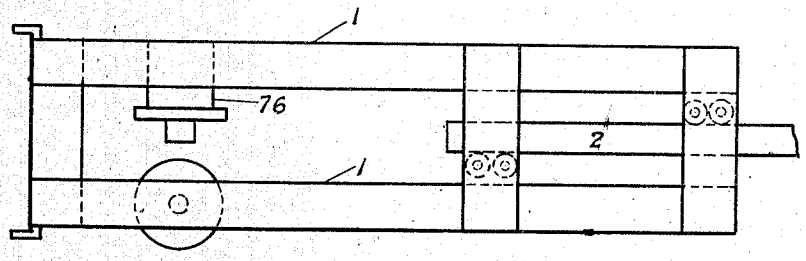


FIG. 19.

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UNITED STATES PATENT OFFICE.

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MINING-MACHINE.

1,184,358. Specification of Letters Patent. Patented May 23, 1916.

Application filed March 27, 1909. Serial No. 486,148.

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.

The objects of our invention are to provide a machine adapted to mine the full vertical height of a coal seam; to mine the coal without the use of explosives; to mine the major portion of the coal in very large lumps; to provide a machine adapted to cut narrow entries or rooms, and to provide a strong serviceable and fast machine for the above purposes, together with such minor improvements and devices as will be hereinafter set forth.

Our invention comprises, generally stated, a substantial frame work mounted upon four wheels, which are adapted to run on the floor of a mine. At the front end of the frame, there are mounted three cutting chains, operating in horizontal planes, and two cutting chains operating in vertical planes. At the center of the machine, there is provided a motor for operating the various mechanisms, and the rear of the machine is provided with a pair of power operated traction wheels and a fluid pressure jack, which is used as a fulcrum to force the cutting chains into the coal.

Referring to the drawings, Figure 1 is a plan view of our improved machine, showing the same in working position in an entry in a mine. Fig. 2 is a side elevation of the same, showing the machine in operation in a coal seam. Fig. 3 is a sectional elevation on the line 1—1 of Fig. 2. Fig. 4 is a sectional elevation on the line 2—2 of Fig. 2. Fig. 5 is a sectional elevation on the line 3—3 of Fig. 2. Fig. 6 is a plan view through the end of an entry, showing the cuts made therein by the machine. Fig. 7 is a sectional elevation of the same on a larger scale. Fig. 8 is a rear elevation of the machine. Fig. 9 is a cross section through the bevel gear 47 and the differential 49. Fig. 10 is a sectional elevation showing the attachment of the supplementary frame 2 and the plunger 64 to the rear jack cylinder 61. Fig. 11 is a diagram showing the various pressure operated mechanisms and their pipe connections. Figs. 12, 13, 14, 15, 16, 17, 18 and 19 are details.

The frame of the machine consists of two parts,—a main frame 1, and a supplementary frame 2. At the front of the machine there are mounted three pairs of forwardly extending plates 3. All of these may be arranged to be adjusted vertically, although in practice it will be sufficient to have the upper and lower ones adjustable. Each pair of plates 3 is provided with a pair of stationary pivot pins 4, upon each of which there is mounted an idler sprocket 5. Mounted in suitable bearings on the frame 1 is the vertical shaft 6. This shaft has secured thereto three sprockets 7, each horizontally in line with one of the sprockets 5. Between the sprockets 5 and the sprockets 7 are the sprockets 8 and 9. The sprocket 8 is loosely mounted on a pin 10, the same being secured to the swinging links 11 and 12. The opposite ends of the links 11 and 12 are pivoted to the frame 1 by the pins 13 and 14. The link 12 comprises two parts connected by the sleeve nut 15, by which the length of the link may be changed. A similar construction is used on the opposite side of the machine, except that the sleeve nut 15 is replaced by a fluid pressure cylinder 16. The sprockets 8 and 9 are thus adapted to act as take-ups to take up the slack of the chain about to be described. By placing the fluid pressure cylinder 16 in constant communication with a pressure reservoir, the same acts automatically to maintain a uniform tension on the slack side of the chain.

The chains 17, of which there are 3, are passed around the sprockets 5, 7, 8, and 9. These chains may be of any desired construction, such as is in common use for chain undercutting machines. Chains 17 are provided at intervals with cutting teeth 18, which are adapted to cut grooves or slots in the coal. In the rear of the shaft 6 there is mounted on the frame 1, a motor or engine 19. In the drawings, we have illustrated this as a four-cylinder gasolene engine, although for the desired purposes there might be substituted an electric motor or a compressed air engine.

