June 18, 1957 J. F. JOY 2,796,246

COAL MINING MACHINE WITH LATERALLY SWINGABLE AND VERTICALLY ADJUSTABLE CUTTER BARS

Filed June 30, 1952 5 Sheets-Sheet 1

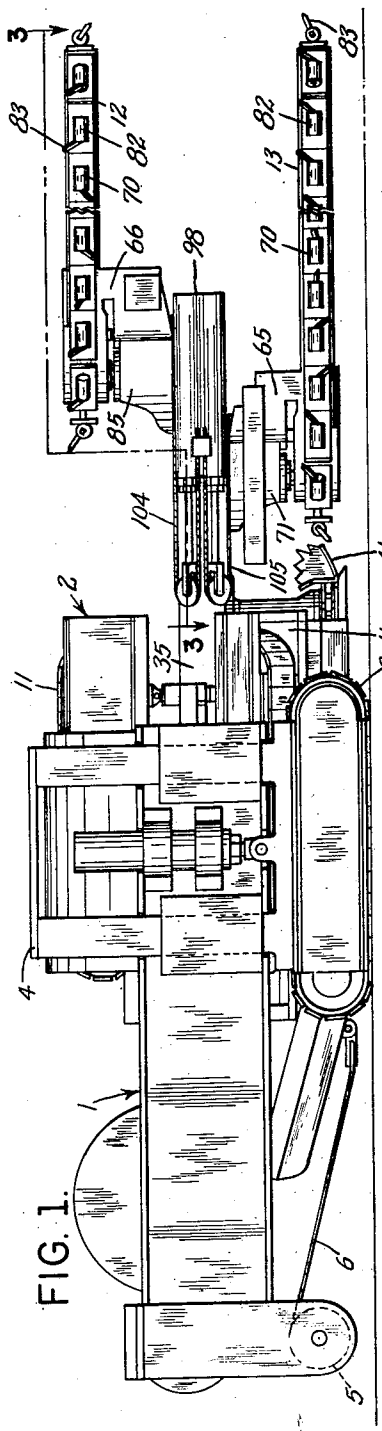


FIG. 1.

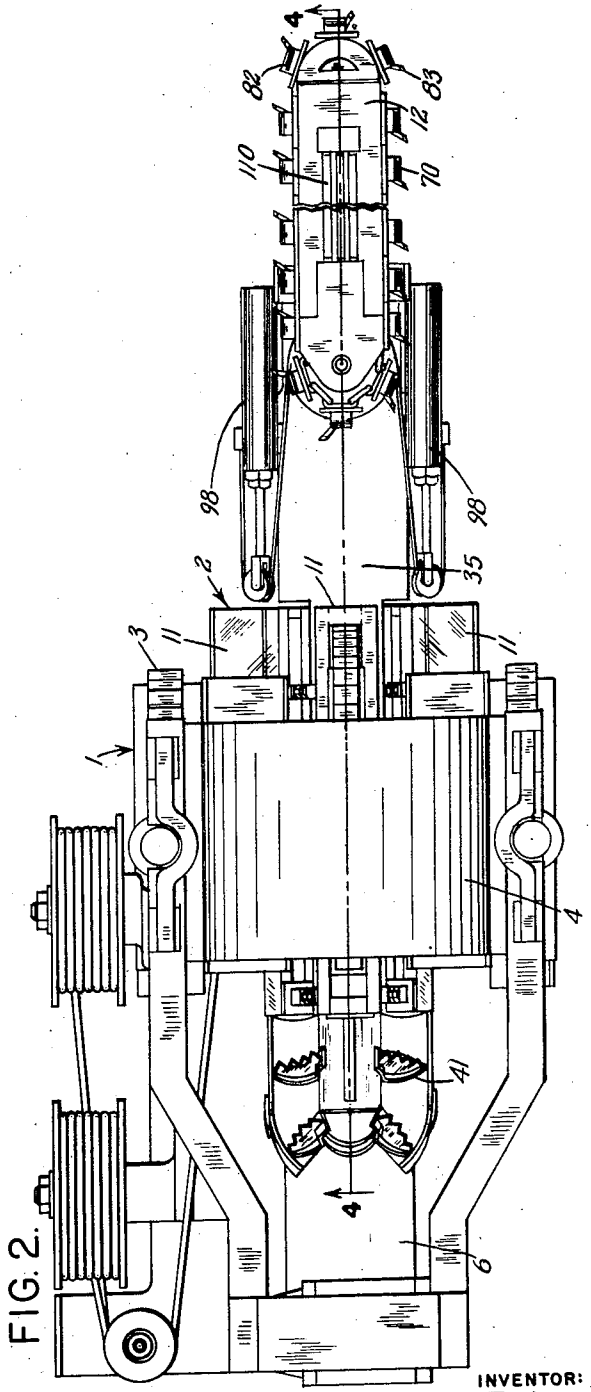


FIG. 2.

