Nov. 26, 1929. D. T. FISHER 1,736,853

MINING MACHINE

Filed March 8, 1924 2 Sheets-Sheet 1

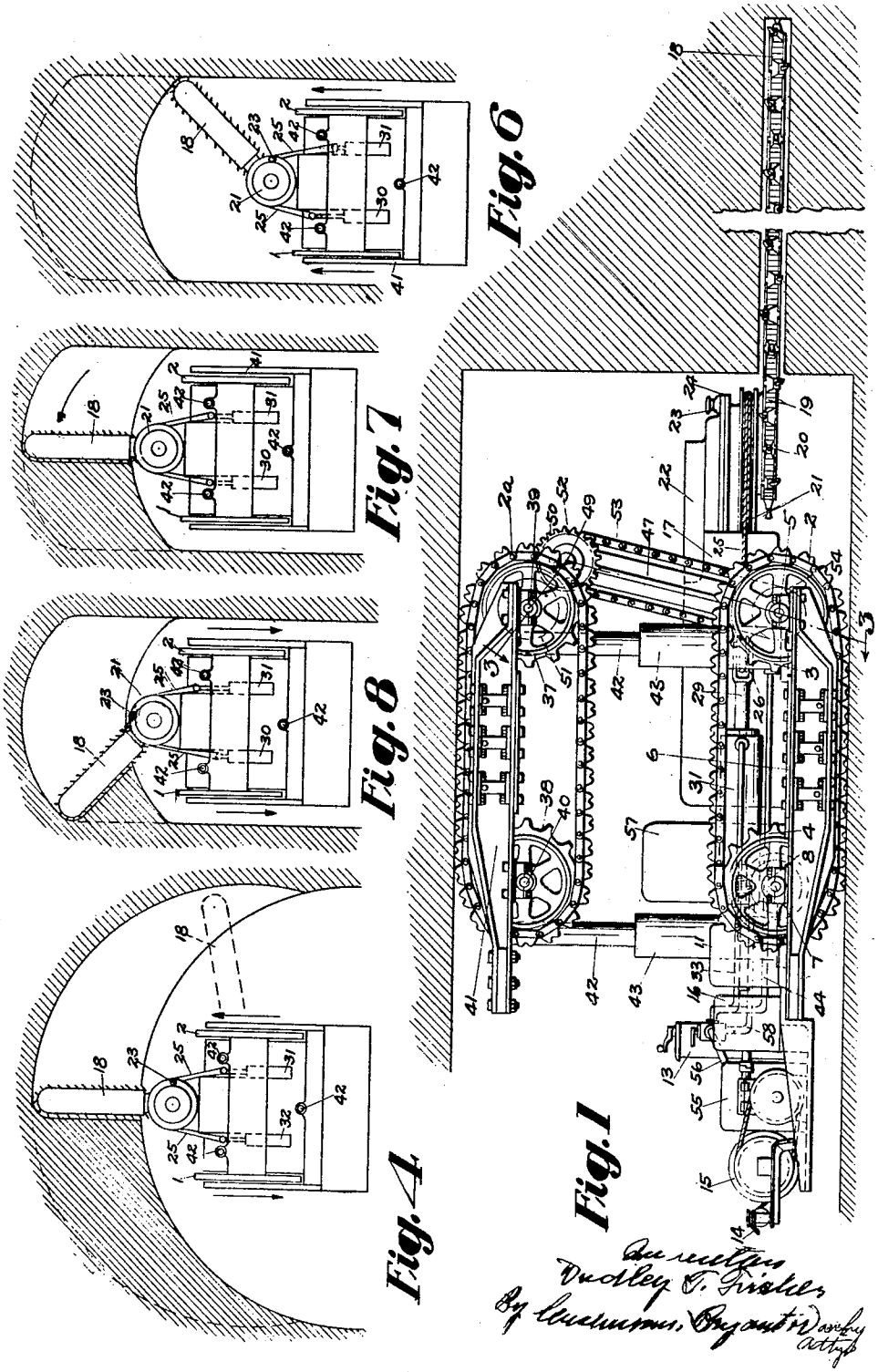


Fig. 6

Fig. 7

Fig. 8

Fig. 4

Fig. 1

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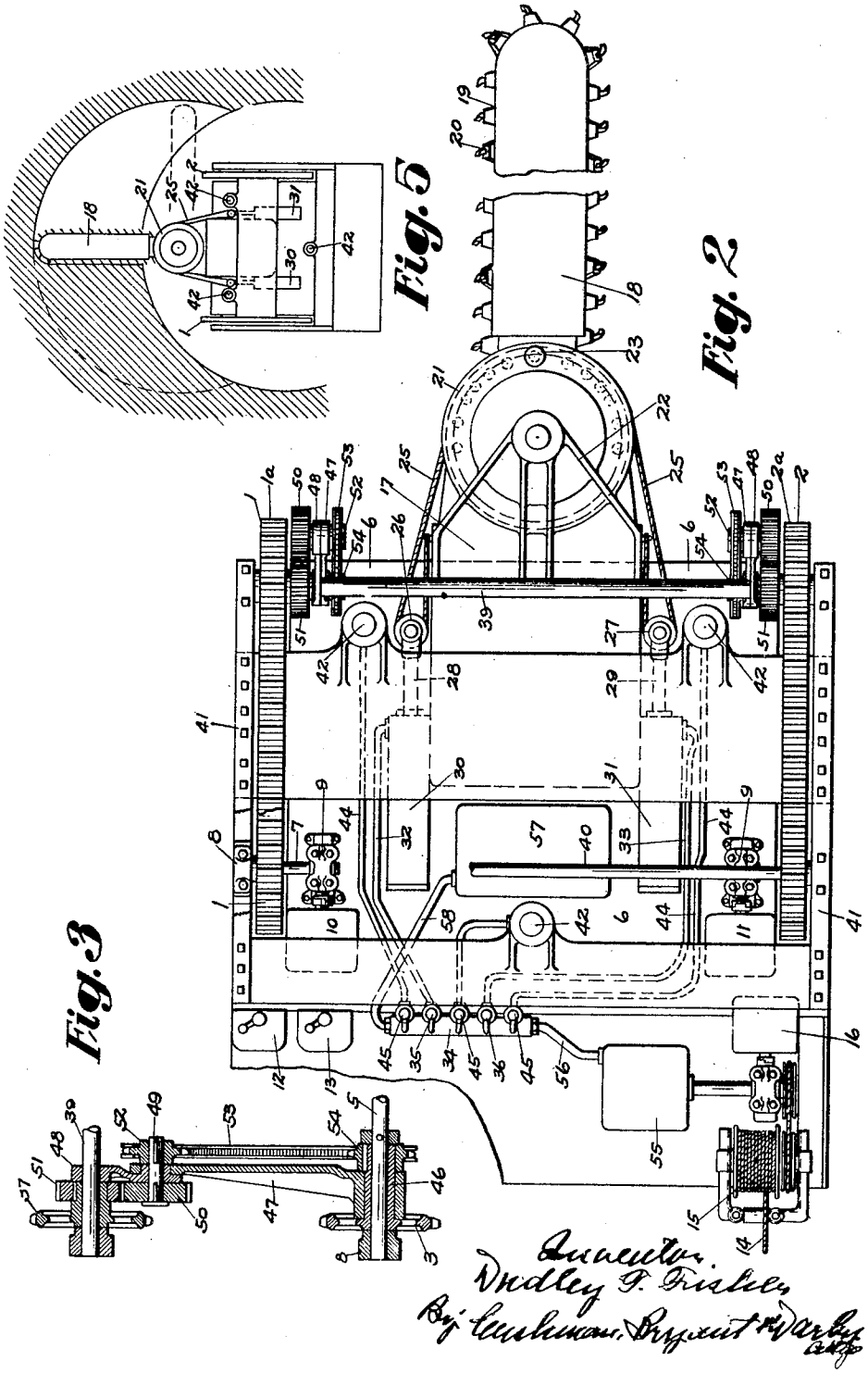


Fig. 5

Fig. 2

Fig. 3

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UNITED STATES PATENT OFFICE

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MINING MACHINE

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The present invention relates to certain new and useful improvements in mining machines of the class wherein a self-propelled carriage supports an elongated horizontally projecting cutting mechanism adapted to be thrust by bodily movement of the carriage longitudinally into the coal and laterally across the face to form a kerf in the mine wall to facilitate breaking the coal out of the vein.