The shaft 20 of the engine 19 is connected by means of the friction clutch coupling 21 to a short shaft 22 mounted in the bearing

23 secured to the frame 1. The shaft 22 carries a bevel pinion 24, which meshes with a bevel gear 25 secured to the shaft 6. Power is thus applied to drive the horizontal chains 17.

At each side of the frame 1, there is retracted to a position flush therewith. Each supplementary frame 26 has secured thereto four rollers 27. The rollers 27 engage the top and bottom members of the frame 1 in such a manner that the supplementary frames 26 may be extended several feet beyond the forward end of the frame 1 or retracted to a position flush therewith. Each frame 26 carries a pair of idler sprockets 28, at the front end thereof, an idler sprocket 29 at the rear end thereof, and a driving sprocket 30 also at the rear end thereof. The driving sprockets 30 are mounted on shafts 31 supported in the bearings 32. Upon the shafts 31 are mounted the bevel gears 33, meshing with and being driven by bevel pinions 34 upon the shafts 35. Upon each of the shafts 35 there is loosely mounted a spur gear 36, so arranged that the shaft 35 may slide through the gear 36 and at the same time be always in driving engagement therewith. The gears 36 both mesh with and are driven by the idler gear 37 supported on the pin 38 secured to the frame 1.

Upon the engine shaft 20 there is fixed a spur pinion 39 meshing with the spur gear 37, and driving, by means of the above described connections, the side chains 40. Side chains 40 are passed around the sprockets 28, 29, and 30, and are provided with the cutting teeth 41. These chains may be duplicates of the horizontal chains 17, or of any desired construction.

In order to feed the chains 40 into the coal, we have provided the double acting fluid pressure cylinders 42 secured to the frame 1. The piston rods 43 of these cylinders are connected by the pin 44 with the supplementary frames 26, each frame 26 having an independent cylinder.

In order to drive the machine as a whole, the following mechanism is employed:—A bevel pinion 45 is loosely mounted upon the ends of the shaft 20 and connected thereto at will by the friction clutch 46, which may be of any desired construction. The bevel pinion 45 meshes with and drives the bevel gear 47 upon a divided shaft 48. Power is differentially applied to the two ends of the shaft 48 through the differential 49. Each end of the shaft 48 carries a sprocket 50, which drives a chain 51. The chain 51 is led around the driving sprocket 50, and also around the idler sprockets 52 and 53. The idler sprocket 52 is mounted on a pin 54 secured to the frame 1. The idler sprocket 53 is mounted on a pin 55 mounted on the supplementary frame 2. Additional idler sprockets 56 and 57 are mounted upon pins secured to the supplementary frame 2. The rear truck wheels 58 are loosely mounted on the axle 59 and secured to each truck wheel 58 there is a sprocket 60. The chain 51 engages the sprockets 50, 52, 53, 56, 57, and 60. Power being applied to the sprockets 50, the same will be transmitted to the truck wheels 58 by means of the sprocket 60. The peculiar arrangement of sprockets and chains shown allows of the telescoping of the supplementary frame 2 within the main frame 1, at the same time providing a constant drive to the truck wheels 58. The friction rollers 2^a provide for the easy movement of the telescoping members.

The fluid pressure jack 61 is secured to the supplementary frame 2, and is supplied with upper and lower pointed plungers 62 adapted to grip the roof and floor of the mine. The lower plunger 62 extends through the axle 59 as shown in Figs. 8 and 10. If now fluid pressure be applied to the cylinder 61, the plunger 62 will be forced into gripping action with the coal, and with cylinder 61 as a fulcrum, the whole machine may be moved in either direction to a limited extent, by means of the double acting fluid pressure cylinder 63 secured to the frame 1, the piston rod 64 of which is connected to the cylinder 61.

At 65 we have shown diagrammatically a small air pump having a pulley or sprocket 66, which may be driven by a chain or belt 67; also, a pulley or sprocket 68 upon the shaft 48. The fluid pressure generated by the pump 65 is passed to a reservoir 69, from whence it may be piped to the various fluid pressure cylinders as needed.

At the front end of the machine we have provided a pair of ground bearing wheels 70, mounted upon swinging axle 71 supported in the axle housing 72. The axle 71 carries the bevel gear 73, the same meshing with and being driven by a bevel pinion 74 upon the vertical shaft 75. This shaft 75 extends up through a bracket 76 in which are formed the bearings 77. Upon the upper end of the shaft 75 is mounted the sprocket 78. The sprocket 78 may be driven by the chain 79, which is in turn driven by a sprocket upon the shaft 6. The axle housing 72 may be rotated about the center of the shaft 75, by means of the teeth 80, to which power can be applied in any convenient manner, as by a spur pinion on a shaft 81 actuated by the rack 82, which in turn is actuated by fluid pressure cylinders 83.

