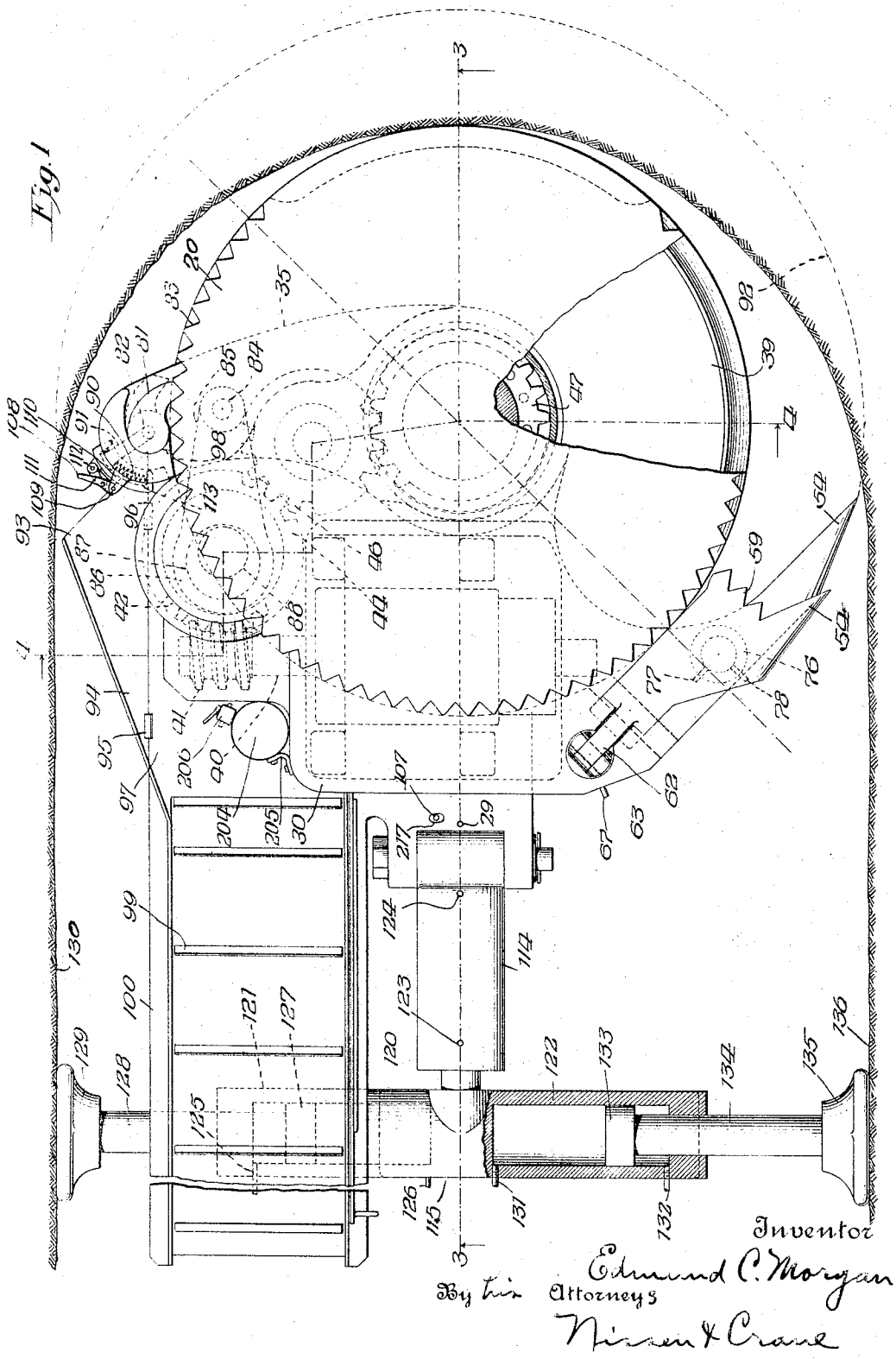
Aug. 2, 1927. 1,637,783

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MINING AND LOADING MACHINE

Filed Nov. 15, 1920 5 Sheets-Sheet 1

Fig. 1



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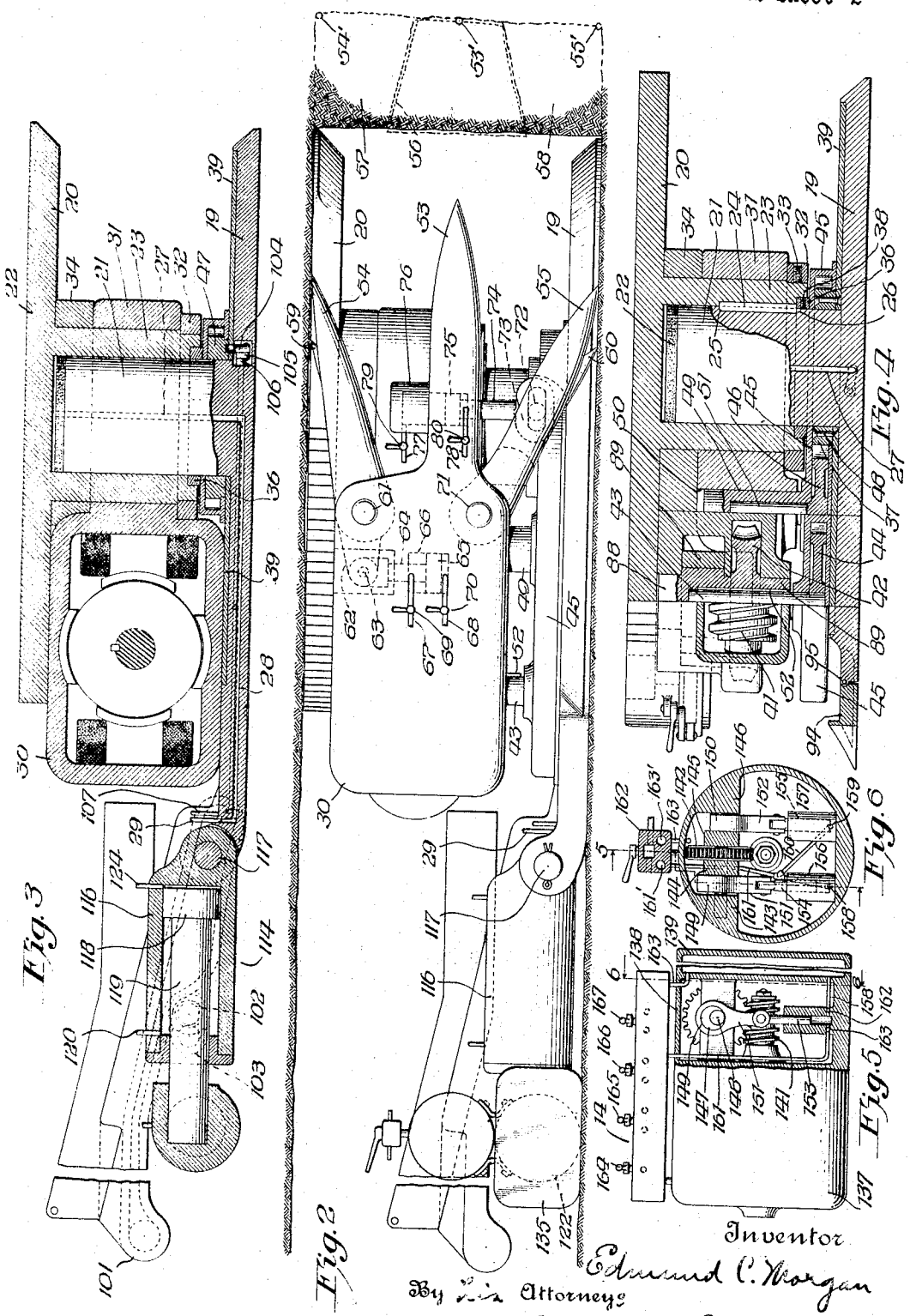


Fig. 3

Fig. 2

Fig. 4

Fig. 6

Fig. 5

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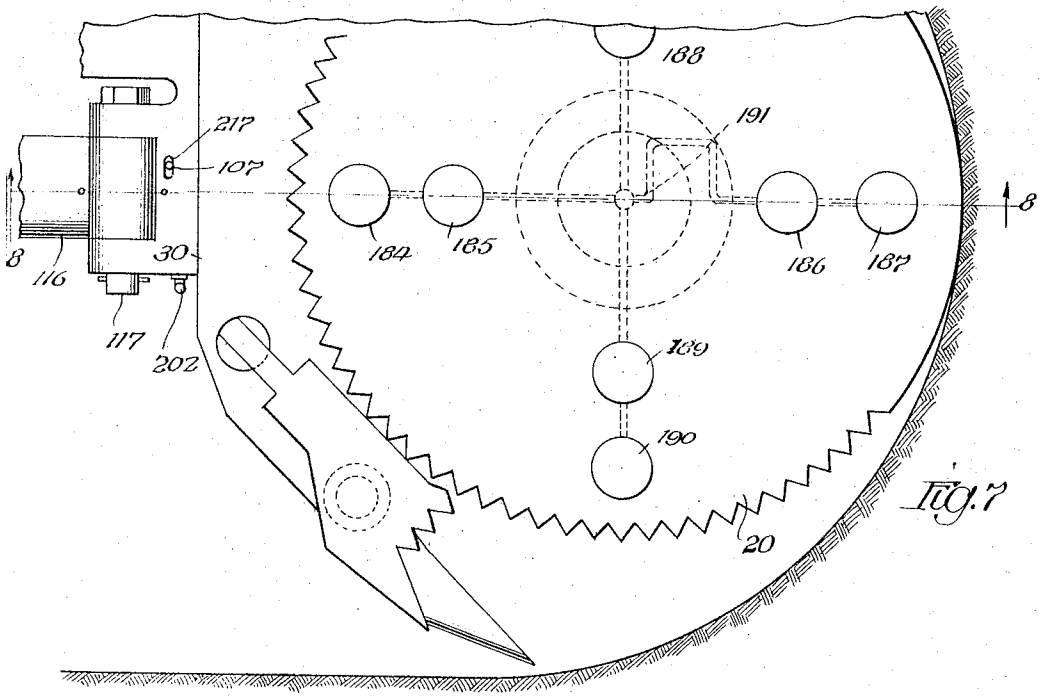