It has heretofore been customary to provide tracks in the rooms and passages of coal mines, over which cars are propelled for the transportation of coal from the mine, and machines have been developed for cutting the coal having track engaging wheels to facilitate their movement from one working place to another. Since these tracks are more or less rigidly anchored to the floor of the mine, they have been utilized to resist lateral strains produced by the reaction of the cutting mechanism during the cutting operation. With the development of other systems of transporting the dislodged coal from the mine the presence of tracks in the rooms and entries has become objectionable, and mining machines have been proposed mounted upon caterpillar tractor devices adapted to be moved and guided over the floor of the mine. Frequently the mine tracks are insecurely anchored to the mine floor, and the track mounted machines, above referred to, require additional bracing. This is also true of the tractor mounted machines when the lateral resistance of the tractor chains is reduced by slippery floor conditions. Under such circumstances jacks, of the type commonly used for the bracing of mining machines, have been placed between the frame of the mining machine carriage and the roof or side walls of the mine chamber to insure stability of the machine during the cutting operation. Such auxiliary bracing devices as have heretofore been proposed prevent bodily movement of the machine, and feeding movement of the cutting devices can be secured while the auxiliary braces are in position only by movement of said cutting devices relative to the main frame of the carriage.

The especial object of this invention is to provide, in a machine of the class described, roof engaging devices adapted to move with and cooperate with the traction devices to resist lateral strains produced by the reaction of the cutting mechanism.

A further object is to provide roof engaging devices such as above referred to, adapted to cooperate with the traction devices to bodily move the machine.

A further object is to provide suitable power devices upon the machine for the convenient adjustment of said roof engaging devices to and from operative position in contact with the roof of the mine.

The means whereby I attain these objects are fully set forth in the following specification and illustrated in the accompanying drawings of which—

Fig. 1 is a side elevation of one embodiment of my invention.

Fig. 2 is a plan view of the machine illustrated in Fig. 1.

Fig. 3 is a fragmentary sectional view taken along the line III—III of Fig. 1.

Figs. 4 to 8 inclusive are diagrams illustrating some of the various methods of operation of the machine.

Like numerals refer to similar parts in the several figures.

For purposes of illustration I have shown an embodiment of my invention comprising a carriage mounted upon a self-propelling dirigible ground engaging traction device, a cutting mechanism mounted upon said carriage and having a cutting element adapted to be brought into engagement with the mine wall to cut a kerf therein either by bodily movement of the carriage or by movement of the cutting mechanism relative thereto, and auxiliary devices adjustable and resiliently supported on said carriage and adapted to engage the roof of the mine to augment the tractive efforts of the traction devices and to supplement their resistance to lateral strains produced by the reaction of the cutting mechanism.

As shown in the drawings the machine is mounted upon two parallel caterpillar tractor chains 1 and 2, each of which is engaged by the sprocket wheels 3 and 4 in the manner well understood in the art. The sprocket

