Aug. 30, 1966 F. E. MUNGER 3,269,776

MINING APPARATUS

Filed Dec. 20, 1961 9 Sheets-Sheet 1

Fig. 1

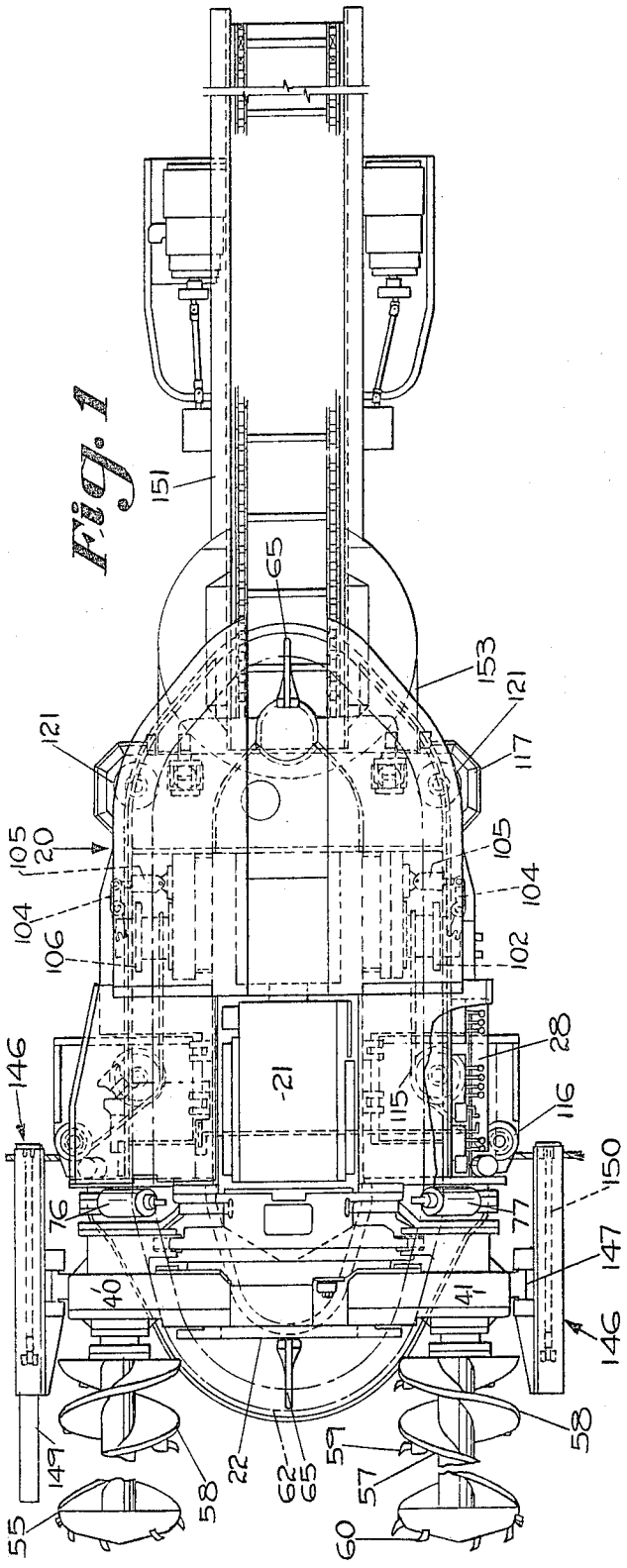
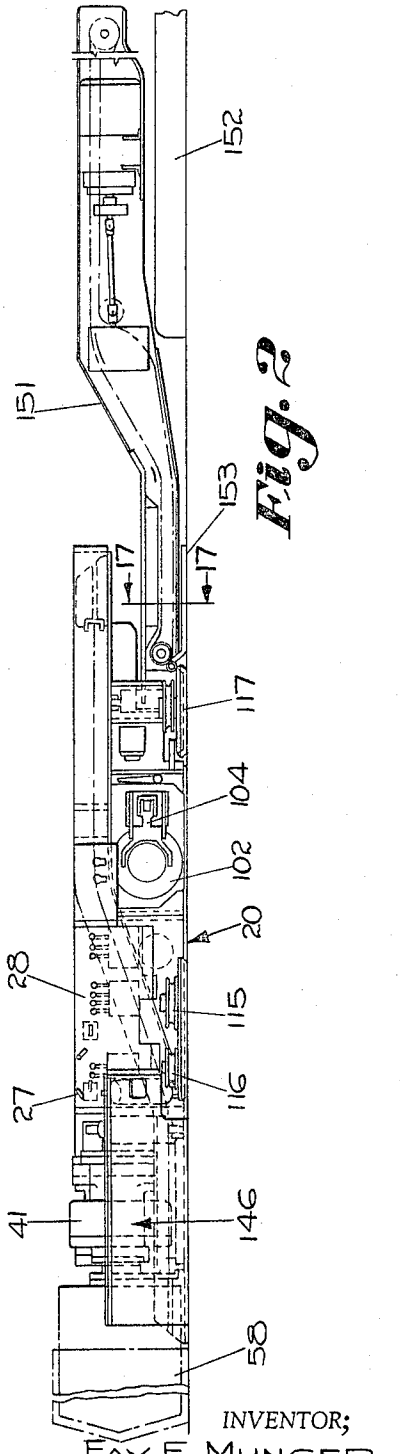



Fig. 2




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Aug. 30, 1966 F. E. MUNGER 3,269,776