Fig. 7

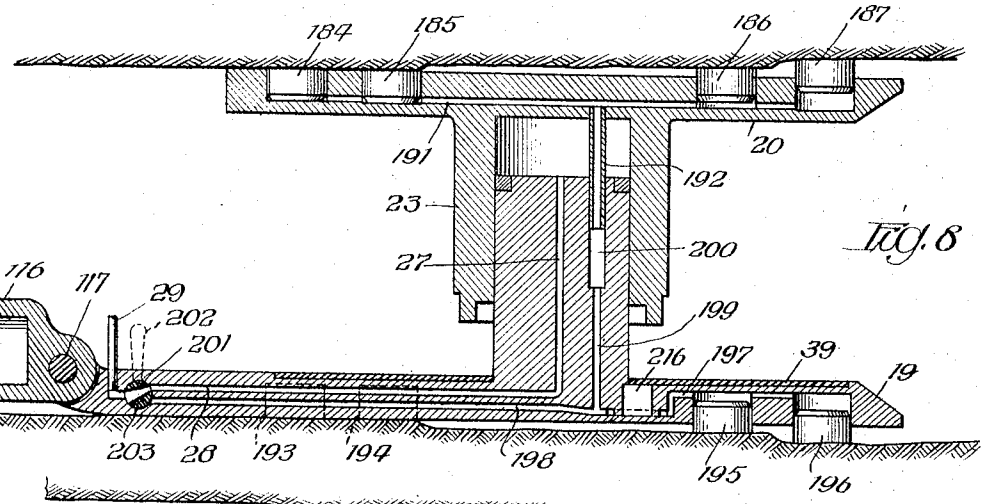


Fig. 8

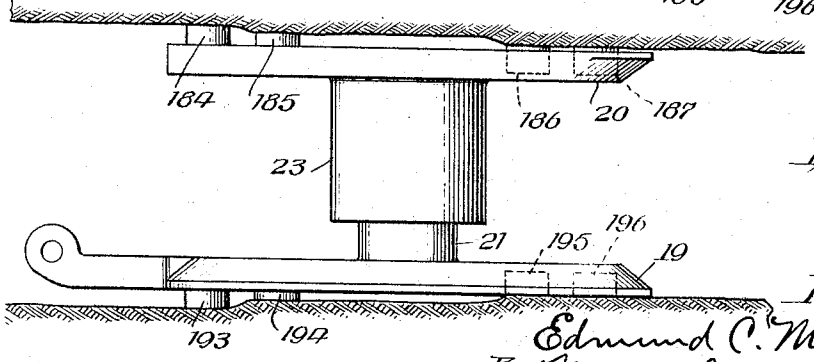


Fig. 9

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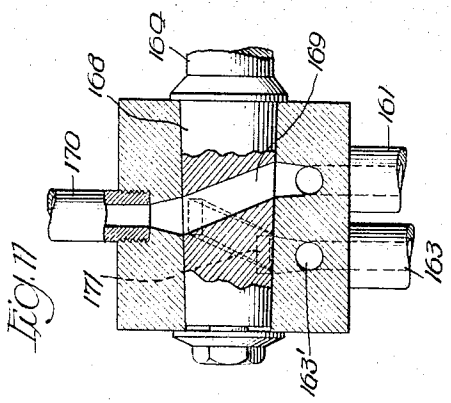


Fig. 11

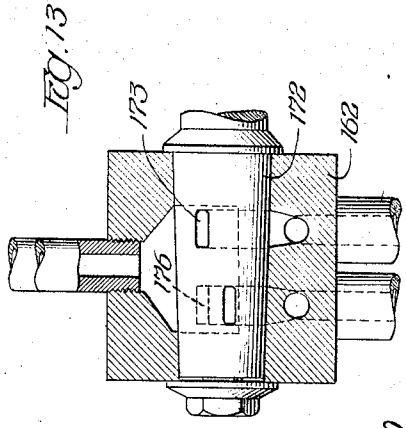


Fig. 13

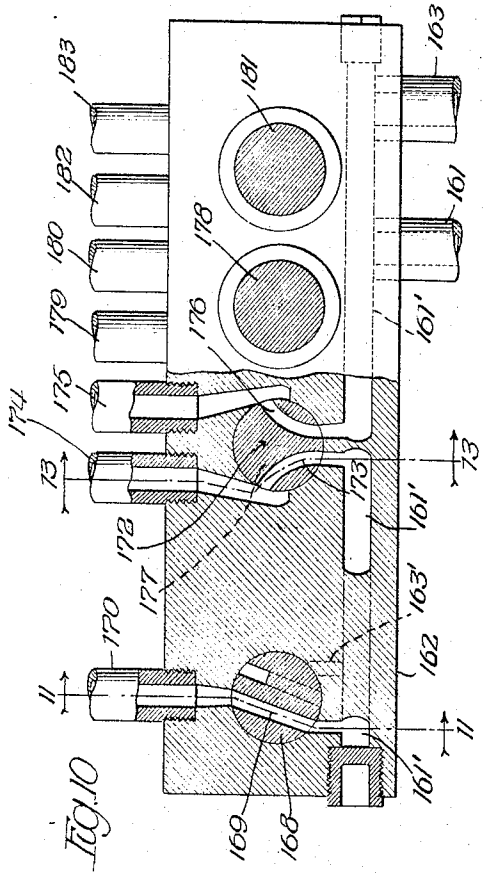


Fig. 10

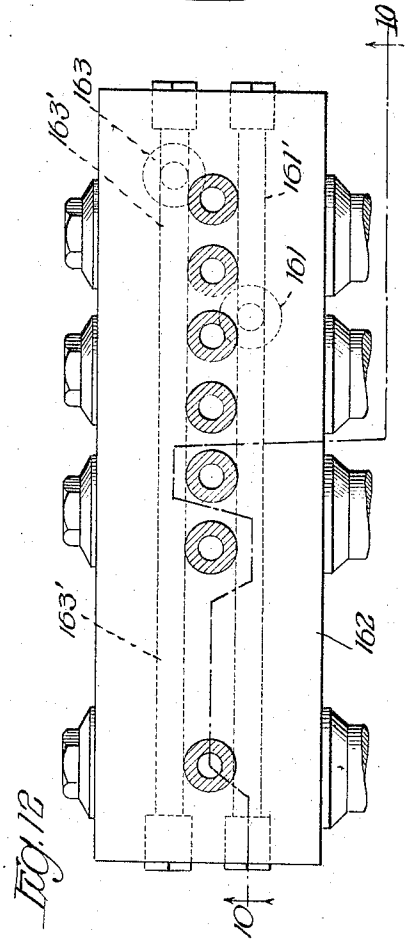


Fig. 12

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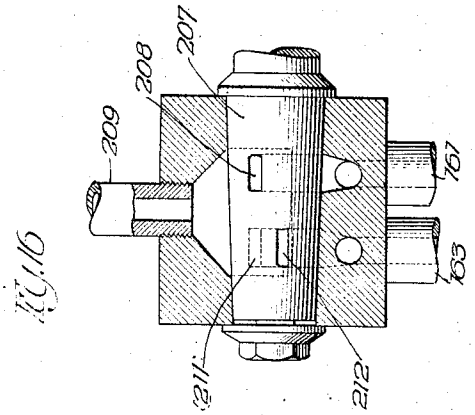


Fig. 16

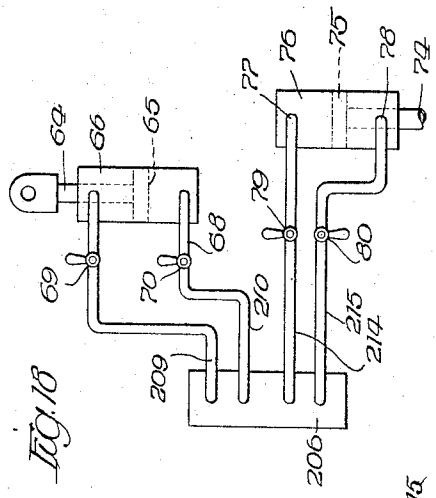


Fig. 18

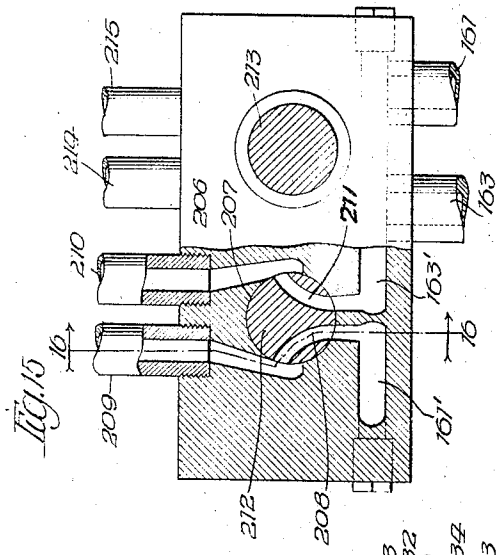


Fig. 15

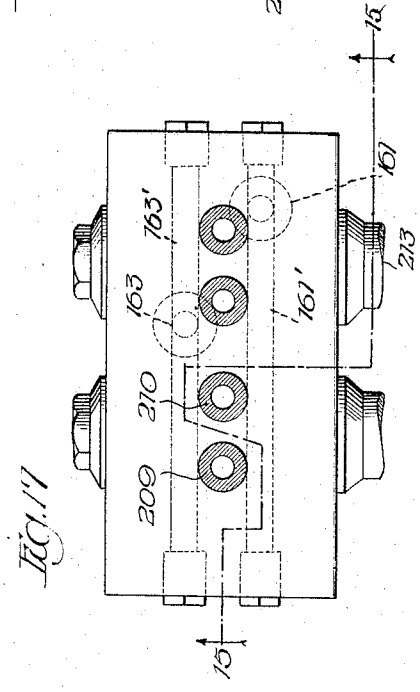


Fig. 17

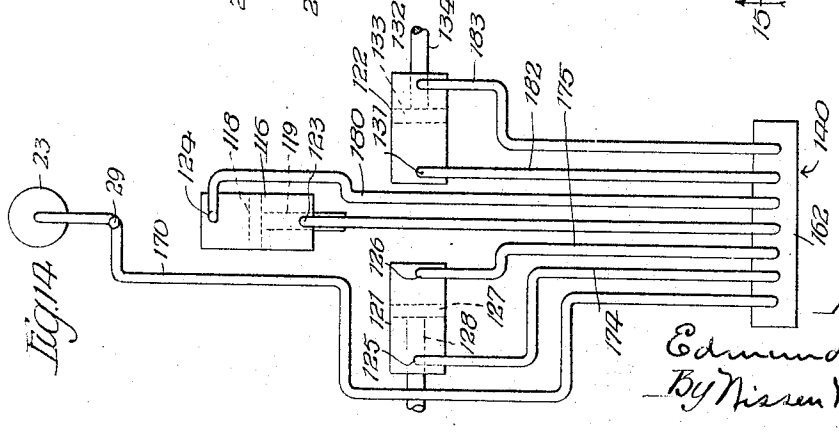


Fig. 14

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UNITED STATES PATENT OFFICE.

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MINING AND LOADING MACHINE.

Application filed November 15, 1920. Serial No. 424,051.

My invention relates to mining and loading machines and one of its objects is the provision of improved and efficient apparatus for mining and loading coal, more particularly it is the object of the present invention to provide an arc wall mining machine with improved mechanism for operating splitting tools to dislodge the coal into position to be automatically received by loading apparatus and transferred to mine cars.

Another object of the invention is the provision of anchoring mechanism for securely holding the mining machine in position during operation between the floor and roof of the mine chamber irrespective of irregularities which may occur along such floor and roof.