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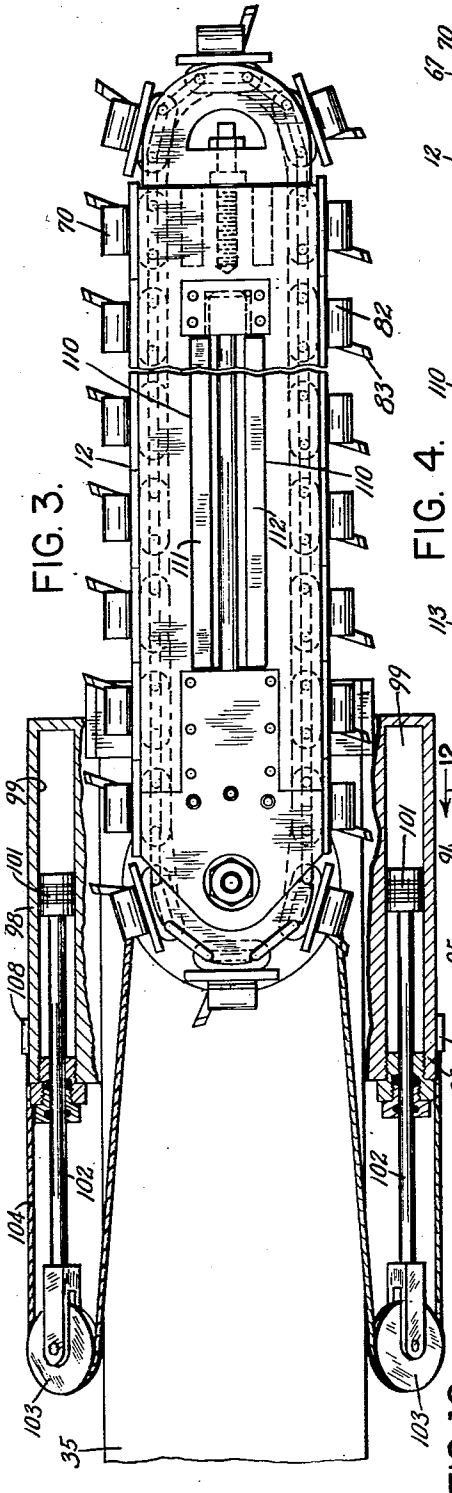


FIG. 3.