wheels 3 are mounted for free rotation upon a shaft 5 which extends across the machine and is fixed to the main frame 6 of the carriage. Each of the sprocket wheels 4 is fixed to a short transverse shaft 7 which is journaled in the journal box 8 attached to the main frame 6 and in the bearings of their respective gear housings 9 which are bolted to the floor of the machine one at each side thereof. The shafts 7 are connected through suitable worm gearing within the gear housings 9 with the motors 10 and 11 by which the tractor chains 1 and 2 are actuated. The motors 10 and 11 may be of any preferred type suitable to the conditions under which the machine operates. For purposes of illustration I have shown electric motors connected by suitable conductors, not shown in the drawings, through the controllers 12 and 13 with a suitable source of electric supply. The controllers 12 and 13 are of the well known double direction type wherein movement of the operating handle to one side of the neutral position causes the armature of the motor to revolve in one direction, and movement of said handle to the other side of said neutral position causes a reversal of that rotation, the speed of rotation being controlled by the degree of movement of said operating handle. By the manipulation of the controllers 12 and 13 the chains 1 and 2 may be caused to travel in unison or at different speeds in the same direction, may be caused to travel in opposite directions, or one or the other of said chains may be held stationary, thereby controlling the direction of travel of the carriage. Electric current for the actuation of the machine is derived from a convenient source of electric supply through the flexible conductor cable 14 which is arranged to be wound upon the cable reel 15 supported in suitable bearings upon the carriage, and actuated by an electric motor 16 to automatically wind the cable or to permit it to unwind under controlled frictional resistance as the carriage travels towards or from the point of attachment of the cable 14 to the source of current supply. As all of these devices are well understood in the art and as they form no part in the present invention further description is not thought to be required at this time.

Mounted upon the main frame 6 of the carriage is a machine frame 17 wherein is contained the actuating motor and driving gearing of the cutting mechanism. This cutting mechanism is of the type well known in the mining machine art and consists of an elongated cutter frame 18 having guideways along its lateral edges wherein travels a cutter chain 19 having renewable cutter bits 20 adapted to engage the coal to cut it. The cutter arm 18 is rigidly attached to a turn table 21 which is pivotally supported upon the extension 22 of the machine frame 17, and the cutter chain 19 passes around a sprocket wheel mounted concentric with the pivot of the turntable 21. This sprocket wheel is connected through the gearing of the mining machine with the motor within the casing 17 to actuate the cutter chain. A coupling pin 23 adapted to engage a suitable aperture in the flange 24 of the machine frame, and either of a plurality of suitable apertures in the turn table 21 affords means for locking the cutter arm in either of several positions of angular adjustment. As such devices are well understood in the mining machine art, and as they form no part in the present invention, fuller illustration and description is not thought to be required at this time.

A rope 25 is connected at its middle to the turntable 21 and after passing around the cable sheaves 26 and 27 both of its ends are attached to the machine frame 17. The cable sheaves 26 and 27 are respectively attached to the pistons 28 and 29 which are reciprocable in the cylinders 30 and 31 mounted one at each side of the machine frame 17. The cylinders 30 and 31 are connected through suitable conductors 32 and 33 with a manifold 34 which is connected with a source of fluid pressure supply, and valves 35 and 36 are provided for the control of the flow of said fluid through the conductors 32 and 33. By the admission of fluid under pressure to either of the cylinders 30 or 31 the rope 25 will be pulled rearwardly to swing the cutter arm about its pivot.

Positioned above the above described carriage is an auxiliary carriage having two tractor chains 1A and 2A similar to and operatively connected with the chains 1 and 2, adapted to engage the roof of the mine and to cooperate with the ground engaging chains to bodily move the machine relative to the material which is to be cut, and to resist the lateral strains produced by the reaction of the cutter chain. The chains 1A and 2A pass around the sprocket wheels 37 and 38 which are mounted for free rotation upon the shafts 39 and 40 extending across the machine and attached to the auxiliary frame 41. The frame 41 is supported upon the upper ends of a plurality of pistons 42 which are vertically reciprocable in the cylinders 43 attached to the main frame 6 of the carriage. Conductors 44 connect the cylinders 43 with the supply of fluid under pressure through the manifold 34, and valves 45 are provided to control the flow of fluid through said conductors and thereby control the actuation of the pistons 42 to lift the tractor chains 1A and 2A into forced engagement with the mine roof. Suitable trains of gearing are provided at both sides of the machine to connect the chains 1 and 1A, and 2 and 2A together so that the upper strands of the roof engaging chains will travel with and in the same direction as the lower strand of the corresponding floor en-

gaging chains, causing their cooperation to bodily move the machine over excessive grades or against excessive cutting resistance. As the gearing is alike on both sides of the machine a description of one will apply to both.