A further object is the provision of anchoring and controlling apparatus for mining machines to effect the proper positioning of the mining machine and the anchoring thereof in adjusted position.

A further object of the invention is the provision of fluid pressure motors for operating splitting tools of a mining machine to adjust the positions of such splitting tools.

A further object of the invention is the provision of fluid pressure apparatus and means for controlling the same to adjust the position of a mining machine and securing the same in adjusted position.

Other objects of the invention will appear hereinafter, the novel combinations and features being set forth in the appended claims.

Referring to the accompanying drawings—

Fig. 1 is a plan view of my improved mining and loading machine, with a portion broken away to show certain details in section;

Fig. 2 is an elevational view of my improved mining and loading machine;

Fig. 3 is a sectional elevation taken on line 3—3 of Fig. 1;

Fig. 4 is a transverse sectional elevation taken on line 4—4 of Fig. 1 looking in the direction of the arrows;

Fig. 5 is an elevational view partly in section showing the electrically operated hydraulic pump and the control mechanism therefor; the sectional portion of this view being taken on line 5—5 of Fig. 6 looking in the direction of the arrows;

Fig. 6 is a sectional elevation taken on line 6—6 of Fig. 5 looking in the direction of the arrows;

Fig. 7 is a plan view of a portion of the machine shown in Fig. 1 with the addition of a plurality of spaced-apart roof jacks mounted on top of the machine;

Fig. 8 is a sectional elevation taken on line 8—8 of Fig. 7 looking in the direction of the arrows;

Fig. 9 is an elevational view of the anchoring mechanism shown in Figs. 7 and 8;

Fig. 10 is a view partly in section illustrating the valve structure shown at the upper part of Fig. 5;

Fig. 11 is a sectional elevation taken on line 11—11 of Fig. 10 looking in the direction of the arrows;

Fig. 12 is another view of the valve structure shown at the top of Fig. 5;

Fig. 13 is a sectional view taken on line 13—13 of Fig. 10 looking in the direction of the arrows;

Fig. 14 is a diagrammatic view illustrating the piping connections between the valve structure and the various hydraulic motors operated by the hydraulic pump shown in Fig. 5;

Fig. 15 is a view of a valve structure adapted to be used in connection with an electrically operated pump for controlling the operation of fluid pressure motors connected to the floor and roof coal splitting devices; the sectional portion of this view being taken on line 15—15 of Fig. 17;

Fig. 16 is a sectional view taken on line 16—16 of Fig. 15;

Fig. 17 is a plan view of the structure shown in Fig. 15; and

Fig. 18 is a diagrammatic view illustrating the piping connections between the valve structure of Fig. 15 and the fluid pressure motor shown in Fig. 2 connected to the uppermost and lowermost coal splitting devices.

The main frame of the mining machine comprises a circular base plate 19 and a circular flat table top 20 connected by a fluid pressure motor which is capable of moving the base plate against the floor of the mine chamber and the circular top against the

roof of the mine chamber to securely anchor the main frame in fixed and immovable position. Extending upwardly from the center of the base plate is a cylindrical post or plunger 21 of comparatively large diameter. The upper end of the standard or plunger 21 may be provided with a packing ring 22 so as to make a water-tight fit in the cylinder 23 which extends downwardly from the center of the top plate 20, as shown in Figs. 3 and 4. The cylinder 23 is splined at 24 to the plunger 21 so that relative rotary movement between the plunger 21 and the cylinder 23 will be prevented, while relative longitudinal movement will be permitted. It should also be noted that the spline 24 fits in a recess in the plunger 21. The ends 25 and 26 of this recess prevent longitudinal movement of the spline 24 and the slot in the cylinder 23 is of such length that its upper end engages the upper end of the spline 24 when the top 20 is in its lowered position where a small space is left between the upper end of the plunger 21 and the upper end of the cylinder 23.

A vertical central passageway 27 connects with a rearwardly extending passageway 28 in the base plate 19. A pipe 29 is connected to the passageway 28 and when the pressure medium, such as the liquid is introduced through the pipe 29 and the passageways 28 and 27 into the cylinder 23, the latter, together with the table 22, will be moved against the roof of the mine chamber to securely anchor the machine in adjusted position. When this takes place the friction of the base plate against the floor and the friction of the top plate 20 against the roof, as well as the presence of the spline 24 will prevent relative rotary movement of the plunger 21 and the cylinder 23. The mechanism for controlling the flow of the fluid pressure medium to secure the anchoring of the main frame is shown in Figs. 10 to 14, inclusive, and will be hereinafter described.

Mounted on the main frame between the base plate 19 and the top plate 20 so as to be rotatable about the cylinder 23 on the upright axis of the plunger 21 is the mechanism for operating the coal splitting devices shown in elevation in Fig. 2. The frame of the electric motor 30 is extended to form a cylindrical collar or sleeve 31 journaled on the outside of the cylinder 23, as shown in Figs. 3 and 4. The electric motor 30 and the sleeve 31, together with other parts carried thereby, are supported on the ring bearing 32 which is secured firmly to the lower end of the cylinder 23 by means of a plurality of spaced-apart set screws, one of which is illustrated at 33 in Fig. 4. Between the sleeve 31 and the bottom of the table 20 is journaled a collar 34 of an arm 35 shown in Fig. 1. It will thus be seen that this collar 34 fills the space between the table 20 and the sleeve 31, but it should be understood that both of the collars 31 and 34 are freely rotatable about the cylinder 23 on the upright central axis of the plunger 21. In fact the construction is such that the motor 30 and the arm 35 may make a complete rotation about the cylinder 23, but I prefer to limit the rotary movement to a large arc when the loading apparatus is used in connection with the mining mechanism in order to avoid the necessity of adjusting the splitting tools so that they will clear the conveying mechanism and the frame-work when passing over the same at the rear portion of the main frame toward the initial operating position shown in Fig. 1.

Secured to the plunger 21 intermediate the ends thereof is a ring 36 which is adapted to be received in the annular recess at the lower end of the cylinder 23, as shown in Fig. 4. The ring 36 may be secured to the plunger 21 in adjusted position by means of a plurality of spaced-apart set screws, one of which is shown at 38 in Fig. 4. When the table 20 is in its lowermost position the weight of the various parts being supported will be distributed, because the motor 30 will then rest on the rear portion of the base plate 19 and the circular carrier 39, while the cylinder 23 rests on the ring 36.

As shown in Fig. 1, the shaft 40 of the electric motor 30 is provided with a worm 41 meshing with the gear 42. As shown in Fig. 4, the vertical shaft 43 connects the worm wheel 42 to a spur gear 44 located in the casing 45. The spur gear 44 meshes with an intermediate gear 46 which is also mounted in the gear casing 45. The gear 46 meshes with an annular gear 47 which is secured by means of the rivets 48 to the annular carrier 39 which is adapted to fit in an annular recess of comparatively large diameter on the upper side of the base plate 19 surrounding the upright standard 21. The gearing between the motor 30 and the annular carrier plate 39 may be readily understood by referring to Fig. 4 in connection with the section line 4—4 of Fig. 1, on which section line Fig. 4 is taken.

It will be seen by referring to Fig. 4 that the gear casing 45 is journaled on the lower end of the upright standard 21 and is provided with an upwardly extending post 49 which fits in a cylindrical recess 50 of an extension of the collar 31 which is rigidly secured to the frame of the motor 30. The gear 46 is provided with an upwardly extending shaft 51 which extends into a cylindrical recess in the post 49 for free rotation relatively to the latter. Since the ring 36 is secured to the plunger 21 immediately above the gear casing 45 the latter must always remain in its lowermost position, as shown

in Fig. 4, but by reason of the post 49 the motor and the worm wheel mechanism, together with the table top and the collar 31, may be moved upwardly without disturbing the rotary connection between the gear casing 45 and the collar 31. That is to say, the gear casing 45 will be rotated on the plunger 21 by the post 51 remaining in the cylinder 50 at various elevations of the motor and collar 31 above the base plate 19.

It should also be noted that when the motor and the table top 20 are moved to various elevations the worm wheel 42 will slide upwardly along the vertical shaft 43 which is connected between the worm wheel 42 and the spur gear 44. However, on account of the spline 52, rotating connection between the worm wheel 42 and the spur gear 44 will be maintained at such various elevations. It will therefore be seen that by referring to Figs. 1 and 4 that irrespective of the elevation to which the table top is moved to anchor the machine between the floor and roof of the mine chamber, the gearing remains connected between the electric motor 30 and the plate 39. Whenever the motor 30 is operated and the plate 39 is free to rotate relatively to the base plate 19 the annular plate 39 will be rotated, and it is preferable that such rotation should be in an anti-clockwise direction, as viewed in Fig. 1, so as to move dislodged material toward the receiving end of the conveyer mechanism hereinafter described.

By referring to Fig. 2 it will be seen that a comparatively large splitting or digging tool 53 is rigidly connected to the motor frame so as to occupy an approximately horizontal position intermediate the floor and roof of the mine chamber with its forward end in advance of both the upper splitting tool 54 and the lower splitting tool 55 so that during operation the tendency will be for the intermediate splitting tool to engage the coal wall at 53′ and dislodge blocks of coal, as indicated by the dotted line 56. By thus providing a comparatively long intermediate splitting tool and securing preliminary dislodgment of intermediate portions of the coal wall, the dislodgment of the uppermost section 57 and of the lowermost section 58 will be facilitated when the uppermost splitting tool acts at the point 54′ and the lowermost splitting tool acts at the point 55′. In addition to the large splitting tools 53, 54 and 55 there may be a series of digging tools 59, as shown in Fig. 1, in position to scrape along the roof of the mine chamber, as shown in Fig. 2. Also, in the latter view I have shown at 60 another series of diggers secured to the splitting tool 55 adapted to scrape along the floor of the mine chamber intermediate the path of travel of the outer end of the splitting tool 55 and the peripheral edge of the base plate 19.

The uppermost splitting tool 54 is pivotally connected at 61 to the frame of the motor 30 and is provided with a rearwardly extending arm 62 which is pivoted at 63 to a vertical piston rod 64 having a piston 65 at its lower end fitting in the cylinder 66. The fluid pressure medium may be directed to the cylinder 66 through the pipes 67 and 68 and after the splitting tool has been moved to adjusted position the liquid in the cylinder 66 on both sides of the piston 65 may be locked in position by closing the valves 69 and 70.

The lower splitting tool 55 is pivoted to the motor frame at 71 and is provided intermediate its ends with a laterally extending pin 72 which fits in a slot 73 at the lower end of the piston rod 74, the upper end of which is provided with a piston 75 fitting in the cylinder 76. The flow of the liquid into the cylinder 76 may be directed by the pipes 77 and 78 and after the splitting tool 55 is moved to adjusted position the piston 75 may be locked in the cylinder 76 by closing the valves 79 and 80.