MINING APPARATUS

Filed Dec. 20, 1961 9 Sheets-Sheet 2

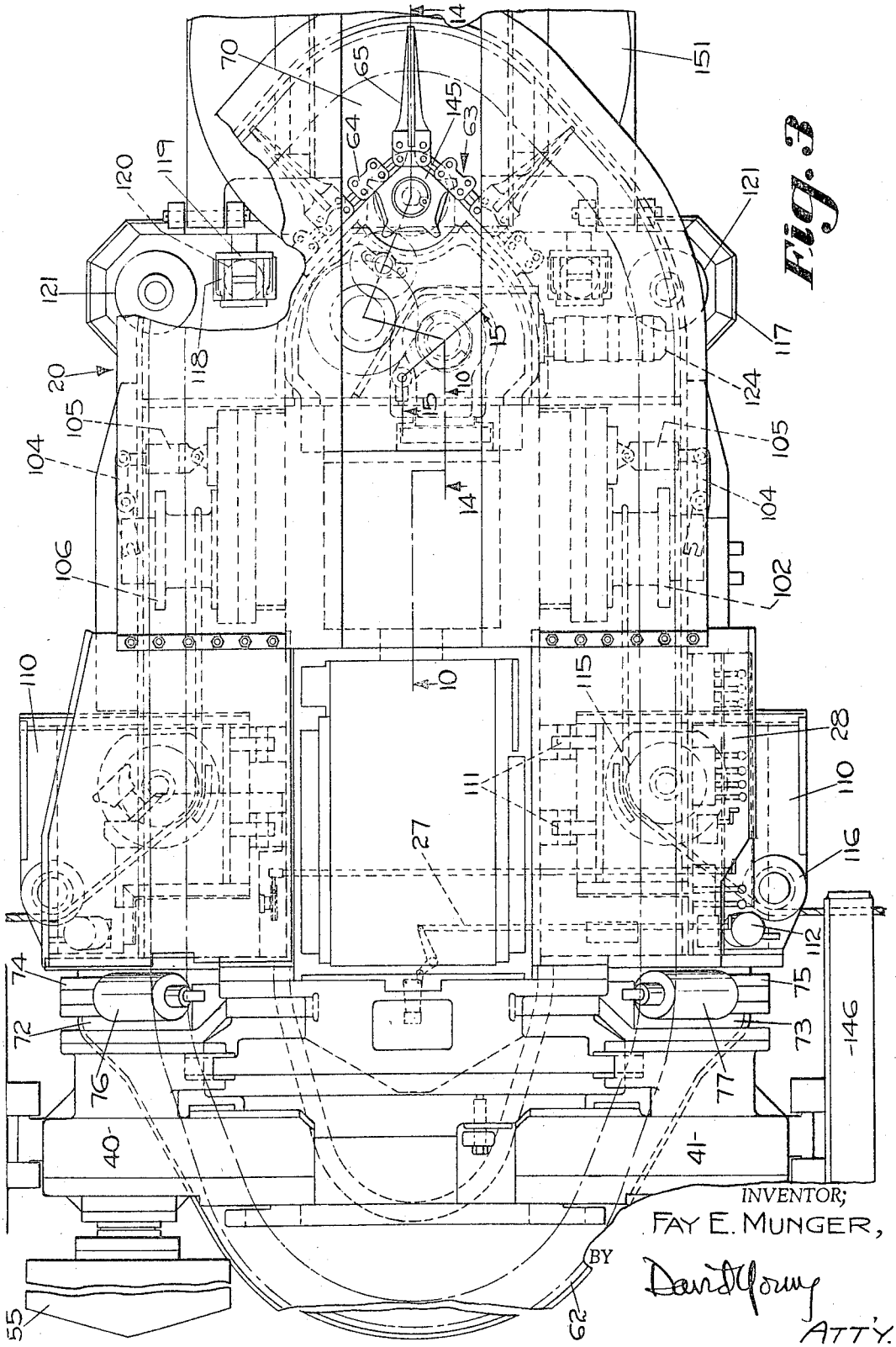



Fig. 3

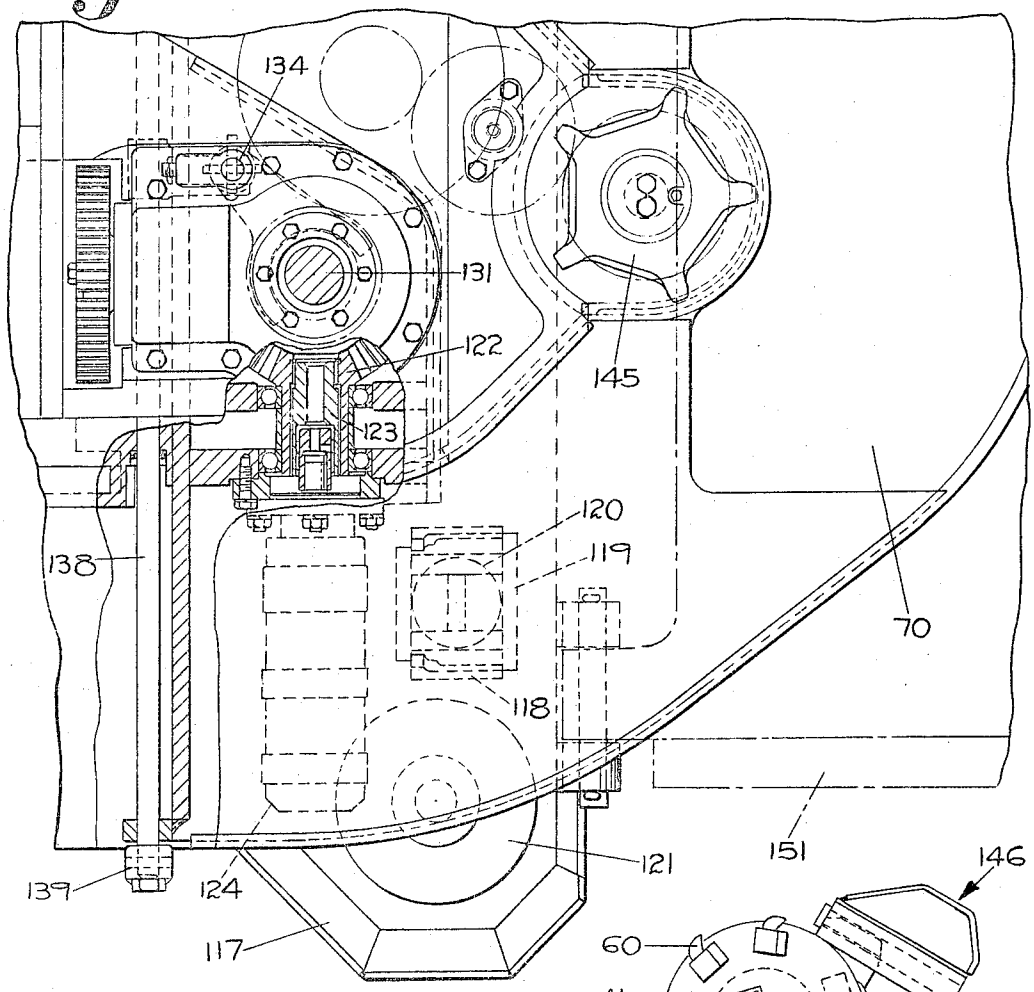
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Aug. 30, 1966 F. E. MUNGER 3,269,776

MINING APPARATUS

Filed Dec. 20, 1961 9 Sheets-Sheet 3

Fig. 16



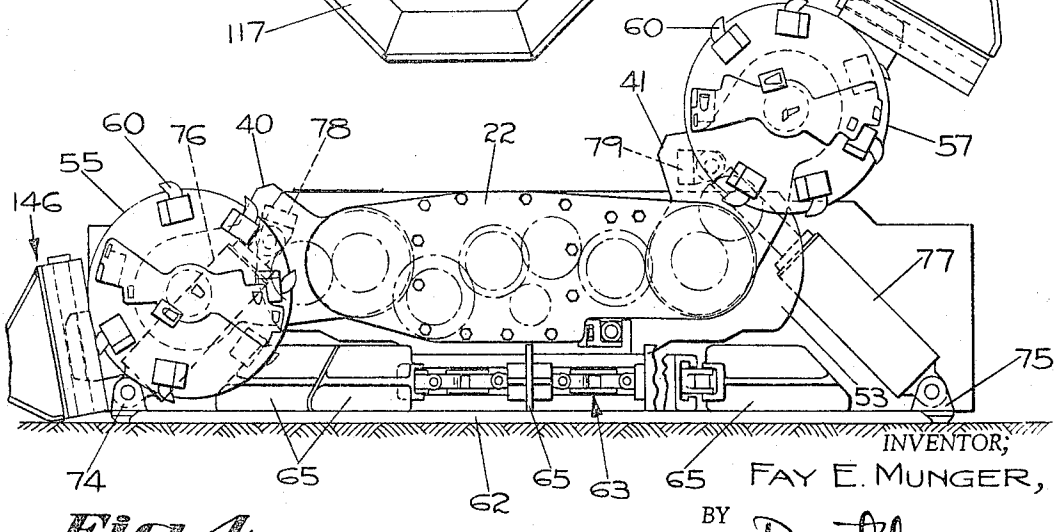




Fig. 4

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MINING APPARATUS

Filed Dec. 20, 1961 9 Sheets-Sheet 4

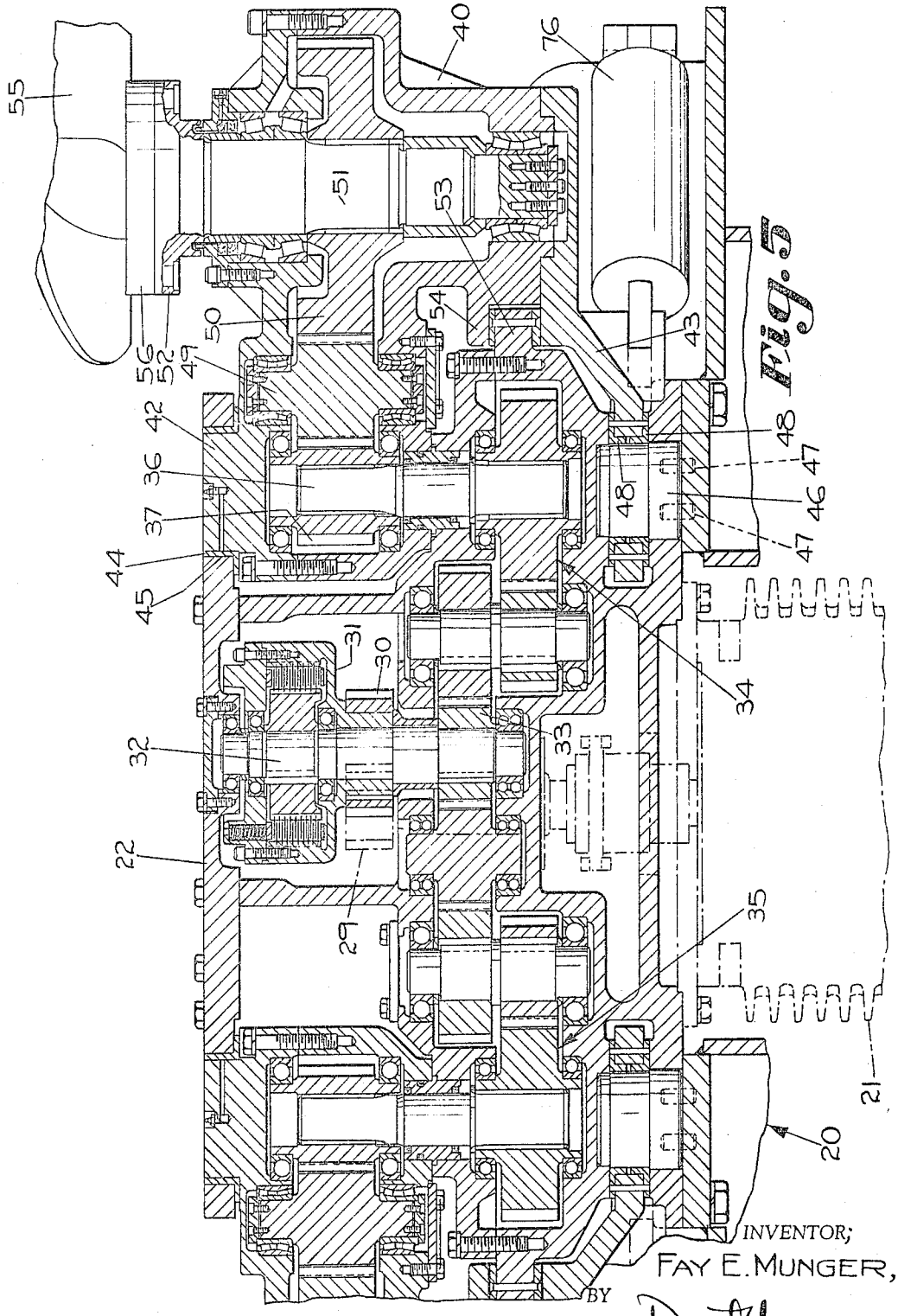



Fig. 5

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Aug. 30, 1966 F. E. MUNGER 3,269,776