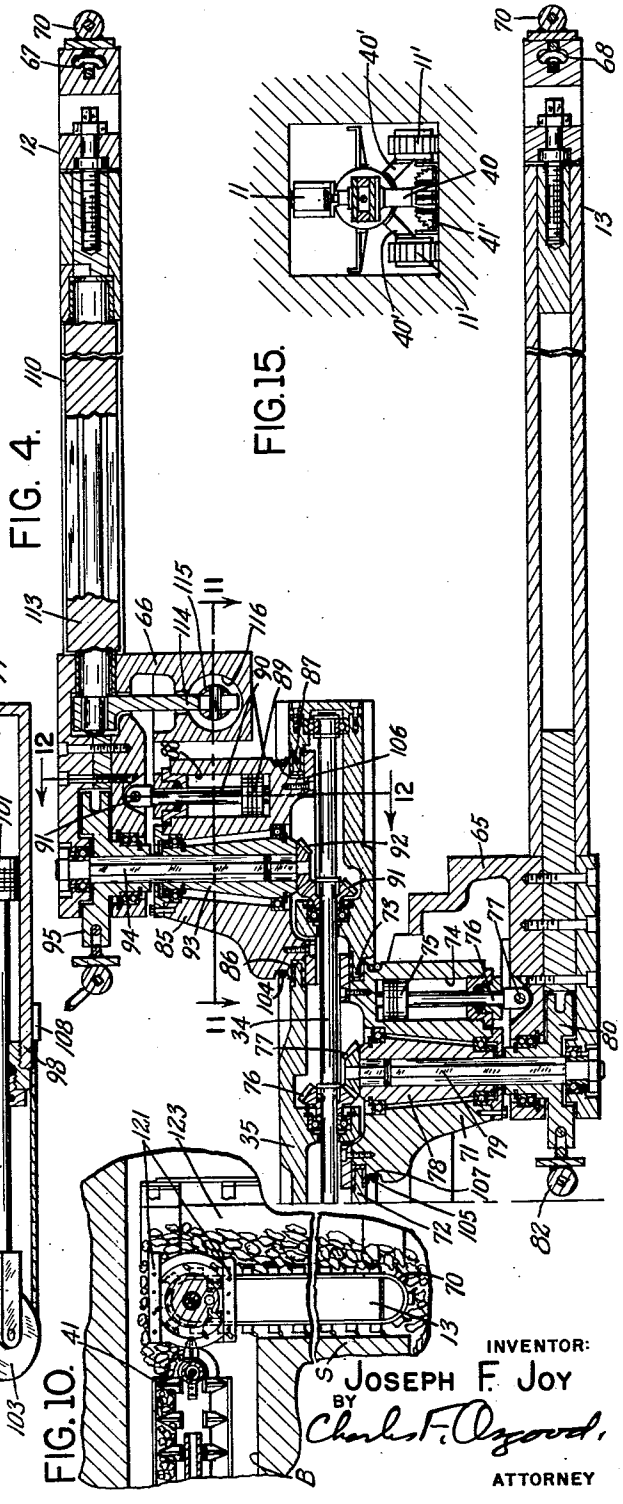


FIG. 4.

FIG. 15.

FIG. 10.

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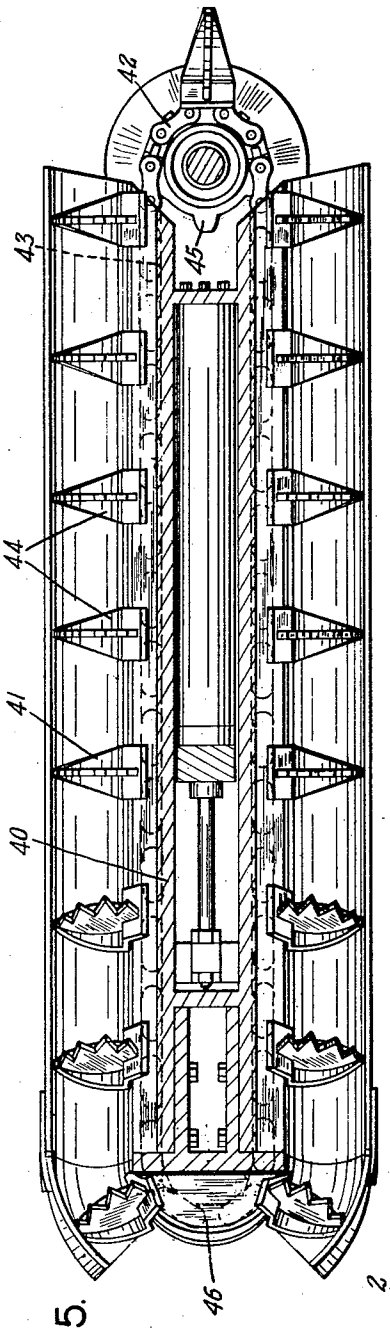


FIG. 5.