The feeding mechanism for the coal splitting devices comprises a pawl 81 pivoted at 82 to the outer end of the arm 35, as show in Fig. 1. Around the large portion of the periphery of the circular table top 20 is a continuous series of notches 83 adapted to be engaged one after another by the pawl 81.

Pivotally connected at 84 to the arm 35 is a pitman 85 which is provided with an eccentric strap 86 at its left-hand end adapted to engage the eccentric cam 87 secured to the hub 88 which extends upwardly from the worm wheel 42, as shown in Fig. 4, which is a section taken on line 4—4 of Fig. 1. It will be seen that the worm wheel 42 is rigidly connected to or integral with the eccentric cam 87 and the hub journals 88 and 89. The hub journals 88 and 89 are journaled in bearings in the frame which is rigidly connected to the motor frame and moves bodily therewith.

When the eccentric cam 87 is rotated, upon rotation of the worm wheel 42 the tendency is to reciprocate the pitman 85 and oscillate the arm 35 on the vertical center line of the plunger 21 as an axis, but such oscillation is prevented when the pawl 81 is on one of the notches 83 because the latter is in the periphery of the table top 20 which is firmly anchored in fixed position during the mining operations. When the cam 87 is moved to the position shown in Fig. 1 the pawl 81 has been moved to the next notch to the left and the spring 90 is relied upon to act on the arm 91 to move the pawl 81 into the next notch. The arm 91 is rigidly connected to the pawl 81 and is so related to the spring 90 that it has free movement to the left when the pawl 81 is being moved toward the left into another notch 83.

Upon continued movement of the cam 87 from the position shown in Fig. 1 the motor frame, together with the frame-work carried thereby, will be moved one step in a clockwise direction, as viewed in Fig. 1 on the upright center of the plunger as an axis. It is therefore evident that upon each complete rotation of the cam 87 the pawl 81 will be moved forward into the succeeding notch and the splitting tools shown in Fig. 2 will be moved forward with sufficient power to cause such tools to dislodge the coal from the mine wall in the manner indicated at the right-hand end of Fig. 2. The continuous operation of the motor would cause the coal splitting tools to advance step by step along the path indicated by the arcuate dotted line 92 in Fig. 1. A crescent-shaped mass of material will therefore be dislodged from the upright mine wall in advance of the main frame and between the floor and roof of the mine chamber.

In this connection it should be noted that by the elimination of traveling chain cutters the capacity of the machine to dislodge the material from the mine wall is materially increased, because the speed of travel of chain cutters is limited in practice, and therefore the speed of feeding movement is also limited. By the use of the apparatus herein disclosed, however, the motor may be controlled to be operated in varying speeds in a well-known manner so that the rate of dislodgement may be in accordance with the hardness of the material acted upon. If the material is comparatively soft the motor may be operated at a speed in accordance with the work to be done, and therefore the dislodgment of the material by means of the tool splitting mechanism may be much more rapid in many instances than by the use of chain cutting mechanism. This is of advantage, particularly in connection with facilitating general operations in the mine by driving the entries at such a rapid rate that the various groups of miners are kept continuously at work up to their capacity in carrying on the various mining operations, such as placing permanent props in the mine chamber back of the mining and loading machine, and in transporting the dislodged material out of the mine. It should also be observed that by the elimination of various kinds of kerf cutters, by the use of the coal splitting mechanism herein disclosed, the amount of cuttings will be greatly reduced and therefore the coal obtained will have comparatively little slack in it; furthermore, in the elimination of kerf cutters, by the use of the said coal splitting mechanism, the amount of dust in the air in the mine chamber will also be greatly reduced.

While the coal is being dislodged from the mine wall along the path indicated by the arcuate dotted line 92 in Fig. 1, the lower horizontal series of diggers 60 will act to scoop the dislodged material and push it partly onto the annular carrier 39 and partly along the space back of the line 92 and in front of the base plate 19 to the receiving end 93 of the conveyer frame. Of course, the dislodgment of the coal from the mine wall, particularly by the upper coal splitting devices, will cause such coal to fall on the carried plate 39 so that such dislodged coal will be carried by the plate 39 toward the receiving end of the conveyer.

The section 94 may be hinged at 95 and 96 to the frame 97 of the conveyer to swing on a longitudinal axis so that such section 94 may be folded onto the frame 97 during transportation of the mining and loading machine. The forward end 98 of the conveyer frame 97 spans the space between the scooping end 93 of the pivotal section and the periphery of the base plate 19. The coal which is directed from the forward scooping edges 93 and 98 passes to the endless traveling conveyer 99 which is mounted on the conveyer frame 100 and extends rearwardly to the delivery end 100 which is adapted to overhang a mine car. The endless conveyer 99 may be connected to gearing 102 operated by a motor 103, as illustrated diagrammatically in Fig. 3.

When it is desired to restore the coal splitting mechanism to initial position after it has traveled along the arcuate path 92, the annular carrier plate 39 is connected to the gear 47 by thrusting a coupling 104 through an opening in the plate 39 into a recess in the bottom of the gear 47. There may be a plurality of spaced-apart holes in the plate 39 adapted to register with a plurality of corresponding recesses in the bottom of the gear 47. The coupling pin 104 may be pivoted at its lower end to an arm 105 which is connected to the forward end of the rod 106 which is adapted to extend rearwardly through the base plate 19 to an operating handle 107. When the handle 107 is operated to rock the shaft 106 so as to thrust the coupling pin 104 upwardly it will move through one of the holes in the plate 39 and then into one of the recesses at the bottom of the gear 47, thereby locking together such plate 39 and the gear 47. When this occurs neither the plate 39 nor the gear 47 can be rotated because held against rotation by the coupling pin 104. When the gear 47 is held stationary rotation of the intermediate gear 46 will cause the motor frame and the parts connected thereto to travel around the stationary gear 47 on the upright center line of the plunger 21 as an axis.

But before the handle 107 is operated to effect the holding of the gear 47 in stationary position the pawl 81 should be moved to its dotted line position shown in

Fig. 1. This may be accomplished by turning the lever 108 to the left from its position shown in Fig. 1. This lever 108 is pivoted at 109 to a bracket 110 which is secured to the outer end of the arm 35. A link 111 is pivoted between the fulcrum 109 and the outer end of the lever 108. The link 111 is also pivoted at 112 to the arcuate frame 113 which is movably mounted in an arcuate recess at the outer end of the arm 35 and is adapted to hold the spring 90 in position to act on the outer end of the arm 91. When the lever 108 is moved to the left the link 111 will act to draw the frame 113 to the left, thereby engaging the arm 91 and moving the latter to the left which will cause the pawl 81 to be moved to its dotted line position and held there out of engagement with any of the notches 83.

In order to secure anti-clockwise rotation of the carrier plate 39 the gear 46 had to be rotated in a clockwise direction, as viewed in Fig. 1. Therefore when the gear 47 is held stationary after the pawl 81 is moved to its dotted line position the motor can be kept rotating in the same direction as before to cause the gear 46 to travel around the stationary gear 47 in the proper direction to restore the coal splitting mechanism to initial position.

In order to move the mining and loading machine forward to a new position a hydraulic motor 114 is connected between the base plate 19 and the anchoring mechanism 115 which is adapted to be located between the walls of the mine chamber, as shown in Fig. 1. After the material has been dislodged from the mine wall along the dotted line 92 of Fig. 1 and the coal splitting mechanism has been restored to initial position the fluid pressure in the cylinder 31 may be relieved so as to release the plate 20 from the roof and thereby release the anchoring of the main frame and free the latter for forward movement.

As shown in Fig. 3, the hydraulic motor 114 comprises a cylinder 116 pivotally connected at 117 to the rear end of the base plate 19. In the cylinder 116 is a piston 118 connected to a piston rod 119 which extends out of the rear end of the cylinder 116 and is secured at 120 to the casting between the horizontal transversely extending cylinders 121 and 122, as shown in Fig. 1. Ports are provided at 123 and 124 at the ends of the cylinder 116 for directing the fluid into and out of the cylinder 116 in accordance with the desired relative movement between the piston rod 119 and the cylinder 116.

The cylinder 121 shown in Fig. 1 is provided with ports 125 and 126 at the ends of the cylinder 121 for directing the fluid into the cylinder at both sides of the piston 127 and thereby controlling the actuation of the piston rod 128 to force the shoe 129 against the wall 130 or to withdraw said shoe therefrom.

In a similar manner the cylinder 122 is provided at its ends with ports 131 and 132 to control the pressure medium on the piston 133 which is connected to the piston rod 134 and the shoe 135, the latter being adapted to engage the wall 136. By anchoring the wall jacks a rigid abutment is obtained so that when pressure is exerted in the cylinder 116 in advance of the piston 118 and the water back of the piston is allowed to exhaust from the port 123, the entire mining and loading machine may be moved forward to a new position provided the main frame has been released by the lowering of the top plate 20. After the machine has been moved forward by the motor 115 to a new position the plate 20 may again be forced against the roof of the mine chamber by directing water under pressure into the cylinder 23. The uppermost and lowermost coal splitting devices 54 and 55 may also be again adjusted in elevation and then locked rigidly in adjusted position by closing the valves 69, 70, 79 and 80.

By referring to Fig. 2 it will be seen that the wall jack shoe 135 is rectangular in elevation; the shoe 129 is of similar shape. When the wall jacks are released and the main frame of the mining machine has been anchored by the upward movement of the top plate 20 against the roof, the motor 114 may be operated to move the piston 118 to the right, as viewed in Fig. 3, whereupon the shoes 135 and 129 will slide along the floor of the mine chamber to a new forward position where they may again be anchored in readiness for another forward movement of the mining and loading machine to a new operating position.

In Figs. 5 and 6 I have illustrated an electrically operated pump which comprises an electric motor 137, a pump casing 138, and a water reservoir 139. The valve structure 140 is adapted to be mounted on top of the motor frame and the casing 138. The whole structure shown in Fig. 5 may be secured on top of the cylinder 122, as shown in Fig. 2. On the motor shaft is a worm 141 which meshes with a worm wheel 142. The shaft of the worm wheel 142 is journaled in the bearings 143, 144, 145 and 146. Between the bearings 143 and 144 is located an eccentric cam 147 which is secured to the shaft 148 on which the worm wheel 142 is mounted. A similar eccentric cam is located between the bearings 145 and 146 on the shaft 148. Eccentric straps 149 and 150 are mounted on the eccentric cams and connected respectively to the pitman 151 and the pitman 152. The latter are pivoted respectively to pump plungers 153 and 154, as shown in Figs. 5 and 6. The pump plungers 154 and 155 operate in vertical cylin-

ders 156 and 157 to pump water from the reservoir 139 through the pipes 158 and 159 into the pressure pipes 160 and 161. Suitable check valves may be located at the lower ends of the cylinders 156 and 157, as indicated diagrammatically at 162 and 163, so that the water may pass freely from the water reservoir to the left, as viewed in Fig. 5, into and through the pump cylinders, and thence into the pressure pipe 161, the return flow being prevented by the check valves.