MINING APPARATUS

Filed Dec. 20, 1961 9 Sheets-Sheet 5

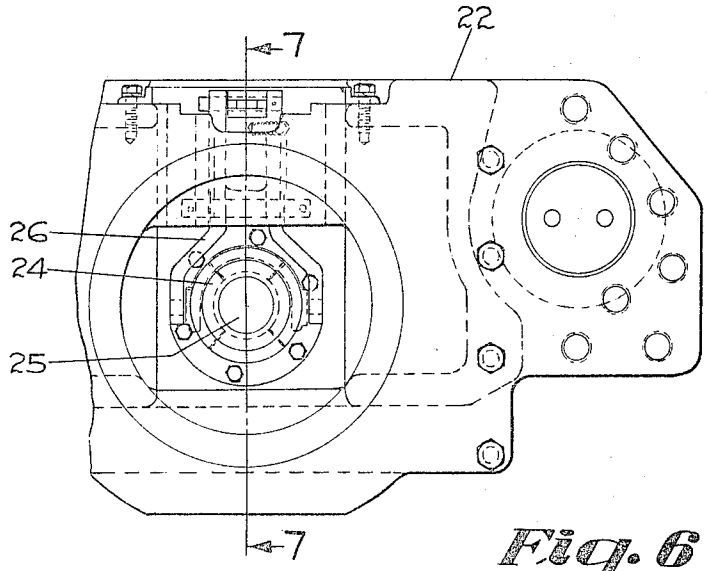



Fig. 6

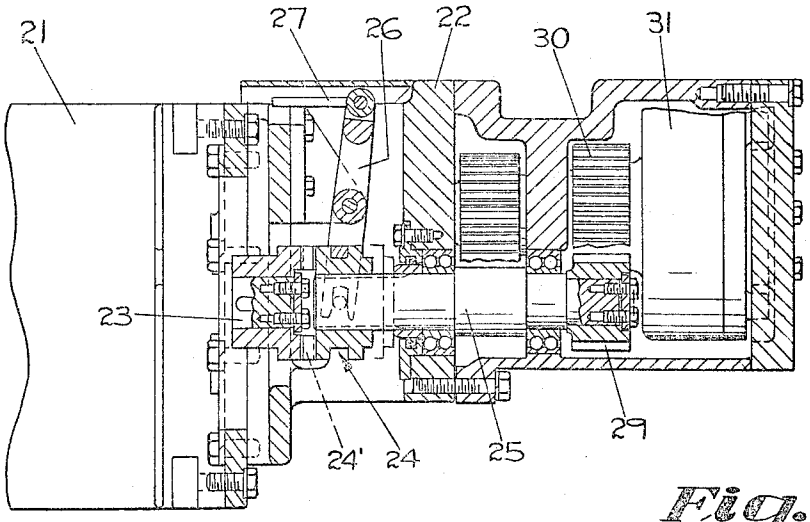



Fig. 7

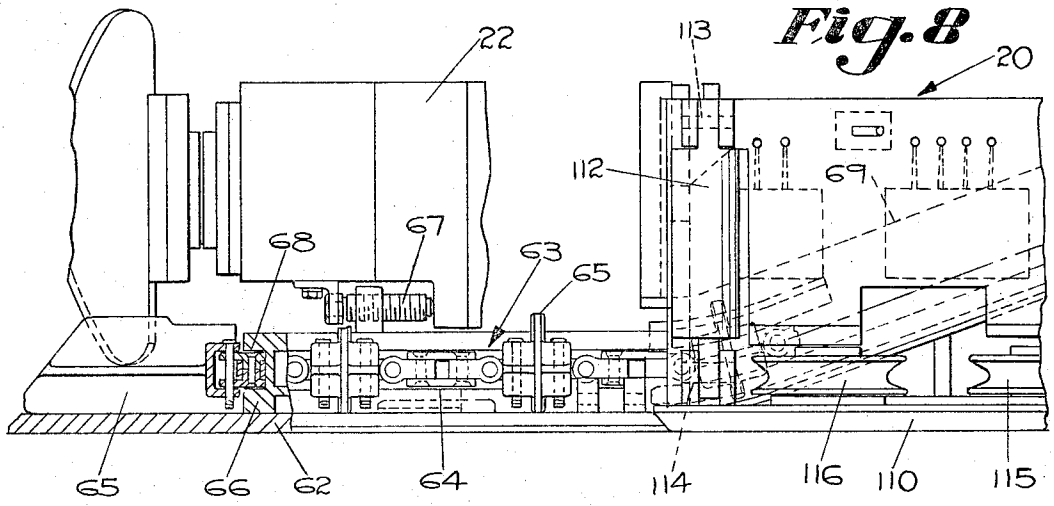
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MINING APPARATUS

Filed Dec. 20, 1961 9 Sheets-Sheet 6

Fig. 8



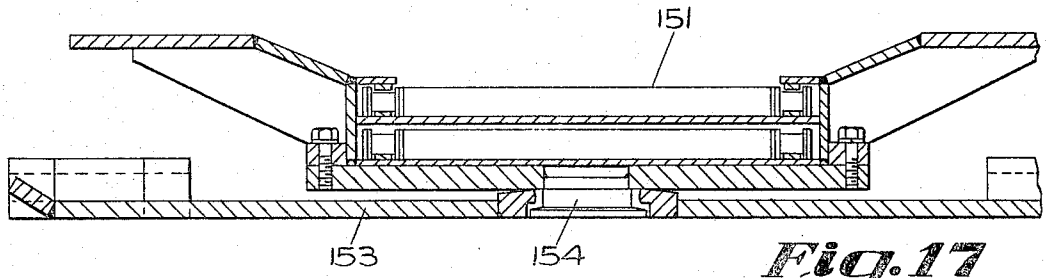




Fig. 17

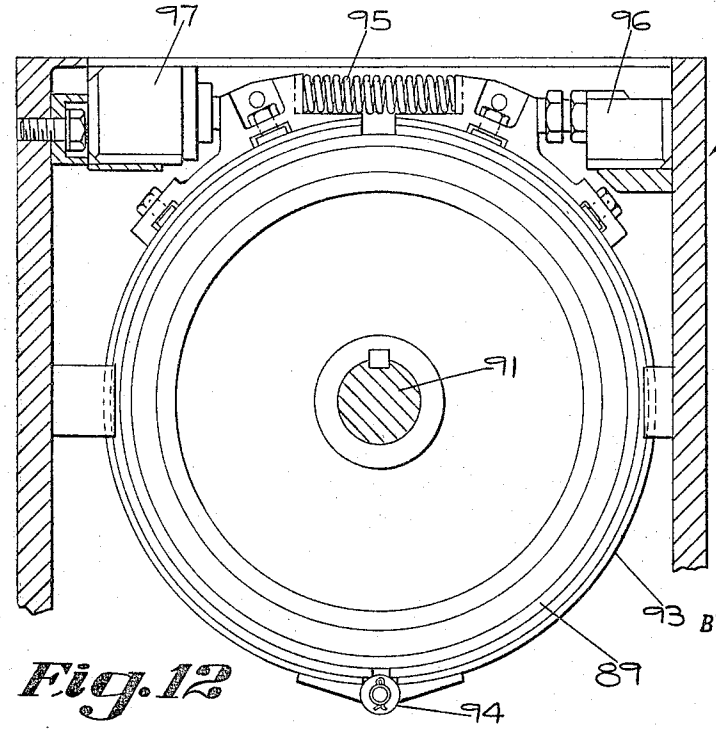



Fig. 12

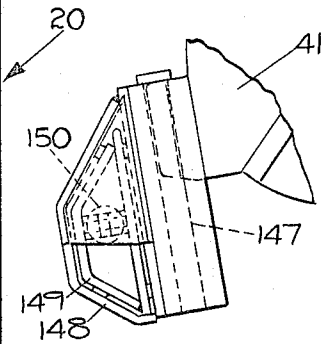



Fig. 9

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MINING APPARATUS

Filed Dec. 20, 1961 9 Sheets-Sheet 7

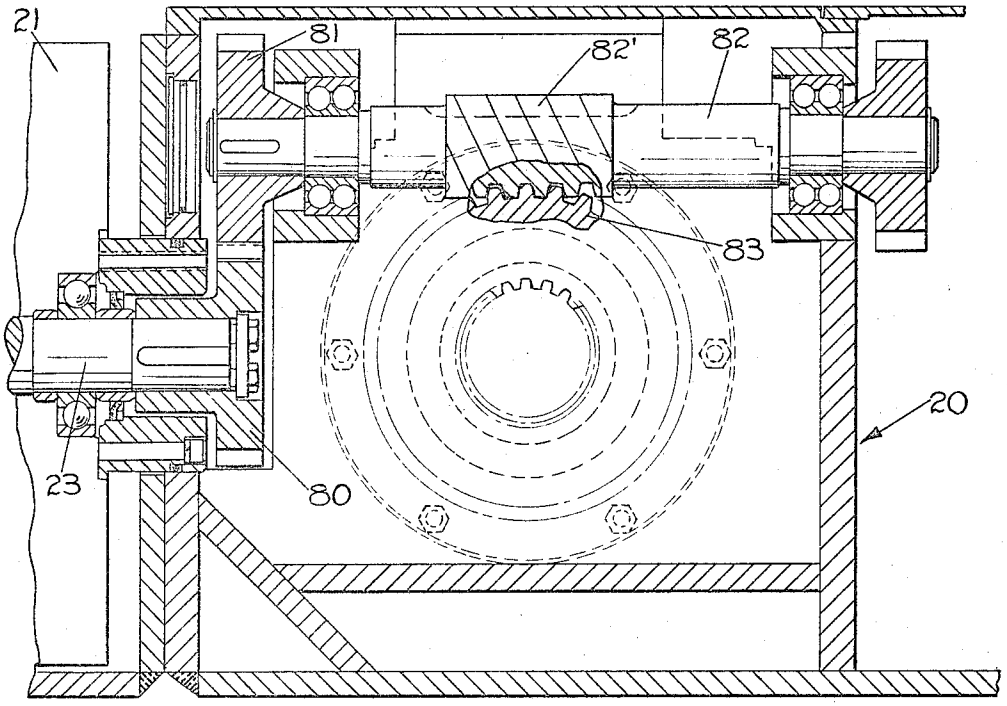



Fig. 10

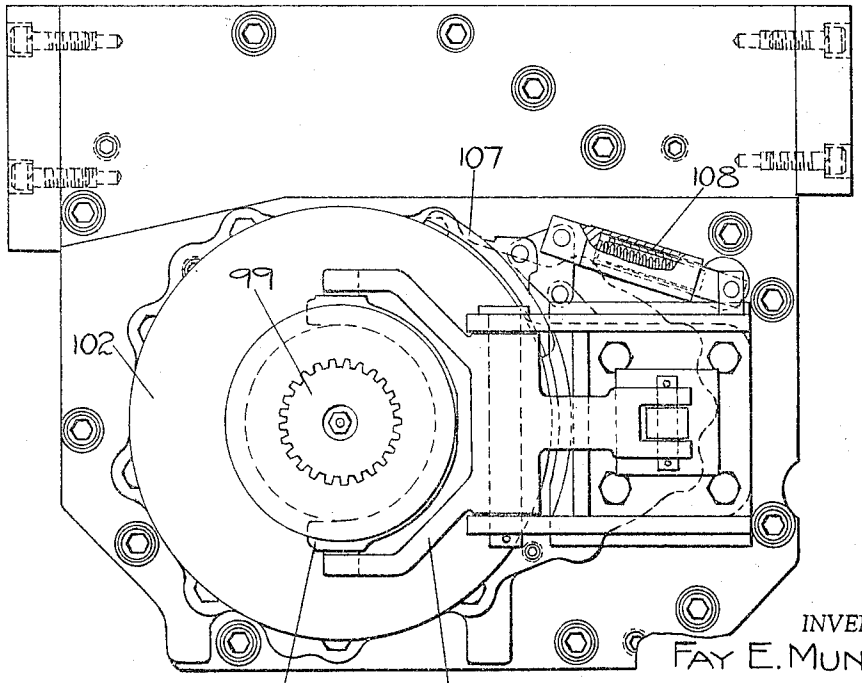



Fig. 13

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Aug. 30, 1966 F. E. MUNGER 3,269,776