Formed on the sprocket wheel 3 is an elongated hub 46 upon the periphery of which is journaled the lower end of the link bar 47. The link bar 47 is pivotally connected at its upper end with a rocker arm 48 journaled upon the cross shaft 39. A short shaft 49 is journaled concentrically with the pivotal connection between the link bar 47 and the rocker arm 48. To one end of the shaft 49 is fixed a spur gear 50 which engages with a similar spur gear 51 attached to the sprocket wheel 37. To the other end of the shaft 49 is fixed a sprocket wheel 52 connected by an endless chain 53 with a similar sprocket wheel 54 attached to the elongated hub 46 of the sprocket wheel 3. These parts are so proportioned and arranged that the sprocket wheel 37 will be driven by and in the opposite direction to the sprocket wheel 3 in all positions of vertical adjustment of the auxiliary carriage. It is desirable that the tractor chains 1A and 2A be resiliently held in contact with the roof of the mine, and with that end in view I prefer to actuate the pistons 42 by compressed air. It is apparent however, that other fluid means may be substituted for compressed air, or that other lifting devices may be substituted for the fluid pressure rams here shown, without departure from the spirit of my invention. Fluid pressure may be supplied to the cylinders 43 from any preferred or convenient source of fluid supply. For purposes of illustration I have here shown diagrammatically at 55 an air compressing pump which may be of any preferred type and actuated in any preferred manner, either by an electric motor connected directly to the pump, or it may be connected by suitable gearing with the electric motor 16, but as such devices are well known in the art, and as they form no part in the present invention, more complete illustration and description is not thought to be required at this time. As here illustrated the pump 55 is connected through a suitable conductor 56 with the manifold 34, and through it with the devices which have been above described. A receiver 57 mounted upon the carriage and connected with the manifold 34 through a suitable conductor 58 serves to accumulate a supply of compressed air in the manner which is well understood in the art.

In Fig. 4 of the drawings I have diagrammatically illustrated a method of cutting an arcwall. As here shown the cutter arm 18 is locked in forward extension along the longitudinal central lines of the machine. The machine is then positioned at the center of the room closely adjacent the coal face with the cutter arm 18 extending towards one of the rib walls of the working. For purposes of illustration I have shown, by dotted lines in Fig. 5, the cutter arm extending towards the right hand rib. After starting the cutter chain 19 the motor 11 will be actuated to drive the tractor chain 2 forwardly, and the motor 10 will be actuated to drive the tractor chain 1 rearwardly thereby causing the machine to turn in an anticlockwise direction about an axis at the center of its traction base to cause the cutter arm to cut a semi-circular kerf in the body of the coal.

In Fig. 5 I have illustrated a method of cutting an arcwall face in a place somewhat narrower than that illustrated in Fig. 4. As here illustrated the cutter arm is swung about its pivotal axis to positions substantially at right angles to longitudinal lines of the machine, as indicated by dotted lines in Fig. 5, and after the cutter chain 19 is started the pneumatic ram 28 is actuated to swing the cutter arm in anticlockwise direction to cut a semicircular kerf having a radius equal to the radial length of the cutter bar 18.

When working in places too narrow to permit of the cutting of a complete semicircle, as when cutting entries, breakthroughs, and similar narrow places, the machine will be positioned on the central line of the working with the cutter arm 18 turned to such an angle that its inner end will reach the line of the right hand rib, as illustrated in Fig. 6. The tractor chains 1 and 2 will then be actuated to drive the machine forwardly parallel with the direction of the working, and thereby thrust the cutter arm longitudinally into the coal to form the sumping or entering cut. By the actuation of the pneumatic ram 28 the cutter arm will then be swung in an anticlockwise direction, as illustrated in Fig. 7, until its inner end reaches the line of the left hand rib. The tractor chains 1 and 2 will be again actuated to bodily move the machine rearwardly along lines parallel to the direction of the working to finish the cut, as illustrated in Fig. 8. Numerous other methods of operation will occur to the skilled miner, those above described being presented merely for the purpose of illustrating the invention.

In the above described apparatus I have provided traction devices adapted to carry the coal cutting mechanism from one working place to another and to move the cutting devices relative to the material to be mined to form kerfs therein, and auxiliary devices adapted, when occasion requires, to be placed in engagement with the mine roof to cooperate with said traction devices to resist lateral strains occasioned by the reaction of the cutting devices and to augment the tractive effort upon steep grades or where the cutting is exceptionally hard.