The valve structure 140 is shown in detail in Figs. 10, 11, 12 and 13. The valve casing 162 is provided with a longitudinal passage 161′ closed at its ends, but having an intermediate connection to the pressure pipe 161. The other side of the casing 162 is provided with a return passage 163′ which connects with the return pipe 163 leading to the upper part of the water reservoir 139, as shown in Fig. 5.

The valve structure 140 comprises four valves manually operable by means of the handles 164, 165, 166 and 167, as shown in Fig. 5. The valve 168 which is adapted to be operated by the handle 164 is shown in detail in Figs. 10 and 11, the latter being a section on line 11—11 of Fig. 10. The details of the valves operable by the handles 165, 166 and 167 are shown in Figs. 10 and 13, the latter being a sectional view on line 13—13 of Fig. 10. Attention is also called to the section lines of Fig. 12 on which the sectional portion of Fig. 10 is taken.

In Fig. 14 the piping connections between the valve structure 140 and the cylinders 23, 116, 121 and 122 are diagrammatically shown. When the valve 168 is moved to the position shown in Fig. 10 the port 169 connects the fluid pressure passage 161′ to the pipe 170, and when this occurs the table top 20 is moved against the roof of the mine chamber to anchor the main frame. The said table top 20 may be released by moving the valve 168 so that its port 171 will connect the pipe 170 to the return passage 163′ whereupon the weight of the parts carried by the cylinder 23 will force the water out of the latter into the return passages 163′ and 163 and back into the reservoir 139.

If it is desired to operate the piston 127 in the cylinder 121 to release the shoe 129 from the wall 130 the valve 172 may be moved to the position shown in Figs. 10 and 13 whereupon communication will be established between the supply pressure passage 161′ through the port 173 to the pipe 174 which leads to the port 125. The piston 127 will be moved to the right, as shown in Fig. 14, and the water to the right moved out of the port 126 into the pipe 175 which leads to the port 176 and thence to the return passage 163′. When it is desired to move the piston 127 to the left to anchor the shoe 129 against the mine wall 130 the valve 172 is moved to the position where the port 173 is connected between the supply passage 161′ and the pipe 175. In this position the port 177 will connect the pipe 174 to the return passage 163′, thus allowing the liquid to the left of the piston 127 to move out of the port 125 and along the pipe 174 back to the reservoir 139.

In the same manner by means of a valve 178 constructed and arranged similar to the valve 172 shown in Figs. 10 and 13 the flow of liquid along the pipes 179 and 180 may be controlled to effect forward or rearward movement of the cylinder 116 relatively to the piston 118 and piston rod 119. Also, in a similar manner the valve 181 constructed and arranged as the valve 172 shown in Figs. 10 and 13 may be operated to control the flow of the pressure medium along the pipes 182 and 183 to effect the operation of the piston 133 in the cylinder 122. It should also be noted that the valves 169, 172, 178 and 181 may each be moved to a neutral position so that the liquid in the cylinders cannot flow out; that is to say, after the fluid pressure motors comprising the cylinders 23, 116, 121 and 122 have been operated to adjusted positions the pistons therein may be locked in adjusted positions by moving the valves 169, 172, 178 and 181 to neutral positions so that the water can flow neither into nor out of the respective cylinders.

In Figs. 7, 8 and 9 I have shown supplemental hydraulic anchoring devices which may be distributed in spaced-apart locations both on the circular table top 20 and the base plate 19. As shown in Fig. 7, these supplemental hydraulic anchoring devices may be arranged radially in pairs. The plungers 184 and 185 are fitted in cylindrical recesses at the rear portion of the top plate 20; the plungers 186 and 187 are similarly arranged in suitable cylindrical recesses in the forward portion of the table top 20. In Fig. 8 I have shown the advantage of the use of a plurality of spaced-apart distributed hydraulic roof jacks on the plate 20 because the forward portion of the mine chamber and the section of the roof engaged by the plunger 186 is at a slightly higher elevation than the section of the roof engaged by the plungers 184 and 185. The section engaged by the plunger 187 is even somewhat higher than the section engaged by the plunger 186. The plungers 188, 189 and 190 are arranged in suitable cylindrical recesses and all of the recesses are interconnected by the passageways 191 so that the fluid pressure medium may be directed simultaneously to all of the fluid pressure cylinders in the top 20 by being connected to the vertical pipe 192, as shown in Fig. 8.

The base plate 19 is also provided with pairs of radially arranged plungers, some of

which are illustrated at 193, 194, 195 and 196, each adapted to fit into a cylindrical recess forming a cylinder of a hydraulic floor jack. The various cylinders in the base plate 19 are connected together by the passageways 197 so that fluid pressure medium may be directed to all of the plungers simultaneously from the pressure supply passage 198. The vertical passage 199 connects the passages 197 and 198 to the vertical cylindrical recess 200 along which the tube 192 is adapted to slide as the table top 20 is moved to various elevations.

By comparing Fig. 8 with Fig. 3 it will be seen that the passageways 27 and 28 are the same in both views, but in Fig. 8 I have added a valve 201 operable by means of a handle 202 and provided with a port 203 to direct the fluid pressure medium first into the passageway 28 so as to force the cylinder 23 upwardly so that the top plate 20 will engage the roof of the mine chamber to a certain extent whereupon the valve 201 is moved so that the port 203 will connect the pipe 29 to the passageway 198 and then the various distributed auxiliary floor and roof jacks will be operated to securely anchor the main frame while maintaining the base plate 19 and the top plate 20 approximately in horizontal positions. The valve 201 may then be moved to neutral position so as to lock the auxiliary plungers in adjusted positions and also lock the cylinder 23 at its adjusted elevation.

I prefer to control the operation of the pistons 65 and 75 independently of the operation of the part illustrated diagrammatically in Fig. 14. For this purpose an electrically operated pump similar to that illustrated in Figs. 5 and 6 is mounted on the frame of the motor 30, as shown at 204 in Fig. 1. The electrically operated pumping mechanism 204 may be secured to the motor frame 30, as indicated at 205. The valve structure 206 is illustrated in detail in Figs. 15, 16 and 17, and Fig. 18 diagrammatically illustrates the connections of the valve structure with the hydraulic motors comprising the pistons 65 and 75. When the valve 207 is moved to the position shown in Fig. 15 the supply passage 161′ will be connected through the port 208 to the pipe 209 which leads to the port 67 at the upper end of the cylinder 66. When the piston 65 is moved down to elevate the splitting tool 54 the water below the piston will be forced out of the port 68 into the pipe 210 which is connected by the port 211 by the valve 207 by the return passage 163′. By turning the valve so that the port 208 will connect the supply passage 161′ to the pipe 210 the piston 65 can be moved upwardly to lower the splitting tool 54. The water above the piston 65 will then flow out through the pipe 209 and port 212 to the return passage 163′. By noting that the sectional portion of Fig. 15 is taken on line 15—15 of Fig. 17 and that Fig. 16 is taken on line 16—16 of Fig. 15, the direction of flow of the fluid pressure medium may easily be traced.

Since the valve 213 is constructed and arranged the same as the valve 207 it will be evident that the operation of the valve 213 will control the flow of the pressure medium through the pipes 214 and 125 into the cylinder 76 to adjust the elevation of the splitting tool 55, as well as the scraping and scooping mechanism designated 60. While the valves 207 and 203 may be moved to neutral position to lock the pistons 65 and 75 in adjusted positions, such locking may also be effected by closing the hand operated valves 69 and 70 for the piston 65 and by closing the hand operated valves 79 and 80 for the piston 75.

In order to facilitate illustration of the auxiliary floor and roof jacks distributed on the base and top plates I have omitted from Fig. 8 the motor and gearing shown in Figs. 2, 3 and 4 and also the coupling pin 104, but it should be observed that ample space for the coupling pin 104 and the crank arm 105 is provided at 216, as shown in Fig. 8. Furthermore, I have shown in Fig. 7 a slot 217 for the handle 107, as also shown in Fig. 1, this handle 107 being adapted to operate a rock shaft 106, as shown in Fig. 3.

Obviously those skilled in the art may make various changes in the details and arrangements of parts without departing from the spirit and scope of my invention as defined by the claims hereto appended and I wish therefore not to be restricted to the precise construction herein disclosed.

What I claim and desire to have secured by Letters Patent of the United States is:

1. In a mining and loading machine, the combination with supporting frame-work, of coal cleavage mechanism having a free and unobstructed space in advance thereof and mounted on said frame-work for arcuate movement relatively thereto, means for operating said coal cleavage mechanism to dislodge material from a mine vein by direct action thereon, a conveyer for transferring dislodged material toward loading position, and means movable with said coal cleavage mechanism along the base of the mine wall to move dislodged material toward the receiving end of said conveyer.

2. In a mining and loading machine, the combination with supporting frame-work, of coal cleavage mechanism having an arcuate path of travel and adapted to act on an upright mine wall, means for operating said coal cleavage mechanism, and mechanism movable therewith in position to scrape simultaneously along both the floor and roof of the mine chamber adjacent the space from which the material is dislodged.

3. In a mining and loading machine, the combination with supporting frame-work, of conveyer mechanism mounted thereon, coal cleavage mechanism having a free and unobstructed space in advance thereof, means for operating the same by direct action on the native bed in the mine, and means for collecting the dislodged material and moving it toward the receiving end of said conveyer mechanism.

4. In a mining and loading machine, the combination with supporting frame-work, of conveyer mechanism mounted thereon, an upright series of coal splitting devices having free and unobstructed spaces in advance thereof, means for operating said coal splitting devices by direct action on the native bed of coal, and means movable along the path of movement of said coal splitting devices for collecting the dislodged material and moving the same toward the receiving end of said conveyer mechanism.

5. In a mining machine, the combination with coal cleavage mechanism comprising a plurality of spaced-apart pointed wedging tools adapted to enter the upright face of a mine vein and split large pieces of coal therefrom over a large area extending from the floor to the roof of the mine chamber, of means for operating said coal cleavage mechanism including arcuate feed thereof to dislodge the material from the mine wall as aforesaid, and spaced-apart devices at the floor and roof of the mine chamber in position to trim off the surfaces both at the floor and at the roof where the material has been dislodged.

6. In a mining machine, the combination with an upright series of coal splitting devices adapted to penetrate the face of the mine vein in its native state and by wedging action split large sections of coal from the unmined mass, said upright series of coal splitting devices including one at the roof and one at the floor of the mine chamber, means for operating said coal splitting devices including arcuate feed thereof, and auxiliary devices carried respectively by the roof and floor coal splitting devices to trim off the surfaces adjacent the space from which the material has been dislodged.

7. In a mining machine, the combination with a main frame, of a supplemental frame mounted to move arcuately on an upright axis on said main frame, an upright series of coal splitting devices mounted on said supplemental frame and movable arcuately therewith, one coal splitting device being at the roof, another at the floor and another being arranged intermediate the floor and roof with its forward end in advance of the other coal splitting devices, and means for turning said supplemental frame on said upright axis to cause the intermediate coal splitting device to first dislodge material intermediate the floor and roof to facilitate the dislodging action of the floor and roof coal splitting devices.