In Figs. 6 and 7, we have illustrated the cuts made in the coal by the various mechanisms above described. The cuts 84, 85, 86, and 87 are made by the side chains 40, and the cuts 88, 89, and 90 are made by the horizontal chains 17. From Fig. 7 it will be

evident that after the cutting operation is complete, the coal being cut from its native bed on all sides, it may be readily dislodged by wedging or similar means in extremely large lumps. The entry, of which a section is shown in Fig. 7, is five feet high by eleven feet wide, and the depths of the cuts are four feet. The lumps 91 would be approximately 2 ft. x 3¼ ft. x 4 ft., and could be even larger if desired.

The operation of our improved machine is as follows: An entry having a smooth level bottom having been prepared for the reception of the machine, the machine is run therein with its front end close up to the face of the coal, and with the rear jack 61 in the center line of the entry. The supplementary frame 2 being telescoped within the main frame for the full extent of its stroke, the front truck wheels 70 are then swung sidewise, and the front end of the machine traversed across the face of the entry, close to the side wall of the coal, by the rotation of the truck wheels 70. This motion is then stopped, and the truck wheels 70 thrown into the position shown in Fig. 2, ready for advancing the machine into the coal. The rear jack 61 is then clamped by the application of fluid pressure and the motor or engine 19 being in operation, fluid pressure is applied to the cylinder 63. Fluid pressure is also applied to the cylinders 42 causing the side chains 40 to move forward in unison with the horizontal chains 17. This action is continued until all five of the cutting chains have buried themselves to their full stroke in the coal, after which operation the cuts 86 and 87 have been completed and portions of the cuts 88, 89, and 90 have been made. The side chains 40 are then withdrawn to the position shown in Fig. 2, by the action of the fluid pressure cylinders 42. The main frame 1 is also withdrawn until the front end of the chains 17 clear the coal, at which time the machine is swung sidewise by means of the traction of the front truck wheels 70, into a central position in the entry. The side chains 40 are allowed to remain in the position shown in Fig. 2, and the main frame 1, carrying the horizontal chains 17 is shoved forward by the action of the cylinder 63, as before, to make the middle portions of cuts 88, 89, and 90. At the completion of this operation, the main frame 1 is withdrawn as before, and the front end of the machine swung clear over to the left side of the entry or room, after which all five of the cutting chains are advanced to make the cuts 84 and 85, and complete the cuts 88, 89, and 90. At the completion of this third operation, the full number of cuts is complete as shown in Fig. 7. The machine may then be propelled rearwardly by its own traction, and steered to one side of the entry, after which mine cars may be brought to the face of the coal and the same loaded thereon for transportation out of the mine.

From the foregoing, it will be evident that we have provided a machine adapted to mine the entire thickness of the coal seam for a convenient width, and that the majority of the coal will be in very large lumps. At the same time, we have used mechanisms of usual and ordinary construction, so combined as to achieve the above results.

Many changes and variations in the design, construction, and operation of our invention may be made by those skilled in these several arts, without departing from the spirit of our invention, and we therefore desire to claim and hold as ours all the patentable subject matter covered by the following claims:

1. In a mining machine, a frame, a plurality of cutting chains mounted in intersecting planes thereon, means for advancing the chains to make simultaneously intersecting cuts in the coal, means for withdrawing the machine therefrom, a pivot at the rear end of said frame, and means for swinging the machine about said pivot to position it for a second cut adjacent to the first, whereby an entry or tunnel may be cut out wider than the machine.

2. In a mining machine, a cutting chain operating in one plane, a second cutting chain operating in a plane at an angle to the first, and means for separately advancing one of said chains to make a cut while the other is out of action.

3. In a mining machine, a plurality of cutting chains operating in horizontal planes, another cutting chain operating in a vertical plane, and means for feeding the first mentioned chains into the coal without the last mentioned chain or for feeding all of said chains in together.

4. In a mining machine, an undercutting chain, a shearing chain, means for feeding in both together, and means for withdrawing the shearing chain independently of the undercutting chain.

5. In a mining machine, a frame, a shearing chain at one side thereof, a second shearing chain at the other side thereof, and independent means for feeding each of said chains to make its cut.

6. In a mining machine, a frame, a shearing chain mounted at each side thereof, and means independent of the movement of said frame and of each other for feeding each of said chains to make its cut.