MINING APPARATUS

Filed Dec. 20, 1961 9 Sheets-Sheet 8

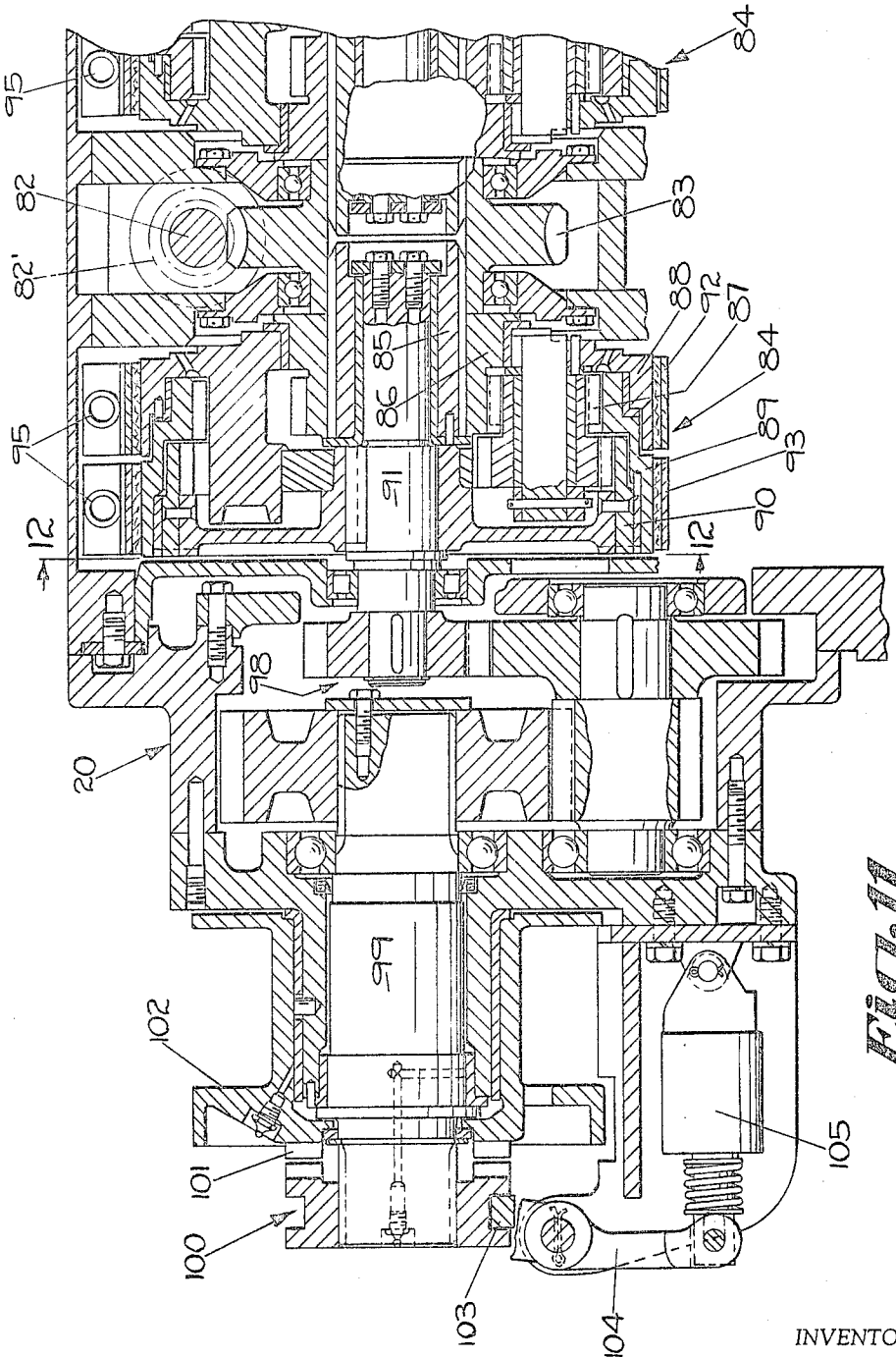



Fig. 11

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Aug. 30, 1966 F. E. MUNGER 3,269,776

MINING APPARATUS

Filed Dec. 20, 1961 9 Sheets-Sheet 9

Fig. 14

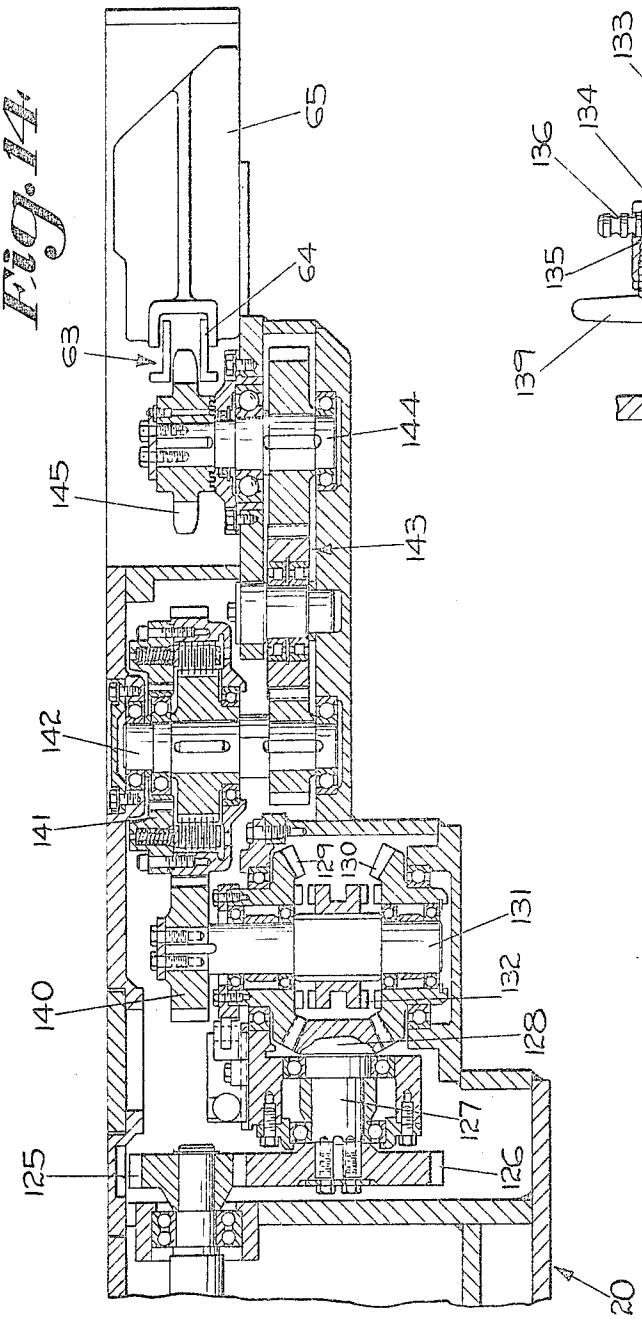
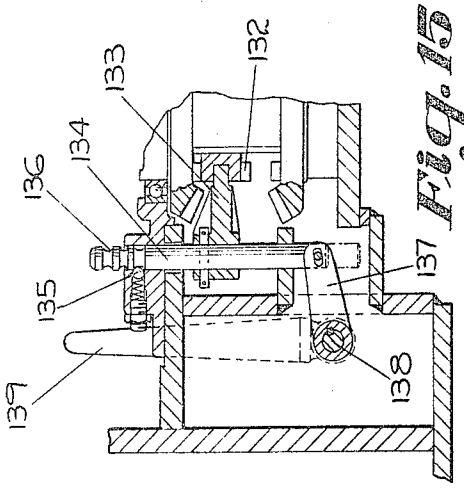



Fig. 15




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United States Patent Office 3,269,776 Patented August 30, 1966



3,269,776

# MINING APPARATUS

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Filed Dec. 20, 1961, Ser. No. 160,783
12 Claims. (Cl. 299—57)

The instant invention relates to mining apparatus, and more particularly to a mining apparatus primarily intended for the mining of coal in low seams.

It is an object of the instant invention to provide an improved mining apparatus of low height, which is particularly suited for mining coal in low seams.

It is another object of the instant invention to provide an improved mining apparatus of low height and compact construction to facilitate the movement of the mining apparatus in the mine.

It is a further object of the instant invention to provide an improved mining apparatus, in which the mining mechanism operates to cut and break the material out of the mine seam, and also operates to deliver the mined material to a loading portion of the mining apparatus for removal of the mined material.