8. In a mining machine, the combination with supporting framework, of a plurality of spaced-apart pointed coal cleavage devices each adapted to penetrate the coal in its native bed and split the coal from the mine vein, means for operating said coal cleavage devices including arcuate feed thereof to cause the same to penetrate the native coal and dislodge the same, and means for adjusting the relative operating positions of said coal cleavage devices.

9. In a mining machine, the combination with a supporting frame, of a coal splitting device having a free and unobstructed space in advance thereof and adjustably mounted on said frame, fluid pressure mechanism for adjusting the position of said coal splitting device relative to said supporting frame, and means for operating said coal splitting device including arcuate feed thereof by causing the same to act directly against the mine wall to penetrate the native coal and dislodge the same.

10. In a mining machine, the combination with a supporting frame, of a supplemental frame pivotally mounted on said supporting frame for arcuate movement relatively thereto on an upright axis, coal splitting mechanism mounted on said supplemental frame to move bodily therewith, means for imparting arcuate movement to said supplemental frame to operate said coal splitting mechanism, and a hydraulic motor connected to said coal splitting mechanism to adjust the position thereof relative to said supplemental frame.

11. In a mining machine, the combination with a supporting frame, of coal splitting mechanism comprising a pointed coal splitting tool pivotally connected to said frame for adjustment in elevation on a horizontal axis, means for operating said coal splitting mechanism including arcuate feed thereof, a hydraulic motor connected to said coal splitting tool to adjust the position thereof relative to said frame, and means for effecting the locking of said motor to hold the coal supporting tool rigidly connected to said splitting frame for feeding movement therewith.

12. In a mining machine, the combination with a supporting frame, of a coal cleavage device pivotally connected thereto to swing on a horizontal axis, a hydraulic motor connected to said device to adjust the elevation of the operating end thereof, and valve mechanism for controlling the operation of said motor and the locking thereof in adjusted position to hold said device rigidly connected to said frame.

13. In a mining and loading machine, the combination with a main frame, of means

for anchoring the frame between the floor and roof of a mine chamber, a supplemental frame mounted on said main frame for arcuate movement relatively thereto on an upright axis having a free and unobstructed space in advance thereof, coal cleavage mechanism mounted on said supplemental frame to move bodily therewith, means for moving said supplemental frame to secure arcuate movement of said coal cleavage mechanism directly against the native coal in its bed to dislodge such coal from an upright mine wall along an arcuate space, conveyer mechanism connected to said main frame in position to receive dislodged material and transfer the same toward loading position, an abutment comprising wall jacks for engaging the walls of the mine chamber back of said main frame, and a motor connected between said abutment and said main frame to move the main and supplemental frames forward when said abutment is anchored and to move the abutment forward when the main frame is anchored.

14. In a mining and loading machine, the combination with a main frame, of means for anchoring the same, arc wall mining mechanism mounted on said main frame, loading apparatus comprising a conveyer for receiving the dislodged material and transferring the same toward loading position, an abutment comprising fluid pressure wall jacks located end to end and adapted to engage opposite walls of the mine chamber, and a fluid pressure motor connected between said abutment and said main frame to move the latter forward when not anchored and to move the abutment forward when said main frame is anchored.

15. In a mining and loading machine, the combination with a base plate, of an arcuate receiving plate on said base plate in a relatively low position adjacent the floor of the mine chamber and on the forward portion of said base plate, means for dislodging material from an upright wall in advance of said base plate, and means for operating said receiving plate to move from the mine wall dislodged material received thereon.

16. In a mining machine, the combination with a circular base plate, of an annular receiving plate mounted on the upper surface of said base plate, coal cleavage mechanism for dislodging material from an upright mine wall onto said receiving plate, and means for operating said receiving plate to carry the dislodged material away from the mine wall.

17. In a mining machine, the combination with a main frame comprising a series of notches, of a pawl adapted to engage said notches successively, a supplemental frame mounted for movement relatively to said main frame, dislodging mechanism mounted on said supplemental frame, and means connected to said pawl for causing said supplemental frame to move forward step by step in accordance with the successive notches engaged by said pawl.

18. In a mining machine, the combination with a main frame, of a supplemental frame mounted on said frame for movement relatively thereto to various elevations, means for moving said supplemental frame relative to said frame to anchor both frames, dislodging mechanism mounted on said frames, means comprising pawl and ratchet mechanism for moving the dislodging mechanism to effect feeding thereof, the ratchet mechanism being mounted on one of said frames in stationary position when said frames are anchored, and mechanism for operating said moving means by causing said pawl to engage various ratchet teeth.

19. In a mining machine, the combination with a main frame, of a supplemental frame mounted thereon for movement relatively thereto to various elevations, means for moving said supplemental frame relatively to said main frame to anchor both frames, dislodging mechanism mounted on said frames, pawl and ratchet mechanism between said frames and comprising ratchet teeth on one of said frames, and means for operating said pawl and ratchet mechanism to effect arcuate feeding movement of said dislodging mechanism while said frames are anchored in stationary position.

20. In a mining machine, the combination with a main frame, of a supplemental frame, mounted thereon for upright movement relatively thereto, dislodging mechanism supported on said frame between the same, a pivoted arm, an operating motor, means connected between said motor and pivoted arm for oscillating the latter and pawl and ratchet mechanism, operated by the oscillations of said pivoted arm to effect the operation of said dislodging mechanism including the feed thereof during the dislodging of material from the mine wall, said ratchet mechanism comprising ratchet teeth arranged along an arc on one of said frames and adapted to occupy a stationary position during the operation of said dislodging mechanism.

21. In a mining machine, the combination with a main frame comprising a circular plate having an arcuate ratchet thereon, of a supplemental frame mounted for rotation on said main frame, dislodging mechanism mounted on said supplemental frame, a motor mounted on said supplemental frame, an arm pivotally connected to said main and supplemental frames, a pawl at the outer portion of said pivoted arm in position to engage said ratchet, an eccentric cam, means connected to said motor for rotating said eccentric cam, and a pitman connected between said cam and said arm for oscillating

the latter to cause said pawl and ratchet mechanism to feed said dislodging mechanism forward step by step along an arcuate mine wall.

22. In a mining machine, the combination with a main frame, of a supplemental frame movable arcuately on an upright axis on said main frame, dislodging mechanism mounted on said supplemental frame to have an arcuate path of travel, means comprising a motor on said supplemental frame for moving the latter arcuately on said upright axis to feed said dislodging mechanism, a gear mounted to rotate on said upright axis relatively to said main frame, power transmission gearing between said motor and said center gear, and means for holding said center gear against rotation relatively to said main frame to cause the restoration of said dislodging mechanism.

23. In a mining machine, the combination with a main frame, of an annular receiving plate mounted to rotate said main frame on an upright axis, a supplemental frame mounted to rotate on said upright axis, a motor mounted on said supplemental frame, dislodging mechanism mounted on said supplemental frame, power transmission gearing between said motor and said annular plate comprising a gear concentric with said upright axis, means comprising pawl and ratchet mechanism connected to said motor for effecting the feeding of said dislodging mechanism while said annular plate is being rotated relatively to said main frame, and means for holding said concentric gear against rotation relatively to said main frame to effect restoration of said dislodging mechanism after release of the pawl from said ratchet mechanism.

24. In a mining machine, the combination with a circular base plate, of an annular receiving plate mounted to rotate thereon on an upright axis, a gear secured to said annular plate concentrically with said upright axis, a supplemental frame mounted to rotate on said upright axis, dislodging mechanism mounted on said supplemental frame, a motor on said supplemental frame, power transmission mechanism between said motor and said concentric gear to rotate said annular plate about said upright axis, and means for holding said annular plate against movement relatively to said base plate for causing said power transmission gearing to rotate said supplemental frame on said upright axis.

25. In a mining machine, the combination with a main frame, of a supplemental frame mounted thereon to move arcuately relatively thereto on an upright axis, a motor mounted on said supplemental frame, power transmission gearing driven by said motor and comprising a gear concentric with the said upright axis, and operator-controlled power-operated mechanism for preventing the rotation of said concentric gear to effect arcuate movement of said supplemental frame on said upright axis.

26. In a mining machine, the combination with a main frame having a rigid portion widely expanding and adapted to rest on and slide over a mine floor, of dislodging mechanism mounted on said frame in position to operate on an upright mine wall, means for operating said dislodging mechanism to dislodge material from said upright mine wall between a flat floor and a flat roof, and means comprising a plurality of shallow fluid pressure jacks distributed on the rigid portion of said main frame for anchoring the same between said flat floor and said flat roof during the operation of said dislodging mechanism on said upright mine wall.

27. In a mining machine, the combination with a rigid main frame, of mining mechanism mounted thereon and adapted to operate on an upright mine wall between an approximately flat floor and an approximately flat roof, means for operating said dislodging mechanism to dislodge material from said upright mine wall, and means for comprising a plurality of distributed fluid pressure jacks each operable downwardly against an uneven floor to varying degrees for anchoring said rigid main frame between said floor and said roof during the operation of said mining mechanism on such upright mine wall.

28. In a mining machine, the combination with a main frame having a rigid portion, of mining apparatus mounted thereon, means for operating said mining apparatus, and mechanism comprising a main fluid pressure jack and a plurality of auxiliary pressure jacks all carried by said rigid portion of said main frame in co-operative relation for anchoring the latter.

29. In a mining machine, the combination with a main frame comprising a base plate having a lower plane surface adapted to engage the floor of a mine chamber and a top plate adapted to engage the roof of a mine chamber, of mining apparatus mounted on said main frame, means for operating said mining apparatus, a plurality of jacks distributed on said base plate to engage the irregularities of the floor, and a plurality of jacks distributed on said top plate to engage the irregularities of the roof of the mine chamber to anchor said main frame.

30. In a mining machine, the combination with a main frame comprising a base plate and a top plate, of mining apparatus mounted thereon, means for operating said mining apparatus, a main fluid pressure jack for anchoring said main frame, and a plurality of auxiliary fluid pressure jacks distributed on said top plate and on said base plate to engage respectively irregularities of

the floor and roof of the mine chamber and more securely anchor said main frame.

31. In a mining machine, the combination with a base plate, of an upright standard thereon, a top plate, a cylinder depending from said top plate and extending over said standard to form a hydraulic roof jack, a liquid supply pressure pipe, a passageway extending from said pipe along said base plate and through said standard into said cylinder, a plurality of auxiliary distributed hydraulic roof jacks on said top plate, a plurality of distributed hydraulic floor jacks on said base plate, passages for simultaneously directing liquid pressure from said pipe to said various distributed floor and roof jacks, a valve adapted to first direct the liquid pressure from said pipe to said cylinder and then to the said floor and roof jacks, said valve being also adapted to lock the main and auxiliary jacks in anchoring positions, mining apparatus mounted on the main frame formed by said base plate, standard and cylinder, and means for operating said mining apparatus while said base and top plates remain locked in anchored positions.