7. In a mining machine, a main frame, means for feeding the whole machine forward, a carriage adjustably mounted on said main frame, a vertical cutting chain carried by said carriage, and a pressure cylinder for feeding said carriage forward independently of said main frame.

8. In a mining machine, a main frame, a carriage adjustably mounted on each side of said frame, each having an independent forward feed, a cutting chain mounted on each of said carriages adapted to shear the coal, and cutting mechanism mounted on said main frame between said carriages.

9. In a mining machine, a main frame, an independently adjustable shearing chain mounted at each side thereof, a series of horizontal cutting chains located one above the other and between said shearing chains, means for driving all of said chains, and means for feeding the machine forward to cause all of said chains to cut simultaneously.

10. In a mining machine, a frame, three horizontal cutting chains mounted thereon, a vertical shaft, three sprockets secured thereto, adapted to drive said horizontal chains, a motor, bevel gears connecting said motor shaft and said vertical shaft, a shearing chain mounted at each side of said frame, a longitudinal drive shaft therefor, and spur gearing connecting said motor shaft and each of said longitudinal shafts.

11. In a mining machine, a frame, three horizontal cutting chains mounted thereon, a motor, connections from said motor to drive said chains, a longitudinally movable carriage at each side of said frame, a shearing chain on each of said carriages, a shaft mounted on each side of said frame, a gear mounted on each of said carriages, and slidably engaging said shaft, power connections between each of said gears and a shearing chain, and power connections between each of said shafts and said motor.

12. In a mining machine, a frame, a plurality of horizontal cutting chains mounted one above the other at the front end thereof, a vertical driving shaft, a sprocket on said shaft for each of said chains and a pair of guide wheels for each of said chains adjacent to the coal being cut, said guide wheels being located in advance of any other part of the machine.

13. In a mining machine, a frame, an adjustable carriage at one side thereof in a vertical plane, a shearing chain on said carriage, means for driving said chain, and a fluid pressure cylinder for moving said carriage to feed said chain to its work.

14. In a mining machine, a frame, horizontally operating cutting devices mounted at the front end thereof, an adjustable carriage carrying a shearing chain at each side of said frame, and a pneumatic cylinder controlling the adjustment of each of said carriages.

15. In a mining machine, a frame, three horizontally operating and two vertically operating cutting devices thereon, and means for driving and feeding all of said cutting devices to cut simultaneous slots in the coal, whereby at each forward motion of the machine the coal in front thereof is sub-divided into two blocks hanging by one end only.

16. In a mining machine, a frame, three horizontally operating and two vertically operating cutting chains thereon, and means for driving and feeding said chains to cause them to make intersecting cuts, thereby substantially separating a portion of standing coal into two blocks hanging by one end only.

17. In a mining machine, a main frame, a second frame adjustably mounted on the main frame, the second frame holding a plurality of chain cutters at the forward end thereof arranged to operate in different planes, power operated means to advance the second frame forward into the coal, power operated means to withdraw the second frame after the cut has been made, and means to swing the main frame sidewise to position the machine for a new cut.

18. In a mining machine, a suitable frame and a power operated horizontal cutting chain adapted to make a horizontal undercut in a coal seam, two power operated vertical cutting chains arranged to make two shearing cuts in the coal above and at each side of the cut made by the horizontal undercutting chain, thereby severing the coal at the bottom and at the two sides, power operated cutting tools of such width to extend the entire space between the two vertical cutters arranged to operate above the undercutter and to make cuts extending the same distance as the undercut across the coal as it feeds forward between the two vertical chain shearing cutters, and power operated means to advance all of said cutters simultaneously into the coal.

19. In a mining machine, a frame, a plurality of cutting chains mounted in intersecting planes thereon, means for simultaneously advancing the chains to make intersecting cuts in the coal, means for withdrawing the chains therefrom, and means for moving the front end of the machine sidewise to position it for a second cut adjacent to the first, whereby an entry or tunnel may be cut wider than the machine.

20. In a mining machine, a suitable frame, a plurality of power-operated chain cutters, two of which are substantially parallel, mounted in intersecting planes with a chain undercutter at the forward end of the frame, power-operated means adapted to make a plurality of cuts in the coal between the parallel chain cutters and above the undercutter, and power-operated means to advance all the cutting elements forward into the coal, means to move the machine forward, backward or sidewise.

21. In a mining machine, a suitable frame, a plurality of power-operated chain cutters,

one, an undercutter and two others being parallel chain cutters, mounted in intersecting planes with the undercutter at the forward end of the frame, power-operated means adapted to make a plurality of cuts in the coal between the parallel chain cutters and above undercutter, and power-operated means to advance all of the cutting elements forward into the coal simultaneously, power-operated means to withdraw some of the chain cutters after the coal has been cut into, and means to move the frame sidewise to position some of the cutters for a new forward cut.