It is still another object of the instant invention to provide an improved mining apparatus including a bed plate therefor, which is disposed at the front of the apparatus for loading mined material.

It is still a further object of the instant invention to provide an improved mining apparatus comprising a bed plate at the front thereof, on which mined material is loaded, and including a forwardly extending, adjustable mining mechanism and power means for adjusting the mining mechanism which is disposed between the bed plate and the mining mechanism supporting means.

Another object of the instant invention is to provide an improved mining apparatus comprising auger mining mechanisms, disposed one at each side of the mining apparatus, and a bed plate extending forwardly between the auger mining mechanisms for loading the mined material, said auger mining mechanisms operating to deliver mined material onto the bed plate.

Still a further object of the instant invention is to provide an improved mining apparatus having a bed plate at the front thereof for loading mined material, and a conveyor operating across the bed plate to sweep the mined material from the bed plate and delivering the mined material at the rear of the mining apparatus for discharge.

It is still a further object of the instant invention to provide an improved mining apparatus comprising a mining mechanism adapted to be operated in a transverse direction through a mine seam, and a plow disposed adjacent the mining mechanism to follow the latter as it is moved through the mine seam to crowd the mined material onto a loading portion of the mining apparatus.

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

In the accompanying drawings:

FIG. 1 is a plan view of a mining apparatus constructed in accordance with the instant invention;

FIG. 2 is a side elevational view of the mining apparatus of this invention;

FIG. 3 is an enlarged, partial plan view of the mining apparatus, showing various details thereof;

FIG. 4 is a front elevational view of the mining apparatus;

FIG. 5 is a transverse sectional view of the main gear case, showing the drive to one mining mechanism;

FIG. 6 is a rear elevational view of a portion of the main gear case;



FIG. 7 is a sectional view of the main gear case, taken on the line 7—7 in FIG. 6;

FIG. 8 is a partial side elevational view of the front end of the mining apparatus;

FIG. 9 is a rear elevational view of the plow;

FIG. 10 is a sectional view through the main frame of the mining apparatus, showing the drive from the rear of the motor, taken on the line 10—10 in FIG. 3;

FIG. 11 is a transverse sectional view of the main frame, showing the drive to one rope drum;

FIG. 12 shows a friction band and the operating mechanism therefor, taken on the line 12—12 in FIG. 11;

FIG. 13 is a side elevational view of a portion of the mining apparatus, showing the rope drum and associated devices;

FIG. 14 is a sectional view of the conveyor drive, taken on the line 14—14 in FIG. 3;

FIG. 15 is a partial sectional view of the conveyor clutch, taken on the line 15—15 in FIG. 3;

FIG. 16 is a partial plan view of the rear of the mining mechanism, and shows the drive to the pump; and

FIG. 17 is a sectional view showing the connection of the bridge conveyor to the mining apparatus, taken on the line 17—17 in FIG. 2.

Referring to the drawings, and particularly to FIGS. 1 to 4, there is illustrated therein the mining apparatus constructed in accordance with the instant invention, and comprising a main frame 20 on which the various elements of the mining apparatus are operatively supported. Within the main frame 20 there is provided a motor 21 for operating the mining apparatus, and having its armature shaft longitudinally disposed, as will appear hereinafter. A main gear case or head 22 is secured to the front of the main frame 20 adjacent to the front of the motor 21. The main drive to the mining mechanisms is mounted within the gear case 22.

The motor armature shaft 23 extends forwardly from the motor 21 in a longitudinal direction, into the main gear case 22, as best seen in FIGS. 5, 6 and 7. A jaw clutch 24 is non-rotatably and slidably mounted on a drive shaft 25, and is engageable with clutch teeth 24', which are secured to the armature shaft 23, for operatively connecting the motor armature shaft 23 to the drive shaft. The jaw clutch 24 is operated by a pivotally mounted lever 26, which in turn is manipulated by a linkage including an operating rod 27, which extends to the control station 28 at the side of the mining apparatus. By engagement of the jaw clutch 24, the motor armature shaft 23 is connected to the drive shaft 25 for operation of the drive means housed within the main gear case 22.

The drive shaft 25 is rotatably mounted within the main gear case 22 and has secured thereto a gear 29, which engages the gear 30 of a friction disc clutch 31, through which the power is delivered to the drive means housed within the main gear case 22. The friction disc clutch 31 provides overload protection for the drive means in the main gear case 22. The drive is delivered from the friction disc clutch 31 by a drive shaft 32 which drives a gear 33. The gear 33 is in engagement with a right gear train 34 and a left gear train 35, as viewed in FIG. 5, which are disposed at opposite sides of the gear 33, and extend in opposite lateral directions from the gear 33 to the right and left sides, respectively, of the main gear case 22.

The drives from the right and left gear trains 34, 35 are the same, and accordingly, it will be sufficient to describe only the drive at the right side of the main gear case 22, it being understood that the description is also applicable to the drive at the left side of the main gear case 22. The right gear train 34 drives a longitudinally extending shaft 36 that is rotatably supported within

the main gear case **22**. The final gear **37** of the right gear train **34** is driven by the shaft **36**.

A right supporting arm **40** extends laterally from the main gear case **22**. At the left side of the mining apparatus there is provided a left supporting arm **41**, as seen in FIG. 3, which is identical in all respects to the right supporting arm **40**, except that the respective supporting arms **40**, **41** are reversed, since they are disposed at opposite sides of the mining apparatus. Accordingly, the description will proceed with respect to the right supporting arm **40**, it being understood that the description is applicable to the left supporting arm **41**, as well.

The right supporting arm **40** is formed with an integral, front hinge arm **42** and an integral, rear hinge arm **43**, by which the supporting arm **40** is pivotally connected to the main gear case **22** on the axis of the longitudinally extending shaft **36**. The front hinge arm **42** is pivotally connected to the main gear case **22**, in part, on the shaft **36** and in part, by a bearing **44** mounted within a bore **45**. The rear hinge arm **43** is pivotally connected to the main gear case **22** on a hinge pin **46**, which is non-rotatably secured in place in the main gear case **22** by a pair of pins **47**. Bearings **48** are secured between the rear hinge arm **43** and the hinge pin **47** to permit free pivotal movement of the rear hinge arm **43** on the hinge pin **46**. The hinge pin **46** is disposed co-axially with the axis of the drive shaft **36**, this being the axis on which the supporting arm is pivotally connected to the main gear case **22**. At the side of the main gear case **22** there is formed an arcuate track **53**, which is concentric with the axis of the longitudinally extending shaft **36**, as seen in FIGS. 4 and 5. The supporting arm **40** is formed with a track follower **54** that is mated with the track **53**. Longitudinal thrust which is applied to the supporting arm **40** is transmitted through the track follower **54** and the track **53** to the main gear case **22** and to the main frame **20**.

Within the supporting arm **40** there is rotatably mounted an intermediate gear **49**, which is driven by the final gear **37**. The intermediate gear **49**, in turn, drives the gear **50**, which is fixedly secured to a shaft **51** rotatably mounted within the supporting arm **40**. The forward end of the shaft **51** projects forwardly from the supporting arm **40** and is formed with a mounting flange **52**.

The supporting arm **40** supports a mining mechanism in the form of a longitudinally extending auger **55**, to which there is secured a mounting flange **56** that abuts the mounting flange **52**, with the two being secured to each other by a plurality of bolts, or the like, whereby the auger **55** is rotated by the shaft **51**. At the left side of the mining apparatus there is provided another mining mechanism comprising an auger **57**, as seen in FIG. 1. The right and left augers **55**, **57** are identical in all material respects, with the exception that they are oppositely formed. Thus, each of the augers **55**, **57** is formed with helical flights **58**, and these are formed in opposite directions on the respective augers **55**, **57**. When the augers **55**, **57** are operating in a seam of material, the auger **55** is rotated in a counterclockwise direction and the auger **57** is rotated in a clockwise direction, as viewed in FIG. 4, and the material which is cut and broken out of the seam is removed from the seam by the helical flights **58**, which move the mined material toward the main frame **20** of the mining apparatus. Each of the helical flights **58** is so directed that the mined material is advanced towards the main frame **20** of the mining apparatus and in towards the longitudinal center line thereof, as will be described in greater detail hereinafter. At regularly spaced intervals along the periphery of the helical flights **57** there is provided a plurality of radially directed cutting bits **59**, and at the front of each of the augers **55**, **57** there is provided a plurality of forwardly directed cutting bits **60**, by which the material is cut and broken out of the mine seam.



The main frame **20** is formed with a forwardly extending bed plate **62**, which is adapted to rest on the mine floor and support the front end of the mining apparatus. As best seen in FIGS. 3 and 8, the bed plate **62** extends forwardly and to the sides of the mining apparatus. The bed plate **62** also extends forwardly between the right and left augers **55**, **57**, as best seen in FIG. 1. The surface of the bed plate **62** forms a loading area for the mined material at the front of the mining apparatus. This loading area extends from one side of the main frame **20**, around the front of the main frame **20**, and to the other side of the main frame **20**, and is formed as part of an orbital path for a conveyor **63**, which sweeps the mined material from the loading area of the bed plate **62** to the rear of the mining apparatus, for discharge. The orbital conveyor path extends substantially around the perimeter of the main frame **20**, whereby the area of the main frame **20** within the orbital path may be used for placement of the motor **21** and the drive system at the rear of the motor **21**, as will be described in greater detail hereinafter. As best seen in FIG. 8, the conveyor **63** has an endless, universally linked chain **64**, to which there are secured, at regularly spaced intervals, laterally extending conveyor flights **65**, which are driven by the chain **64**.