32. In a mining and loading machine, the combination with supporting framework, of dislodging mechanism mounted thereon comprising a plurality of spaced-apart pointed tools adapted to penetrate the coal in its native bed, means for operating said dislodging mechanism by moving the same arcuately relatively to said framework, a conveyer for transferring the dislodged material toward said loading position, and means movable with said dislodging mechanism along the base of the mine wall to move the dislodged material toward the receiving end of said conveyer.

33. In a mining and loading machine, the combination with supporting framework, of conveyer mechanism mounted thereon, coal cleavage mechanism comprising a plurality of spaced-apart dislodging tools arranged in upright series and adapted to penetrate the native bed of coal and tear the same from the unmined mass, means for operating said coal cleavage mechanism, and means for collecting the dislodged material and moving it toward the receiving end of said conveyer mechanism.

34. In a mining and loading machine, the combination with supporting framework, of conveyer mechanism mounted thereon, an upright series of coal splitting devices arranged in spaced relation and adapted to penetrate the coal in its native bed and dislodge the same in comparatively large lumps over the entire upright mine wall, means for operating said coal splitting devices by direct action on the native bed of coal, and means movable along the path of movement of said coal splitting devices for collecting the dislodged material and moving the same toward the receiving end of said conveyer mechanism.

35. In a mining machine, the combination with supporting framework, of coal cleavage mechanism comprising a plurality of spaced-apart pointed wedging tools adapted to penetrate the face of a mine vein and split coal therefrom, means for supporting said coal cleavage mechanism on said framework for an arcuate path of travel relatively thereto, means for operating said coal cleavage mechanism by imparting an arcuate movement thereto relatively to said framework, and mechanism movable with said coal cleavage mechanism in position to simultaneously scrape material from the floor and from the roof to trim the same adjacent spaces from which the material is dislodged.

36. In a mining and loading machine, the combination with a supporting frame, of a supplemental frame mounted on said main frame for arcuate movement relatively thereto on an upright axis, coal cleavage mechanism mounted on said supplemental frame for arcuate movement relatively thereto, a conveyer on said main frame, means for delivering to said conveyer dislodged material from a position diametrically opposite the initial dislodging position of said coal cleavage mechanism, and means for assisting said coal cleavage mechanism in delivering dislodged material to said delivering means.

37. In a mining machine, the combination with an upright series of coal splitting devices including one at the roof and one at the floor of the mine chamber, of means for operating said coal splitting devices including arcuate feed thereof, and an auxiliary scraper carried by the floor coal splitting devices to trim the surface adjacent the space from which the material has been dislodged along the floor.

38. In a mining machine, the combination with a main frame, of a supplemental frame mounted thereon to move arcuately relatively thereto, an upright series of coal splitting devices mounted on said supplemental frame and movable bodily therewith, one coal splitting device being at the roof, another at the floor and another intermediate the floor and roof with its forward end in advance of the other coal splitting devices, and means for moving said supplemental frame arcuately relatively to said main frame to cause the intermediate coal splitting device to first dislodge the material intermediate the floor to facilitate the dislodging action of the floor and roof coal splitting devices.

39. In a mining machine, the combination with supporting framework, of a plurality of spaced-apart pointed coal cleavage devices comprising one at the roof and another at the floor, means for individually adjust-

ing the elevation of the respective floor and roof coal cleavage devices, and means for operating said coal cleavage devices including arcuate feed thereof to cause the same to penetrate the native coal and dislodge the same.

40. In a mining machine, the combination with a pointed coal cleavage device in position to act on the coal in its native bed along an arcuate path approximately in the horizontal plane of the roof in the mine chamber, and means for operating said pointed coal cleavage device including arcuate feed thereof to act directly on the coal in its native bed to split the same from the coal vein.

41. In a mining machine, the combination with supporting framework, of coal cleavage mechanism mounted thereon and comprising floor and roof coal splitting devices each adjustable in elevation, separate and independent means for adjusting the respective floor and roof coal splitting devices, and means for operating said coal cleavage mechanism by causing the same directly on the coal in its native bed to dislodge the coal.

42. In a mining machine, the combination with supporting framework, of coal cleavage mechanism comprising a pointed pivoted tool, a hydraulic motor for adjusting the elevation of the point of said tool, and means for operating said coal cleavage mechanism including arcuate feeding movement thereof to dislodge material between the floor and roof by one continuous movement along the mine wall.

43. In a mining and loading machine, the combination with a main frame, of means for anchoring the same, arc wall mining mechanism mounted on said main frame and comprising coal cleavage mechanism adapted to act directly on the coal in its native bed to dislodge the same, loading apparatus comprising a conveyer for receiving the dislodged material and transferring the same toward loading position, and means located diametrically opposite the initial position of said coal cleavage mechanism for receiving and directing the dislodged material onto said conveyer.

44. In a mining and loading machine, the combination with a supporting frame, of an arcuate receiving plate on said supporting frame, means comprising a plurality of spaced-apart pointed coal cleavage devices adapted to dislodge material from the entire upright mine wall between the floor and roof thereof, means for operating said coal cleavage mechanism, and means for operating said receiving plate to move from the mine wall the dislodged material received therefrom.

45. In a mining machine, the combination with a main frame, of means for anchoring the same, a supplemental frame mounted for arcuate movement relatively to said main frame, dislodging mechanism mounted on said supplemental frame and comprising spaced-apart pointed coal cleavage devices, and self-contained power-operated mechanism between said supplemental frame and said main frame and comprising a widely expanded notched horizontal table for moving the supplemental frame together with said coal cleavage mechanism step by step along said main frame to operate said coal cleavage mechanism by imparting arcuate feeding movement thereto.

46. In a mining machine, the combination with a main frame, of a supplemental frame mounted on said main frame for arcuate movement relatively thereto, dislodging mechanism mounted on said supplemental frame and movable bodily therewith in an arc, a motor carried by said supplemental frame, a ratchet on said main frame, a pawl, and means connected between said motor and said pawl for effecting arcuate feeding movement of said dislodging mechanism.

47. In a mining machine, the combination with a main frame, of a supplemental frame mounted thereon to move arcuately relatively thereto, dislodging mechanism mounted on said supplemental frame, a ratchet on said main frame, a pawl, a pivoted lever carrying said pawl, and means for oscillating said lever relatively to said supplemental frame to effect arcuate feeding of said dislodging mechanism.

48. In a mining machine, the combination with a main frame, of a supplemental frame pivoted thereto for arcuate movement on an upright axis, dislodging mechanism carried by said supplemental frame, a lever pivoted to said upright axis to have a swinging movement thereon with said supplemental frame, means for oscillating said lever relatively to said supplemental frame and on said upright axis, and pawl and ratchet mechanism between said lever and said main frame to effect feeding movement of said dislodging mechanism when said lever is oscillated.

49. In a mining machine, the combination with a main frame, of means for anchoring the same, an arcuate ratchet on said main frame, a supplemental frame pivoted to said main frame for arcuate movement thereon, dislodging mechanism carried by said supplemental frame for bodily movement therewith, a motor on said supplemental frame, a lever pivoted on said upright axis for movement with said supplemental frame, a pawl carried by said lever in position to engage said arcuate ratchet and motor carried by said supplemental frame, and means connected between said motor and said lever for oscillating the latter relatively to said supplemental frame to effect the operation of said pawl and ratchet mechanism to effect

feeding movement of said dislodging mechanism.

50. In a mining machine, the combination with a main frame, of a supplemental frame mounted thereon for arcuate movement relatively thereto, dislodging mechanism mounted on said supplemental frame, means comprising pawl and ratchet mechanism for moving said supplemental frame to effect feeding of said dislodging mechanism, and mechanism comprising power-operated spur gearing for restoring said dislodging mechanism to initial position when said pawl and ratchet mechanism is released.

51. In a mining machine, the combination with a main frame, of a supplemental frame mounted thereon for movement relatively thereto, dislodging mechanism mounted on said supplemental frame, means for moving said supplemental frame step by step relatively to said main frame to effect feeding movement of said dislodging mechanism, idle gearing connected to said moving means, and locking mechanism associated with said gearing to effect restoration of said dislodging mechanism by a continuous and comparatively rapid movement of said supplemental frame to initial position.

52. In a mining machine, the combination with a main frame, of a supplemental frame mounted thereon for movement arcuately relatively thereto on an upright axis, dislodging mechanism mounted on said supplemental frame to have an arcuate path of travel, a gear concentric with the axis of arcuate movement of said supplemental frame, means comprising power transmission gearing for operating said dislodging mechanism while said concentric gear is free to rotate relatively to said frame, a power transmission connection between said power transmission gearing and said concentric gear, and means for holding said concentric gear against rotation relatively to said main frame to effect restoration of said dislodging mechanism to initial position.

53. In a mining machine, the combination with a main frame, of a supplemental frame mounted thereon to move relatively thereto along an arc, dislodging mechanism mounted on said supplemental frame, means for operating said dislodging mechanism comprising power transmission gearing, a gear concentric with the axis of movement of said supplemental frame and connected for rotation to said power transmission gearing but free to operate during the operation of said dislodging mechanism, and means for preventing at will the rotation of said concentric gear to effect arcuate continuous restoring movement of said supplemental frame on said axis.

54. In a mining machine, the combination with a main frame, of a supplemental frame pivoted thereto, dislodging mechanism carried by said supplemental frame, means comprising power transmission gearing for moving said supplemental frame to effect feeding of said dislodging mechanism, a gear concentric with the pivotal axis of said supplemental frame and connected to said power transmission gearing for free rotation thereby during the operation of said dislodging mechanism, and means for preventing rotation of said concentric gear relatively to said main frame to cause said power transmission gearing to give said supplemental frame a continuous and comparatively rapid restoring movement.

55. In a mining machine, the combination with a main frame having a lower rigid plane surface, of dislodging mechanism mounted on said main frame in position to operate on an upright mine wall, means for operating said dislodging mechanism to dislodge material from such upright mine wall between the floor and roof of the mine chamber, and means comprising a plurality of fluid pressure jacks distributed on said main frame over the lower rigid plane surface thereof, for anchoring said main frame rigidly between the floor and roof of the mine chamber during the operation of said dislodging mechanism on such upright mine wall.

56. In a mining machine, the combination with a main frame, of means comprising a roof plate having an upper plane surface, for anchoring said main frame between the floor and roof of the mine chamber, mining mechanism mounted on said main frame and adapted to operate on an upright mine wall between the floor and roof of the mine chamber, means for operating said mining mechanism to dislodge material from such upright mine wall, and a plurality of auxiliary jacks distributed over said upper plane surface for engaging irregularities along the roof where the machine is anchored.

57. In a mining machine, the combination with a main frame, of a supplemental frame comprising a top plate adapted to engage the roof of a mine chamber, mining apparatus supported by said main frame, means for operating said mining apparatus, and means comprising a plurality of jacks distributed on said top plate to engage irregularities of the roof of the mine chamber to anchor both of said frames.