22. In a mining machine, a suitable frame and a power-operated cutting chain adapted to make an undercut in the bottom of the coal seam, a power-operated chain shearing cutter adapted to make a shearing cut above the horizontal cut made by the chain undercutter, a plurality of power-operated cutting members arranged to cut into the coal above the bottom cutter and to one side of the shearing cutter, means to advance all the cutting elements to their work, means to withdraw some of said cutters independently, and means to move all of the cutters sidewise.

23. In a mining machine, a suitable frame and a power-operated undercutting device, a plurality of power-operated shearing devices, a cutting device operating between the shearing devices and above the undercutting device, means to operate all the cutting devices together and means to advance them into the coal forwardly at substantially right angles to the face of the coal, means to withdraw or advance the cutters operating in one plane independently of those operating in another plane.

24. In a mining machine, a frame, a horizontal cutting device, means to operate the horizontal cutting device, a cutting device working at an angle to the horizontal, means to feed forward and work the vertical cutting device independently of the horizontal cutting device, means to feed the machine forward, means to move it rearwardly and means to move it sidewise.

25. In a mining machine, a frame, a plurality of cutting elements mounted thereon and arranged to cut a plurality of slots in the coal whereby a plurality of blocks of coal are left hanging by one end only, power-actuated means to feed the machine forward to its work, power actuated means to move it rearwardly, and power-actuated means to move it sidewise to position it for its next operation.

26. In a mining machine, a main frame, a second frame adjustably mounted on the main frame, the second frame holding a plurality of chain cutters at the forward end thereof, power-operated means to advance the second frame forward into the coal substantially at right angles to the face, power-operated means to withdraw the second frame, and means to move the main frame sidewise to position the machine for a new cut.

27. In a mining machine, a frame, mining devices carried on said frame, a cutting mechanism mounted on a carrier supported on said frame and adapted to move thereon, power-actuated means for moving said cutting device, and power-actuated means for moving the frame forward, backward or sidewise.

28. In a mining machine, a frame, an overcutter mounted on said frame, a second cutter arranged to cut into the coal below the plane of the overcutter, means to operate the cutters, means to feed them forward, means to feed the overcutter sidewise through the coal, means to move the machine forward, means to move it rearwardly, means to move it sidewise.

29. In a mining machine, a main frame, a motor supported on said frame, a second frame movably mounted on said main frame, a shaft mounted on said main frame and slidably mounted in said second frame, a cutter mounted on said second frame, power connections from said motor to said shaft and from said shaft to said cutter, power-actuated means to move the machine forward, sidewise and rearwardly.

30. In a mining machine, a main frame, a motor mounted on said main frame, a second frame movably mounted on said main frame, a cutter mounted on said second frame, power connections between said motor and said cutter, means to operate said cutter, and means to move said cutter and operate it at the same time by means of said motor, means to move the machine forward, backward and sidewise.

31. In a mining machine, two frames, one frame engaging with the other, one frame supporting cutters, power-actuated means to feed one of the frames forward or backward while the other is stationary, power-actuated means to move the machine forward, backward or sidewise whereby a wall of coal wider than the machine may be attacked by the cutting elements.

32. In a mining machine, a frame, an adjustable carrier at one side thereof, a shearing chain mounted on said carrier, power-actuated means to move said carrier to feed said shearing chain to its work independently of the movement of said frame, power-actuated means to withdraw said chain, power-actuated means to move said frame sidewise, power-actuated means to move both frame and cutter forward together or move them rearwardly together or sidewise while operating in a fixed relationship one with the other.

33. In a mining machine, a frame, cutting

means carried thereby arranged to make a horizontal cut in the coal, a cutter arranged to make a cut forwardly at an angle to the horizontal, means to withdraw said last-mentioned cutter from its cut, means to feed the horizontal cutter forward, power-actuated means to feed it sidewise, means to move the machine forward, means to move it rearwardly, and means to move it sidewise.

34. In a mining machine, a frame, a horizontal cutter, a cutter arranged to make a cut at an angle to the horizontal, means to feed the horizontal cutter to its work, means to work both cutters together or independently of each other, means to feed the machine forward, means to move it rearwardly, means to move it sidewise.

35. In a mining machine, an extensible frame, a motor, mechanism operated by said motor for extending said frame, and mechanism also driven by said motor for moving said frame sidewise whereby the machine may be positioned for another cycle of operations.

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