On the bed plate **62** there is provided a take-up shoe **66** which is adjustable, forwardly and rearwardly, by means of a bolt **67** abutting against a portion of the main gear case **22**. The take-up shoe **66** is formed with a track **68**, in which the chain **64** is guided in its travel over the loading area of the bed plate **62**. In the main frame **20** there is provided a conveyor trough **69** extending from the bed plate **62** at one side of the mining apparatus, and substantially around the perimeter of the main frame **20** to the bed plate **62** at the other side of the mining apparatus. At each side of the mining apparatus the conveyor trough **69** extends in an upwardly inclined direction away from the loading area of the bed plate **62**, to a horizontally disposed trough portion extending around the rear of the mining apparatus and adjacent the top thereof, as best seen in FIG. 2. The conveyor trough **69** is formed with a discharge opening **70** at the rear of the mining apparatus, through which the mined material is discharged.

As best seen in FIGS. 3 and 4, the bed plate **62** extends laterally beyond the loading area thereof at each side of the mining apparatus, to provide bed plate extensions **72**, **73** at the right and left sides, respectively. Connecting lugs **74**, **75** are secured to the bed plate extensions **72**, **73**, respectively, and extend upwardly therefrom, as seen in FIG. 4. A cylinder and piston power device **76** has its cylinder end pivotally connected to the connecting lugs **74**. A cylinder and piston power device **77** is similarly connected to the connecting lugs **75**. The cylinder and piston power device **76** has its piston end pivotally connected to a connecting lug **78** formed on the rear of the right supporting arm **40**, and the piston end of the cylinder and piston power device **77** is similarly connected to a connecting lug **79**, formed on the rear of the left supporting arm **41**. By operation of the cylinder and piston power devices **76**, **77**, the positions of the supporting arms **40**, **41**, respectively, may be adjusted upwardly and downwardly by pivoting the latter on the main gear case **22**. In FIG. 4 the supporting arm **40** is shown in its lowermost position, in which the cylinder and piston power device **76** is fully contracted. In the same figure, the supporting arm **41** is shown in its uppermost position, in which the cylinder and piston power device **77** is fully extended.

The lines of action of the cylinder and piston power devices **76**, **77** are disposed laterally beyond and outwardly of the axes on which the supporting arms **40**, **41** are pivotally connected to the main gear case **22**. The force due to the weight of the supporting arms **40**, **41** and the augers **55**, **57**, is transmitted to the bed plate **62**

directly through the cylinder and piston power devices **76, 77**. Also, the forces applied for adjusting the positions of the supporting arms **40, 41** act between the bed plate **62** and the supporting arms **40, 41**. Each of the cylinder and piston power devices **76, 77** is hydraulically operated and is double acting. The mining apparatus includes a hydraulic system which may be of a conventional type, for supplying hydraulic fluid under pressure to the cylinder and piston power devices **76, 77**, for controlled operation of the latter, to adjust the positions of the supporting arms **40, 41** and the augers **55, 57** carried thereby.

Referring to FIG. 10, it is seen that the motor armature shaft **23** extends rearwardly from the motor **21** and has a gear **80** secured thereto. A gear **81** is driven by the gear **80** to rotate a worm shaft **82** that is rotatably supported within the main frame **20** behind the motor **21**. The worm shaft **82** is formed with a worm **82'** that drives a worm wheel **83**, which is disposed on an axis that extends laterally of the main frame **20**.

At each side of the worm wheel **83** there is provided a planetary gear system **84**, as best seen in FIG. 11. The planetary gear systems **84** are identical, with the exception that they are oppositely disposed, and accordingly, the description will proceed with respect to the left side of the apparatus, it being understood that the description is equally applicable to the right side thereof. The worm wheel **83** has a driving connection to the planetary gear system **84** through a splined sleeve **85**, by which the drive gear **86** is rotated. The drive gear **86** engages with a plurality of dual planet pinions **87** for operating the latter. The planet pinions **87** are rotatably supported by the cage **88**. The dual planet pinions **87** mesh with an internal gear **89** and with an internal gear **90**. The drive from the planetary gear system **84** is delivered from the internal gear **90** to a laterally extending shaft **91**.

The planetary gear system **84** provides either a high speed drive or a low speed drive to the shaft **91**. A high speed friction band **92** surrounds the periphery of the cage **88**. A low speed friction band **93** surrounds the periphery of the internal gear **89**. When both friction bands **92, 93** are released, the planetary gear system **84** operates idly and there is no drive delivered to the shaft **91**. When the high speed friction band **92** is engaged with the cage **88**, the latter is locked, and the high speed drive is delivered to the shaft **91**. Upon release of the high speed friction band **92** and engagement of the low speed friction shaft **93** with the internal gear **89**, the latter is locked, whereupon the low speed drive is delivered to the shaft **91**.

Referring to FIG. 12, there is illustrated therein the low speed friction band **93**, which is made in two parts pivotally connected to each other by a hinge **94**. A coil spring **95** is placed between the free ends of the two parts of the friction band **93**, and normally acts to maintain the friction band **93** in its released condition. A take-up block **96** is disposed at one side in engagement with one part of the friction band **93** and abutting a portion of the main frame **20**, and is adjustable for setting the released position of the friction band **93**. At the other side, there is provided a hydraulic cylinder and piston device **97**, by which the friction band **93** is engaged with the internal gear **89**, to lock the latter. The hydraulic cylinder and piston device **97** is single acting in opposition to the force of the coil spring **95** to tighten the friction band **93** on the internal gear **89**. Upon venting the hydraulic cylinder and piston device **97**, the friction band **93** is restored to its released position by the force of the coil spring **95**. The friction band **92** is similarly constructed as the friction band **93** and operates in the same manner.

The shaft **91** delivers its drive to a gear train **98** which drives a shaft **99**. The gears of the gear train **98** and the shaft **99** are rotatably supported within the main frame **20**, with the shaft **99** extending laterally outwardly to the side of the main frame **20**. A jaw clutch **100** is slidably and non-rotatably mounted on the projecting end of the shaft **99**. By sliding the jaw clutch **100** inwardly on the shaft **99**, it is engaged with the teeth **101** formed on the rope drum **102**, whereby the drive from the shaft **99** is delivered to the rope drum **102**, to rotate the latter. As best seen in FIG. 13, the clutch yoke **103** is pivotally connected to a crank **104**, the pivotal movement of which causes the clutch **100** to slide along the shaft **99**. A double acting hydraulic cylinder and piston device **105** is connected to the crank **104** to pivot the latter for engagement or disengagement of the clutch **100** with the rope drum **102**. Another rope drum **106** of the same construction is provided at the opposite side of the mining apparatus, as seen in FIG. 3. The several hydraulic power devices, described in connection with the planetary gear systems **84** and the jaw clutches **100**, are operated by the hydraulic system of the mining apparatus, and controlled from the control station **28**.

The opposite rope drums **102, 106** may be operated together or singly, as may be desired, for moving the mining apparatus in a desired path. Each of the rope drums **102, 106** is driven in one direction only, to wind the rope on the drum, and when it is desired to pay out rope from the drum, this is done by free-wheeling of the drum. Each of the rope drums **102, 106** is provided with a brake **107** which is disposed in engagement with a flange thereof, as best seen in FIG. 13. The brake **107** is pressed into engagement with the rope drum by a spring-loaded cylinder **108** to prevent back lash of the rope and fast back spooling of the rope drum, by restraining the rotation of the brake drum.

At each side of the mining apparatus there is provided a leveling shoe **110**, as best seen in FIG. 3. The leveling shoe **110** is pivotally connected to the main frame **20** on a longitudinally extending axis, by means of pivot pins **111**. A hydraulic cylinder and piston power device **112** is disposed in a substantially upright position between each leveling shoe **110** and the main frame **20**. The cylinder end of the cylinder and piston power device **112** is pivotally connected to the main frame **20** by a pivot pin **113**, and the piston end thereof is pivotally connected to the leveling shoe **110** by a pivot pin **114**. Thus by operation of the cylinder and piston power devices **112**, the leveling shoes **110** may be raised or lowered, with respect to the main frame **20**, to tilt the mining apparatus in a lateral direction to compensate for uneven floor conditions. A rope sheave **115** is rotatably mounted on each leveling shoe **110** under the main frame **20**, and a second rope sheave **116** is rotatably mounted on each leveling shoe **110**, near the outer edge of the leveling shoe **110**. The rope from the rope drums **102, 106** may be trained around the rope sheaves **115, 116**, at the respective sides of the mining apparatus, as seen in FIG. 3, with the free ends of the ropes being tied to anchors at opposite sides for moving the mining apparatus over the mine floor in a lateral direction.

At the rear of the mining apparatus there is provided a rear leveling shoe **117**, as seen in FIGS. 2 and 3, which may be raised or lowered with respect to the main frame **20**, to provide fore and aft compensation for uneven floor conditions. The rear leveling shoe **117** is provided with an upright post **118** at each side thereof, which is received within a box-like track **119** secured to the main frame **20**, to permit the rear leveling shoe **117** to be moved upwardly and downwardly relative to the main frame **20**. Within each upright post **118** there is provided a hydraulic cylinder and piston power device **120** connected between the rear leveling shoe **117** and the main frame **20**. By extension of the hydraulic cylinder and piston power device **120**, the rear leveling shoe **117** may be lowered, and by contraction of the hydraulic cylinder and piston power device **120**, the rear leveling shoe **117** is raised, for tilting the mining mechanism in a fore and aft direction, accordingly.

At each side of the main frame **20**, above the rear leveling shoe **117**, there is provided a rope sheave **121** which is rotatably supported on the main frame **20**. For sumping the augers **55**, **57** into the mine seam, the ropes from the rope drums **102**, **106** are trained about the respective rope sheaves **115**, **116**, and thence rearwardly around the respective rope sheaves **121**. The ropes are then led from the rope sheaves **121** in a forwardly direction and anchored near the front of the mining apparatus. Then, as the rope is wound on the rope drums **102**, **106**, the mining apparatus is moved forwardly, with the augers **55**, **57** being sumped into the mine face.