What I claim is:—

1. In a mining apparatus, the combination with a main frame supported upon dirigible traction devices adapted to move said main frame relative to the material to be mined, of roof engaging devices mounted upon said main frame and adapted to move with and cooperate with said traction devices to resist lateral strains exerted upon said main frame.

2. In a mining apparatus, the combination with a main frame supported upon dirigible traction devices, of auxiliary traction devices adapted to engage the roof of the mine and to cooperate with the first mentioned traction devices to move said main frame relative to the material to be mined and to resist lateral strains exerted upon said main frame.

3. In a mining apparatus, the combination with a main frame supported upon dirigible traction devices, of auxiliary traction devices mounted upon said main frame, means to resiliently hold said auxiliary traction devices in contact with the mine roof to cause their cooperation with the first mentioned traction devices to resist lateral strains exerted upon said main frame.

4. In a mining apparatus, the combination with a main frame supported upon dirigible traction devices, of auxiliary traction devices mounted upon said main frame, means to resiliently hold said auxiliary traction devices in contact with the mine roof, and means to actuate all of said traction devices to cause their cooperation to move and guide said main frame relative to the material to be mined and to resist lateral strains exerted upon said main frame.

5. In a mining apparatus, the combination with a main frame supported upon dirigible traction devices, of auxiliary traction devices mounted upon said main frame, optionally controlled means to lift said auxiliary traction devices into contact with the roof of the mine to cause their cooperation with the first mentioned traction devices to resist lateral strains exerted upon said main frame.

6. In a mining apparatus, the combination with a main frame supported upon dirigible traction devices, of auxiliary traction devices mounted upon said main frame, optionally controlled means to lift said auxiliary traction devices into contact with the roof of the mine, and means to actuate all of said traction devices to cause their cooperation to move and guide said main frame relative to the material to be mined and to resist lateral strains exerted upon the main frame.

7. In a mining apparatus, the combination with a main frame supported upon dirigible traction devices, of auxiliary traction devices mounted upon said main frame, fluid pressure devices connected and arranged to lift said auxiliary traction devices into contact with the mine roof, and means to actuate all of said traction devices to cause their cooperation to move and guide the main frame relative to the material to be mined and to resist lateral strains upon the main frame.

8. In a mining apparatus, the combination with a main frame supported upon dirigible traction devices, of a vertically disposed cylinder mounted upon said main frame, a piston longitudinally reciprocable in said cylinder, a roof engaging device attached to said piston and adapted to be lifted thereby to contact with the roof of the mine to move with and cooperate with said traction devices to resist lateral strains exerted upon said main frame.

9. In a mining apparatus, the combination with a main frame mounted upon dirigible traction devices adapted to move and guide said main frame relative to the material to be mined, of a vertically disposed cylinder mounted upon said main frame, a piston longitudinally reciprocable in said cylinder, a device attached to said piston and adapted to engage the roof of the mine to move with and cooperate with said traction devices to resist lateral strains exerted upon said main frame, and fluid pressure means to actuate said piston to lift said device into engagement with the mine roof.

10. In a mining machine, the combination with a main frame supported upon dirigible traction devices, of horizontally projecting cutting mechanism carried by said main frame and adapted to engage the coal to cut it, means to actuate said traction devices to bodily move and guide the machine relative to the material to be mined, and roof engaging devices adapted to move with said traction devices and to cooperate therewith to resist lateral strains produced by the reaction of the cutting mechanism.

11. In a mining machine, the combination with a main frame supported upon dirigible traction devices, cutting mechanism projecting horizontally from said main frame and adapted to engage the coal to cut it, means to actuate the traction devices to bodily move and guide the machine relative to the material to be mined, and roof engaging devices adapted to move with said traction devices to augment their tractive effort and to cooperate therewith to resist lateral strains produced by the reaction of the cutting mechanism.