58. In a mining and loading machine, the combination with supporting framework, comprising a base plate with a beveled edge adapted to be located at the mine floor at the forward end of said plate, of means on said plate for transferring rearwardly dislodged material, mechanism for operating said transferring means, and cleavage mechanism comprising a plurality of spaced-apart dislodging tools arranged in upright series and adapted to penetrate the native

bed of mineral and tear the same from the unmined mass, and means for operating said cleavage mechanism.

59. In a mining and loading machine, the combination with a supporting frame comprising a base plate with a forward beveled edge arcuate in plan, of coal cleavage mechanism comprising an upright series of coal splitting devices arranged in spaced relation and adapted to penetrate the coal in its native bed and dislodge the same in comparatively large chunks, means for operating said coal splitting devices by direct action on the native bed of coal, and loading apparatus comprising transferring mechanism movable along said arcuate beveled edge.

60. In a mining machine, the combination with supporting framework comprising a base plate having a lower plane surface and a forward edge inclined upwardly and rearwardly from said plane surface, said framework also comprising a top plate having an upper plane surface and a forward edge inclined downwardly and rearwardly from said upper plane surface, mining apparatus mounted on said supporting framework between said base plate and said top plate, means for operating said mining apparatus, and loading apparatus extending along said base plate adjacent the forward edge thereof.

61. In a mining machine, the combination with a widely expanded base frame having a forward beveled edge adapted to be located at the floor of the mine chamber in position to scrape over the floor when the machine is moved forward, of a top frame mounted on said base frame and having a forward beveled edge adapted to be located at the roof of the mine chamber, mining apparatus supported on said base frame below said top frame, and means for operating said mining apparatus.

62. In a mining machine, the combination with widely expanded self-supporting framework having a base with a forward beveled edge at the floor of the mine chamber and a top with a forward beveled edge at the roof, of mining mechanism on said framework, means for operating said mining mechanism, abutment mechanism, and means between said abutment mechanism and said framework for moving said framework while being self-sustained and while said beveled edges move along the said floor and roof, respectively.

63. In a mining machine, the combination with widely expanded supporting framework comprising a base plate having a forward beveled edge and an adjustable top plate having a forward beveled edge, of means for adjusting the elevation of said top plate relatively to said base plate, mining mechanism mounted on said framework, means for operating said mining mechanism, and means for moving said framework and mining mechanism forward to new locations.

64. In loading apparatus, the combination with a supporting frame having a widely expanded base plate with a forward beveled edge adapted to be located at the floor of the mine chamber in position to scrape over such floor, of loading mechanism comprising transferring means extending along said base plate near said beveled edge, abutment mechanism, and a fluid pressure motor between said abutment mechanism and said frame for positively moving said base plate to cause the beveled edge to scrape over the mine floor to collect material therefrom.

65. In a mining machine, the combination with a main frame, of dislodging mechanism mounted on said main frame and comprising a plurality of spaced-apart pointed wedging tools each adapted to penetrate the face of the coal vein and by wedging action split large portions of the coal from the unmined mass over a wide area between and adjacent said tools, anchoring mechanism for the main frame comprising a roof jack, and a plurality of supplemental jacks to resist twisting strains during the operation of such dislodging mechanism, a hydraulic operating system for said anchoring mechanism, and means for operating said dislodging mechanism to cause said tools to penetrate the solid face of the mine vein and split the coal therefrom over such wide area while said main frame remains anchored by said anchoring mechanism.

66. In a mining machine, the combination with a supporting frame comprising an upright standard, of a hub mounted on said standard, a radial arm extending from said hub, dislodging mechanism mounted on said arm to move bodily therewith, means geared to one portion of said hub for moving said arm in one direction to effect feeding of said dislodging mechanism, and means geared to another portion of said hub for moving said arm in the opposite direction to effect restoration of said dislodging mechanism.

67. In a mining machine, the combination with a supplemental frame comprising a cylinder, of a hub journaled on said cylinder to move pivotally relative to said supplemental frame, a radial arm extending from said hub, dislodging mechanism mounted on said radial arm to move bodily therewith, a ratchet connected to said hub, a pawl for engaging said ratchet, and means for reciprocating said pawl to act on said ratchet to cause said supplemental frame and said dislodging mechanism to be moved in feeding direction.

68. In a mining machine, the combination with a supporting frame comprising an upright standard, of a hydraulic jack for anchoring said standard between the floor and

roof of a mine chamber, a radial arm pivotally connected to said standard for swinging movement on an upright axis, dislodging mechanism mounted on said arm to move bodily therewith and comprising a plurality of spaced-apart penetrating tools adapted to penetrate the coal in its native bed and split the same from the face of the mine vein over an area extending from the floor to the roof, means for moving said arm in one direction to effect feeding of the dislodging mechanism, and means for moving said arm in the opposite direction to effect restoration of said dislodging mechanism.

69. In a mining machine, the combination with a main frame, of anchoring mechanism therefor comprising a hydraulic roof jack and a plurality of supplemental hydraulic jacks to resist twisting strains, dislodging mechanism mounted on said main frame comprising a plurality of spaced-apart pointed tools each adapted to penetrate the coal in its native bed and co-operate with the other tools to split the coal from the face of the mine vein over an area extending from the floor to the roof, a hydraulic operating system for said anchoring mechanism, and means for operating said dislodging mechanism to cause said tools to dislodge the coal from the face of the mine vein while said main frame remains anchored by said anchoring mechanism.

70. In a mining machine, the combination with supporting framework, of dislodging mechanism comprising coal splitting tools adapted to have a continuous forward feeding movement along an arcuate path of travel in position to operate on an upright mine wall, pawl and ratchet mechanism for feeding said dislodging mechanism, and means for holding said framework stationary during the operation of said dislodging mechanism.

71. In a mining and loading machine, the combination with a main frame, of a supplemental frame mounted on said main frame for swinging movement relatively thereto on an upright axis, dislodging mechanism comprising a plurality of spaced-apart claw-like penetrating and wedging tools each stationary relative to said supplemental frame and movable bodily therewith in feeding direction, means for swinging said supplemental frame on said upright axis to operate said dislodging mechanism by causing said tools to penetrate the solid face of the coal in its native bed and by wedging action split the coal from the mine vein over a wide area and in large pieces, mechanism for holding the main frame stationary during the operation of said dislodging mechanism, loading apparatus connected to said main frame in position to receive the dislodged coal upon the completion of the arcuate swinging feeding movement of said dislodging mechanism, and means for operating said loading apparatus to transfer the received coal toward loading position while said dislodging mechanism is restored to initial position.

72. In a mining and loading machine, the combination with a main frame, of a supplemental frame, dislodging mechanism comprising pointed penetrating wedging tools in position to operate on the solid upright coal face of a mine vein by moving along such coal face, means arranged to move along the floor at the base of the mine wall to move the dislodged material along the path of travel of the dislodging mechanism, and loading apparatus connected to said frame with its receiving end adjacent the end of the path of travel of said dislodging mechanism in position to receive said dislodged material upon the completion of a forward feeding stroke of said dislodging mechanism.

73. In a mining and loading machine, the combination with a main frame, of a supplemental frame connected to the forward end of said main frame to extend horizontally in advance thereof for arcuate movement relatively thereto on an upright axis, dislodging mechanism comprising spaced-apart penetrating wedging tools rigidly connected together and rigidly connected to said supplemental frame to move bodily therewith as a rigid unit, a floor trimmer movable with said dislodging mechanism and adapted to move the dislodged material along the base of the mine wall in the direction of the feeding travel of the dislodging mechanism, means for imparting arcuate movement to said supplemental frame to effect the operation of said dislodging mechanism and the operation of said floor trimmer while said main frame remains stationary, and a conveyor at one side of said main frame with its receiving end adjacent the limit of feeding travel of said dislodging mechanism where the floor trimmer moves the dislodged material.

74. In a mining and loading machine, the combination with a main frame, of a supplemental frame mounted thereon for arcuate movement relatively thereto on an upright axis, dislodging mechanism on said supplemental frame to move bodily therewith, a traveling conveyer extending around the forward end of said main frame and comprising a scooping conveyer frame movable over the mine floor to gather dislodged material in advance thereof, an additional conveyer at one side of said main frame with its receiving end adjacent the limit of feeding movement of said dislodging mechanism and in position to receive material from said first-named conveyer, means for arcuately moving said supplemental frame to operate

said dislodging mechanism toward said additional conveyer and in advance of said first-named conveyer and to restore said dislodging mechanism to initial position on that side of said main frame opposite the receiving end of said additional conveyer, and means for moving the whole machine forward to re-position the dislodging mechanism for another operation and at the same time move said scooping conveyer frame over the mine floor to gather dislodged material therefrom.

75. In a mining machine, the combination with a supporting frame, of a supplemental frame mounted thereon for swinging movement relatively thereto, spaced-apart pointed wedging tools mounted on said supplemental frame for bodily movement therewith and adapted to penetrate the solid face of a mine vein and by wedging action split large pieces of coal from the unmined mass over a wide area between the floor and roof of a mine chamber, pawl and ratchet mechanism for swinging said supplemental frame to actuate said tools, oscillating mechanism to operate said pawl and ratchet mechanism, and anchoring means for said supporting frame including wall-abutment mechanism.

76. In a mining and loading machine, the combination with a main frame, of a supplemental frame swingable on an upright axis, dislodging mechanism mounted on said supplemental frame and dependent entirely upon movement of the latter for its operation, means for swinging said supplemental frame to impart to said dislodging mechanism a translating movement corresponding to that of said supplemental frame to thereby effect the operation of said dislodging mechanism, and loading apparatus comprising a conveyor on the front portion of said supplemental frame in position to receive the material as dislodged and convey such material toward loading position.

77. In coal mining apparatus, the combination with a supporting frame, of a horizontally swinging tool-carrier on said supporting frame, a plurality of spaced-apart dislodging tools each adapted to penetrate the coal in its native vein and by wedging action split and tear the coal from the unmined mass, and means for swinging said tool-carrier horizontally and relatively to said supporting frame to effect the operation of said dislodging tools to dislodge the coal from an upright mine wall over an area extending from the floor to the roof of the mine chamber.

78. In a mining and loading machine, the combination with a main frame, of a supplemental frame mounted on said main frame for swinging movement on an upright axis through an angle of 180 degrees or more, spaced-apart penetrating wedging tools mounted on said supplemental frame in position to pierce the upright face of a solid coal vein and by wedging action split the coal from the unmined mass in large pieces over a wide area, digging mechanism pivoted to said supplemental frame in position to move bodily therewith along the floor of the mine chamber adjacent the base of the mine wall, and means for swinging said supplemental frame on such upright axis to effect the operation of the coal splitting mechanism and at the same time effect the operation of said digging mechanism to split masses of material from the floor and thus trim it approximately to the level of the floor in front of the upright mine wall.

In testimony whereof I have signed my name to this specification on this 13th day of November, A. D. 1920.

EDMUND C. MORGAN.