Referring to FIG. 14, there is illustrated therein the drive for the conveyor **63**. A gear **125** is secured to the worm shaft **82** and engages with a gear **126** that drives a shaft **127**, which is formed with a bevel pinion **128**. The bevel pinion **128** meshes with oppositely disposed bevel gears **129**, **130** to drive the latter. A shaft **131** is coaxially disposed with respect to the bevel gears **129**, **130**, and is mounted for rotation relatively thereto. A jaw clutch **132** is non-rotatably and slidably mounted on the shaft **131** and is engageable with either the bevel gear **129** or the bevel gear **130**, for connecting either of these to the shaft **131** to rotate the latter in one direction or the other. As seen in FIG. 15, a clutch yoke **133** engages the clutch **132**. The clutch yoke **133** is fixedly secured to a detent rod **134**, which is slidable upwardly and downwardly and has three positions, as determined by engagement of the ball detent **135** with one or another of the detent grooves **136**. A lever **137** is connected to the detent rod **134** for moving it upwardly and downwardly, and the lever **137** is keyed to a rod **138**, by which the lever **137** may be operated to set the detent rod **134** in a selected position. The operating rod **138** extends outwardly to the side of the mining apparatus and has a handle **139** secured thereto, for manipulation.

A gear **140** is secured to the shaft **131**, to be driven by the latter. The gear engages with a friction disc clutch **141**, through which the drive is delivered to a shaft **142**. The friction disc clutch **141** provides overload protection in the drive to the conveyor **63**. The drive from the shaft **142** is delivered through a gear train **143** to an upright shaft **144**, to the upper end of which there is secured a sprocket **145**. The sprocket **145** engages with the links of the chain **64**, as best seen in FIG. 3, to drive the conveyor **63**. By selective operation of the clutch **132**, the conveyor chain **64** may be driven in one or the other of opposite directions, or it may be maintained idle.

The mining apparatus includes a hydraulic system for operation of the various hydraulic devices described herein. The hydraulic system may be of the usual form customarily found in mining equipment. Referring to FIG. 16, it is seen that a bevel gear **122** engages the bevel gears **129**, **130** and is driven by the latter. The bevel gear **122** is disposed on a laterally extending axis and is rotatably supported in the main frame **20**. A coupling element **123** connects the bevel gear **122** to a hydraulic pump **124**, for driving the latter to supply hydraulic fluid under pressure to the hydraulic system of the mining apparatus. The hydraulic pump **124** illustrated herein is a three-section pump, although it will be understood that other pump arrangements may be used. The various controls for the mining apparatus, including the controls for the hydraulic system, are collected at the operator's station **28** in the customary manner to permit convenient operation of the various devices of the mining apparatus.

In the operation of the mining apparatus the augers **55**, **57** are sumped into the mine seam by use of the ropes at the opposite sides of the mining apparatus. When the augers **55**, **57** have been sumped into the mine seam to the desired depth the ropes at the opposite sides of the mining apparatus are reset, and the mining apparatus is then moved in a lateral direction to move the augers **55**, **57** laterally through the mine seam, to remove the material from the mine seam. Thus, one of the augers **55**, **57** will be leading and the other will be trailing. The height of the cut in the mine seam is determined by the vertical positions of the augers **55**, **57**. Thus, as viewed in FIG. 4, the mining apparatus would be moved through the mine seam from left to right, with the auger **57** leading, and the auger **55** trailing. The vertical height of the cut would be approximately equal to the sum of the diameters of the augers **55**, **57**, since the one auger **55** is in its lowermost position, and the other auger **57** is in its uppermost position. The minimum height of cut would be equal to the diameter of the augers **55**, **57**, in which case both of the augers **55**, **57** would be positioned in their lowermost positions.

Adjacent each auger **55**, **57** and disposed outwardly thereof, there is provided a longitudinally extending plow **146**, as best seen in FIGS. 1 and 9. The plows **146** are supported by the respective supporting arms **40**, **41**, being attached thereto by tongue and groove means **147**. The plow **146** comprises an outer plow portion **148** and an inner telescoping plow portion **149**, as seen in FIG. 9. The outer plow portion **148** is longitudinally fixed to its respective supporting arm by the tongue and groove **147**, and the inner telescoping plow portion **149** is longitudinally slidable with respect to the outer plow portion **148**. A cylinder and piston power device **150** is mounted within the plow **146**, with one end being secured to the outer plow portion **148**, and the other end being secured to the inner telescoping plow portion **149**. When the cylinder and piston power device **150** is contracted, the inner plow portion **149** is withdrawn within the outer plow portion **148**. By extension of the cylinder and piston power device **150**, the inner plow portion **149** is extended along the auger **57**, as seen in FIG. 1.

Referring now to FIG. 4, it is seen wherein the plow **146** is adjustable with the supporting arm **40** or **41** to which it is secured. Thus, with the supporting arm **41** in elevated position, the plow **146** is similarly elevated, and with the auger **57** being in leading position, the plow **146** is contracted so as to be out of the path of operation of the auger **57**. The supporting arm **40** is in its lowermost position, which causes the plow **146** attached thereto to rest on the floor, and it is noted that the tongue and groove **147** connecting the plow **146** to the supporting arm **40** permits relative sliding of the plow **146** upwardly with respect to the supporting arm **40**, to permit the latter to be fully lowered without interference from the plow **146**. The auger **55** being in trailing position, the plow **146** follows the operation of the auger **55**, and accordingly, is extended to lie adjacent a substantial length of the auger **55**. As the auger **55** is moved in a lateral direction, the plow **146** follows the auger **55**, sweeping the mined material which has fallen on the mine floor. The plow **146** crowds the mined material into the helical flights **58** of the auger **55**, and also crowds the mined material onto the loading area of the bed plate **62**. Both the auger **55** and the plow **146** operate to deliver the mined material onto the loading area of the bed plate **62**, the auger **55** providing a screw feed of the mined material, and the plow **146** operating to crowd the mined material into the helical flights **58** and onto the loading area of the bed plate **62**.

The conveyor flights **65** then sweep the mined material from the loading area of the bed plate **62** to the rear of the mining apparatus, for discharge of the mined material through the discharge opening **70**. A bridge conveyor **151** may be attached to the rear of the mining apparatus, for receiving the mined material discharged therefrom, to deliver the same to a room conveyor **152**, or other suitable means for removing the mined material. As seen in FIGS. 1, 2 and 17, the bridge conveyor **151** may be connected to the mining apparatus by a connecting plate **153** that is hingedly connected to the rear leveling shoe **117**. An upright pin **154** extends through the connect-

ing plate **153** and pivotally connects the bridge conveyor **151** to the connecting plate **153**, to permit the bridge conveyor **151** to swing laterally with respect to the mining apparatus. As seen in FIG. 17, the upright pin **154** has a loose connection with the connecting plate **153** to provide compensation for uneven floor conditions.

The mining apparatus constructed in accordance with the instant invention provides a low height, compact piece of equipment, which is particularly suited for mining in low seams. As seen in FIG. 2, the highest parts of the mining apparatus are the augers **55**, **57**, the diameters of which determine the minimum height of the cut. Thus, there is provided ample clearance for the mining apparatus to be moved about in the mine seam after a cut has been made by the augers **55**, **57**. The augers **55**, **57** are adjustable so that the mining apparatus is adapted for operation in mine seams of varying height. The mining apparatus further includes loading and conveying means for the mined material, whereby the latter is continuously discharged from the rear of the mining apparatus, permitting a cut to be made in the mine seam without interruption.

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

Having thus described and shown an embodiment of the invention, what it is desired to secure by Letters Patent of the United States is:

**1.** Mining apparatus comprising a main frame, said main frame being formed with a bed plate having portions thereof extending forwardly and laterally to the sides of said mining apparatus to form a loading area on the bed plate, said bed plate being disposed at the bottom of said main frame to be placed on a ground surface for loading mined material from the ground surface onto said loading area of the bed plate, a mining mechanism for cutting and breaking material out of a mine seam, said mining mechanism extending forwardly of said main frame for movement of the mining mechanism through the mine seam, means for supporting said mining mechanism on the main frame for operation, said supporting means including relatively adjustable elements for adjustment of the position of said mining mechanism, and power means for adjusting the position of said mining mechanism, said power means being disposed between the bed plate and the supporting means for said mining mechanism, and means for connecting said power means to said supporting means for said mining mechanism and to a part of said bed plate that is spaced from said loading area thereof and is disposed at a side of the mining apparatus.

**2.** Mining apparatus comprising a main frame, said main frame being formed with a bed plate having portions thereof extending forwardly and laterally to the sides of said mining apparatus to form a loading area at the front of the mining apparatus on the bed plate, said bed plate being disposed at the bottom of said main frame to be placed on a ground surface for loading mined material from the ground surface onto said loading area of the bed plate, a portion of said bed plate being disposed laterally beyond the loading area thereof, a mining mechanism for cutting and breaking material out of a mine seam, said mining mechanism extending forwardly of said main frame for movement of the mining mechanism through the mine seam, means for supporting said mining mechanism on the main frame for operation, said supporting means including relatively adjustable elements for adjustment of the position of said mining mechanism, and power means for adjusting the position of said mining mechanism, said power means being disposed between the bed plate and the supporting means for said mining mechanism, and means for connecting said power means to said supporting means for said mining mechanism and to said portion of the bed plate which is disposed laterally beyond the loading area thereof.

**3.** Mining apparatus comprising a main frame, said main frame being formed with a bed plate having portions thereof extending forwardly and laterally to the sides of said mining apparatus to form a loading area on the bed plate, said bed plate being disposed at the bottom of said main frame to be placed on a ground surface for loading mined material from the ground surface onto said loading area of the bed plate, a mining mechanism for cutting and breaking material out of a mine seam, said mining mechanism extending forwardly of said main frame for movement of the mining mechanism through the mine seam, means for supporting said mining mechanism on the main frame for operation, said supporting means including relatively pivotable elements for adjustment of the position of said mining mechanism about a longitudinally extending axis, and power means for adjusting the position of said mining mechanism, said power means being disposed between the bed plate and the supporting means for said mining mechanism to operate in a lateral direction with respect to said longitudinally extending axis, and means for connecting said power means to said supporting means for said mining mechanism and to a part of said bed plate that is spaced from said loading area thereof and is disposed at a side of the mining apparatus.