12. In a coal mining machine, the combination with a main frame supported upon dirigible traction devices, of cutting mechanism projecting horizontally from said main frame and adapted to engage the coal to cut it, means to actuate said traction devices to bodily move and guide the machine relative to the material to be mined, and auxiliary traction devices adapted to engage the mine roof and to cooperate with the first mentioned traction devices to increase the tractive effort thereof and to resist lateral strains

produced by the reaction of the cutting mechanism.

13. In a coal mining machine, the combination with a main frame supported upon dirigible traction devices, cutting mechanism projecting horizontally from said main frame and adapted to engage the coal to cut it, means to actuate said traction devices to bodily move and guide said machine relative to the material to be mined, auxiliary traction devices mounted upon said main frame, and means to resiliently hold said auxiliary devices in contact with the mine roof to cause them to cooperate with the first mentioned traction devices to resist lateral strains produced by the reaction of the cutting mechanism.

14. In a coal mining machine, the combination with a main frame supported upon dirigible traction devices, cutting mechanism projecting horizontally from said main frame and adapted to engage the coal to cut it, auxiliary traction devices mounted upon the main frame, means to resiliently hold said auxiliary devices in contact with the mine roof and means to actuate all of said traction devices to cause their cooperation to bodily move and guide the machine relative to the material to be cut and to resist lateral strains produced by the reaction of the cutting mechanism.

15. In a coal mining machine, the combination with a main frame supported upon dirigible traction devices, cutting mechanism projecting horizontally from said main frame and adapted to engage the coal to cut it, means to actuate said traction devices to bodily move the machine relative to the material to be mined, auxiliary traction devices mounted upon said main frame, optionally controlled means to move said auxiliary devices into contact with the mine roof and means to operatively connect said traction devices to cause them to cooperate to increase the tractive effort and to resist lateral strains produced by the reaction of the cutting mechanism.

16. In a coal mining machine, the combination with a main frame supported upon dirigible traction devices, cutting mechanism projecting horizontally from said main frame and adapted to engage the coal to cut it, means to actuate said traction devices to bodily move and guide the machine relative to the material to be mined, auxiliary traction devices mounted upon said main frame, optionally controlled means to move said auxiliary devices into contact with the mine roof, and automatically adjustable means to operatively connect said traction devices to cause them to cooperate to increase the tractive effort and to resist lateral strains produced by the reaction of the cutting mechanism.

17. In a coal mining apparatus, the combination with a main frame supported upon dirigible traction devices, cutting mechanism projecting horizontally from said main frame and adapted to engage the coal to cut it, means to actuate said traction devices to bodily move and guide the machine relative to the material to be mined, auxiliary traction devices mounted upon said main frame, optionally controlled means to move said auxiliary devices into contact with the mine roof, and means effective in all positions of adjustment of the auxiliary traction devices to operatively connect them with the first mentioned traction devices to cause them to cooperate to increase the tractive effort and to resist lateral strains produced by the reaction of the cutting mechanism.

18. In a coal mining machine, the combination with a main frame supported upon dirigible traction devices, of cutting mechanism projecting horizontally from said main frame and adapted to engage the coal to cut it, means to actuate said traction devices to bodily move and guide the machine relative to the material to be mined, auxiliary traction devices mounted upon the main frame, power actuated devices arranged to move said auxiliary devices into engagement with the roof of the mine, to cause them to cooperate with the first mentioned traction devices to increase the tractive effort thereof and to resist lateral strains produced by the reaction of the cutting mechanism.

19. In a coal mining machine, the combination with a main frame supported upon dirigible traction devices, of cutting mechanism projecting horizontally from said main frame and adapted to engage the coal to cut it, means to actuate said traction devices to bodily move and guide the machine relative to the material to be mined, auxiliary traction devices mounted upon the main frame, fluid pressure means to lift said auxiliary devices into contact with the mine roof, and means to operatively connect said auxiliary devices with the first mentioned traction devices to cause their cooperation to increase the tractive effort and to resist lateral strains produced by the reaction of the cutting mechanism.

20. In a coal mining machine, the combination with a main frame supported upon dirigible traction devices, of cutting mechanism projecting horizontally from said main frame and adapted to engage the coal to cut it, means to actuate said traction devices to bodily move and guide the machine relative to the material to be mined, an auxiliary frame mounted upon the main frame, auxiliary traction devices mounted upon the auxiliary frame, fluid pressure devices connecting said main and auxiliary frames whereby said auxiliary traction devices may be caused to engage the mine roof, means to actuate the auxiliary traction devices to cause their cooperation with the first mentioned traction

devices to increase their tractive effort and to resist lateral strains produced by the reaction of the cutting mechanism.

21. In a mining apparatus, the combination with a main frame supported upon traction devices by which said main frame can be turned laterally and moved relative to the material to be mined, of roof engaging devices mounted upon said main frame and adapted to move with and cooperate with said supporting traction devices to resist lateral strains exerted upon said main frame.

22. In a coal mining machine, the combination with a main frame, of an elongated cutting mechanism pivotally mounted upon the main frame, power devices upon the main frame to actuate the cutting mechanism, a sheave attached to said cutting mechanism concentric with said pivotal support, a flexible draft member engaging said sheave, a cylinder mounted upon the main frame, a piston connected with said draft member and reciprocable in said cylinder to tension said draft member and thereby cause rotation of said cutting mechanism about its pivotal support.

23. In a coal mining apparatus, the combination with a main frame, of an elongated cutting mechanism projecting horizontally from the main frame and adapted to rotation about a vertical axis, a sheave attached to said cutting mechanism concentric with said vertical axis, a flexible draft member engaging said sheave, a cylinder mounted upon said main frame, a piston connected with said draft member and reciprocable in said cylinder to tension said draft member and thereby cause rotation of said cutting mechanism.

24. In a coal mining machine, the combination with a main frame, of an elongated cutting mechanism projecting horizontally from said main frame and adapted to rotation about a vertical axis, power devices upon the main frame to actuate the cutting mechanism, a cylinder mounted upon the main frame, a piston longitudinally reciprocable in the cylinder, fluid pressure means to cause the reciprocation of said piston, and means to connect said piston with said cutting mechanism to cause its rotation about its pivotal support.

25. In a mining apparatus, the combination with a main frame supported upon traction devices, of auxiliary dirigible traction devices adapted to engage the roof of the mine to cooperate with the first mentioned traction devices to move said main frame relative to the material to be mined.

26. In a mining apparatus, the combination with a main frame supported upon dirigible traction devices, of auxiliary dirigible traction devices adapted to engage the roof of the mine and to be operated with the first mentioned traction devices to move said main frame relative to the material to be mined.

27. In a mining apparatus, the combination with a main frame supported upon traction devices adapted to move said main frame relative to the material to be mined, of roof engaging traction devices mounted upon said main frame, means for adjusting the roof engaging traction devices relative to the supporting traction devices, and means for driving the roof engaging traction devices from the supporting traction devices and permitting said relative movement.

28. In a mining apparatus, the combination with a main frame supported upon traction devices adapted to move said main frame relative to the material to be mined, of roof engaging traction devices mounted upon said main frame, fluid pressure means for adjusting said roof engaging traction devices relative to the supporting traction devices, and means for driving the roof engaging traction devices from the supporting traction devices and permitting said relative movement.

29. In a mining apparatus the combination with a main frame supported upon traction devices adapted to move said main frame relative to the material to be mined, of roof engaging traction devices mounted upon said main frame, link means connecting the supporting traction devices and roof engaging traction devices for permitting adjustment of the latter with respect to the frame, means for adjusting said roof engaging traction devices relative to the supporting traction devices, and means for driving the roof engaging traction devices from the supporting traction devices and permitting said relative movement.

30. A roof supporting mechanism for supporting the roof of a mine comprising a base member, a jack on said base member, a roof support carried by said jack, tractor members on said base and roof support, and means for driving said tractor members.

31. A roof supporting mechanism for supporting the roof of a mine comprising an elongated base member, a jack member mounted on said base member, an elongated roof support carried by said jack, tractor members on said base and said roof support, and means for driving said tractors.

In testimony whereof I have hereunto set my hand.

DUDLEY T. FISHER.