**4.** Mining apparatus comprising a main frame, said main frame being formed with a bed plate having portions thereof extending forwardly and laterally to the sides of said mining apparatus to form a loading area at the front of the mining apparatus on the bed plate, said bed plate being disposed at the bottom of said main frame to be placed on a ground surface for loading mined material from the ground surface onto said loading area of the bed plate, a portion of the bed plate being disposed laterally beyond the loading area thereof, a mining mechanism for cutting and breaking material out of a mine seam, said mining mechanism extending forwardly of said main frame for movement of the mining mechanism through the mine seam, means for supporting said mining mechanism on the main frame for operation, said supporting means including relatively adjustable elements for adjustment of the position of said mining mechanism, power means for adjusting the position of said mining mechanism, said power means being disposed between the bed plate and the supporting means for said mining mechanism, and means for connecting said power means to said supporting means for said mining mechanism and to said portion of the bed plate which is disposed laterally beyond the loading area thereof, and conveying means traversing the loading area of the bed plate to remove mined material therefrom.

**5.** Mining apparatus comprising a main frame, said main frame being formed with a bed plate having portions thereof extending forwardly and laterally to the sides of said mining apparatus to form a loading area on the bed plate, said bed plate being disposed at the bottom of said main frame to be placed on a ground surface for loading mined material from the ground surface onto said loading area of the bed plate, a mining mechanism at each side of the mining apparatus for cutting and breaking material out of a mine seam, said mining mechanisms extending forwardly of the main frame for movement of the mining mechanisms through a mine seam, a supporting head for said mining mechanisms including means for operating said mining mechanisms, a supporting arm for each mining mechanism, the supporting arms for the respective mining mechanisms extending in opposite lateral directions from the mining head, means for adjustably connecting each supporting arm to the mining head for adjustment of the positions of said mining mechanisms, and a power means for adjusting the position of each supporting arm and its mining mechanism, each said power means being disposed between the bed plate and the supporting arm, and means for connecting

each power means to a supporting arm for the mining mechanism and to a part of said bed plate that is spaced from said loading area thereof and is disposed at a side on the mining apparatus.

6. Mining apparatus comprising a main frame, said main frame being formed with a bed plate having portions thereof extending forwardly and laterally to the sides of said mining apparatus to form a loading area on the bed plate, said bed plate being disposed at the bottom of said main frame to be placed on a ground surface for loading mined material from the ground surface onto said loading area of the bed plate, a mining mechanism at each side of the mining apparatus for cutting and breaking material out of a mine seam, said mining mechanisms extending forwardly of said main frame for movement of the mining mechanisms through a mine seam, a portion of said loading area of said bed plate being disposed between said mining mechanisms, said mining mechanisms including means to deliver mined material to the loading area of the bed plate, means for supporting said mining mechanisms on the main frame for operation, said supporting means including relatively adjustable elements for adjustment of the positions of said mining mechanisms, and a power means for each mining mechanism for adjusting the position thereof, each said power means being disposed between the bed plate and a supporting means for a mining mechanism, and means for connecting each said power means to a supporting means for a mining mechanism and to a part of said bed plate that is spaced from said loading area thereof and is disposed at a side of the mining apparatus.

7. Mining apparatus comprising a main frame, said main frame being formed with a bed plate having portions thereof extending forwardly and laterally to the sides of said mining apparatus to form a loading area on the bed plate, said bed plate being disposed at the bottom of said main frame to be placed on a ground surface for loading mined material from the ground surface onto said loading area of the bed plate, a mining mechanism at each side of the mining apparatus for cutting and breaking material out of mine seam, said mining mechanisms extending forwardly of said main frame for movement of the mining mechanisms through the mine seam, means for supporting said mining mechanisms on the main frame for operation, said supporting means including relatively pivotable elements for adjustment of the positions of said mining mechanisms, a cylinder and piston power means for each mining mechanism for adjusting the position thereof, each said cylinder and piston power means being disposed between the bed plate and the supporting means for a mining mechanism, and means for connecting each said cylinder and piston power means to a pivotable element of said supporting means and to a part of said bed plate that is spaced from said loading area thereof and is disposed at a side of the mining apparatus.

8. Mining apparatus comprising a main frame, said main frame being formed with a bed plate having portions thereof extending forwardly and laterally to the sides of said mining apparatus to form a loading area on the bed plate, said bed plate being disposed at the bottom of said main frame to be placed on a ground surface for loading mined material from the ground surface onto said loading area of the bed plate, a mining mechanism at each side of the mining apparatus for cutting and breaking material out of a mine seam, said mining mechanisms extending forwardly of said main frame for movement of the mining mechanisms through a mine seam, a portion of said loading area of said bed plate extending forwardly between said mining mechanisms, said mining mechanisms including means to deliver mined material to the loading area of the bed plate, means for supporting said mining mechanisms on the main frame for operation, said supporting means including relatively adjustable elements for adjustment of the positions of said mining mechanisms, a power means for each mining mechanism for adjusting the position of the mining mechanisms, each said power means being disposed between the bed plate and the supporting means for said mining mechanisms, means for connecting each said power means to said supporting means for said mining mechanism and to a part of said bed plate that is spaced from said loading area thereof and is disposed at a side of the mining apparatus, a conveyor having an orbital path of operation extending substantially around the perimeter of the main frame, a portion of said orbital conveyor path extending over the bed plate to sweep mined material from the loading area of the bed plate, and said conveyor including a discharge at the rear of the mining machine for discharging the mined material.

9. Mining apparatus comprising a main frame, said main frame being formed with a bed plate having portions thereof extending forwardly and laterally to the sides of said mining apparatus to form a loading area on the bed plate, said bed plate being disposed at the bottom of said main frame to be placed on a ground surface for loading mined material from the ground surface onto said loading area of the bed plate, a mining mechanism for cutting and breaking material out of a mine seam, said mining mechanism extending forwardly of said main frame for movement of the mining mechanism through a mine seam, said mining mechanism including means for delivering mined material to said loading area of the bed plate, a plow disposed adjacent the mining mechanism for crowding mined material onto said loading area of the bed plate, means for supporting said mining mechanism on the main frame for operation, said supporting means including relatively adjustable elements for adjustment of the position of said mining mechanism, and power means for adjusting the position of said mining mechanism, said power means being disposed between the bed plate and the supporting means for said mining mechanism, and means for connecting said power means to said supporting means for said mining mechanism and to a part of said bed plate that is spaced from said loading area thereof and is disposed at a side of the mining apparatus.

10. Mining apparatus comprising a main frame, said main frame being formed with a bed plate having portions thereof extending forwardly and laterally to the sides of said mining apparatus to form a loading area on the bed plate, said bed plate being disposed at the bottom of said main frame to be placed on a ground surface for loading mined material from the ground surface onto said loading area of the bed plate, a mining mechanism for cutting and breaking material out of a mine seam, said mining mechanism comprising an auger extending forwardly of said main frame for movement of the mining mechanism through a mine seam, said auger being formed with a helical flight to deliver mined material to said loading area of the bed plate, a plow disposed at the side of and adjacent the mining mechanism to crowd mined material into the helical flight thereof and onto said loading area of the bed plate, said plow being adjustable for extension along the mining mechanism, means for supporting said mining mechanism on the main frame for operation, said supporting means including relatively adjustable elements for adjustment of the position of said mining mechanism, and power means for adjusting the position of said mining mechanism, said power means being disposed between the bed plate and the supporting means for said mining mechanism, and means for connecting said power means to said supporting means for said mining mechanism and to a part of said bed plate that is spaced from said loading area thereof and is disposed at a side of the mining apparatus.

11. Mining apparatus comprising a main frame, said main frame being formed with a bed plate having portions thereof extending forwardly and laterally to the sides of said mining apparatus to form a loading area on the bed plate, said bed plate being disposed at the bottom of said

main frame to be placed on a ground surface for loading mined material from the ground surface onto said loading area of the bed plate, a mining mechanism for cutting and breaking material out of a mine seam, said mining mechanism extending forwardly of said main frame for movement of the mining mechanism through a mine seam, a main gear case on said main frame, a support arm for said mining mechanism, adjustable elements connecting said support arm to the main gear case for adjustment of the position of said mining mechanism, drive means in said main gear case and driving elements in said support arm connecting to said drive means for operation of the mining mechanism, and power means for adjusting the position of said mining mechanism, said power means being disposed between the bed plate and the support arm, and means for connecting said power means to said support arm and to a part of said bed plate that is spaced from said loading area thereof and is disposed at a side of the mining apparatus.

**12.** Mining apparatus comprising a main frame, said main frame being formed with a bed plate having portions thereof extending forwardly and laterally to the sides of said mining apparatus to form a loading area on the bed plate, said bed plate being disposed at the bottom of said main frame to be placed on a ground surface for loading mined material from the ground surface onto said loading area of the bed plate, a mining mechanism for cutting and breaking material out of a mine seam, said mining mechanism extending forwardly of said main frame for movement through a mine seam, a main gear case on said main frame, a support arm for said mining mechanism, relatively pivotable elements connecting the support arm to the main gear case for pivotal movement of the support arm to adjust the position of said mining mechanism, said support arm extending laterally outwardly from said main gear case, drive means in said main gear case and drive elements in said support arm connecting to said drive means for operation of the mining mechanism, and power means for adjusting the support arm and the position of the mining mechanism, said power means being disposed between the bed plate and the support arm and being connected to the support arm at a point disposed laterally outwardly of the pivotal connection of the support arm to the main gear case, and means for connecting said power means to a part of said bed plate that is spaced from said loading area thereof and is disposed at a side of the mining apparatus.

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