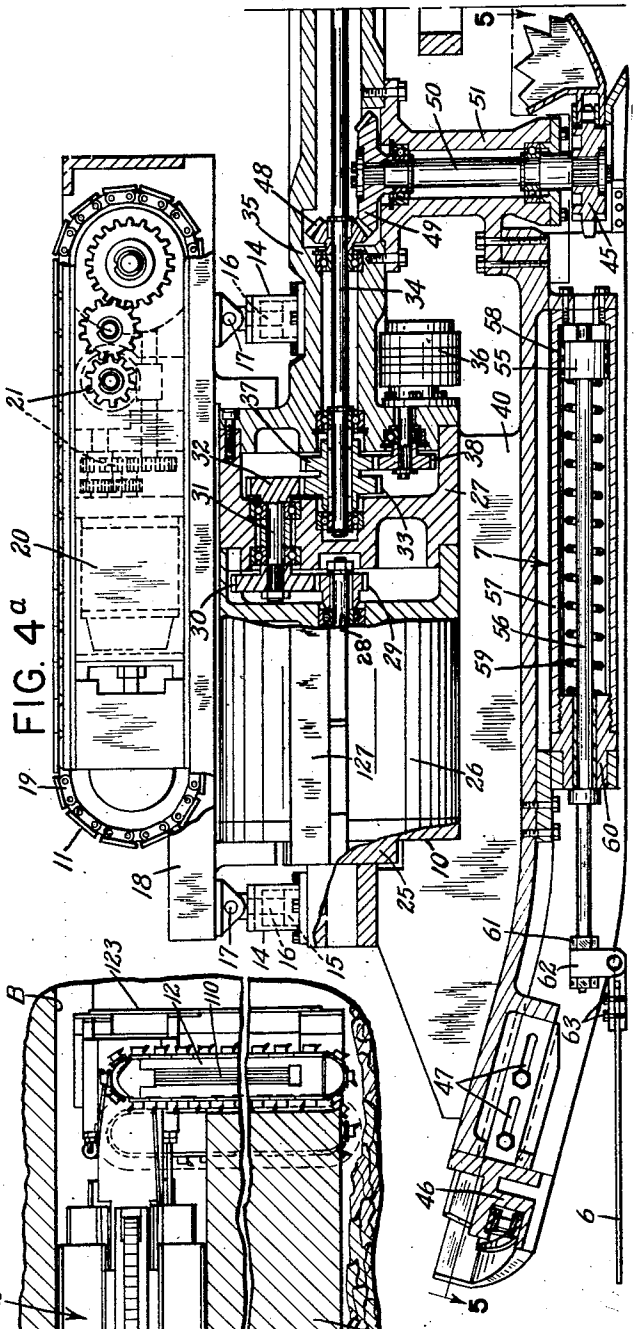


FIG. 4a

FIG. 9.

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FIG. 6.

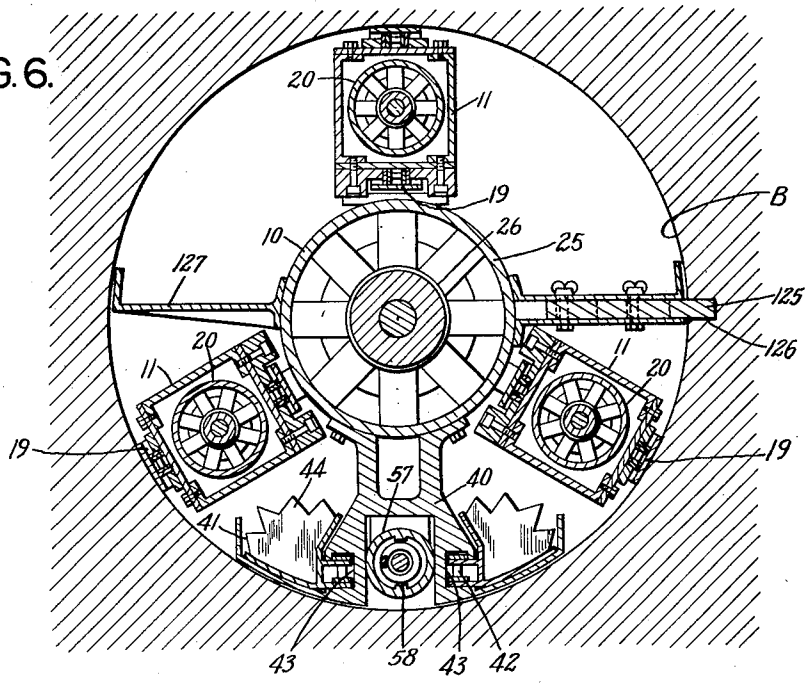


FIG. 8.

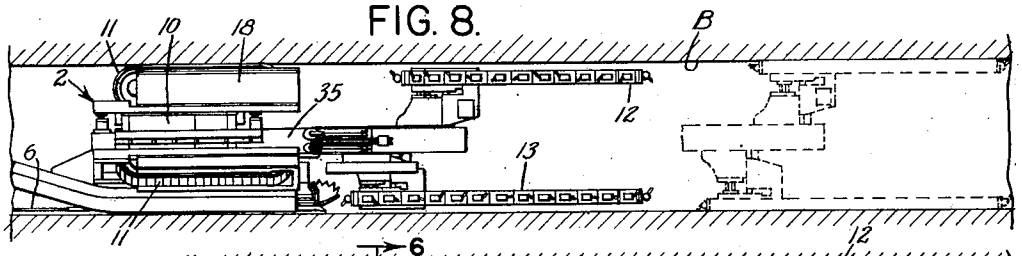
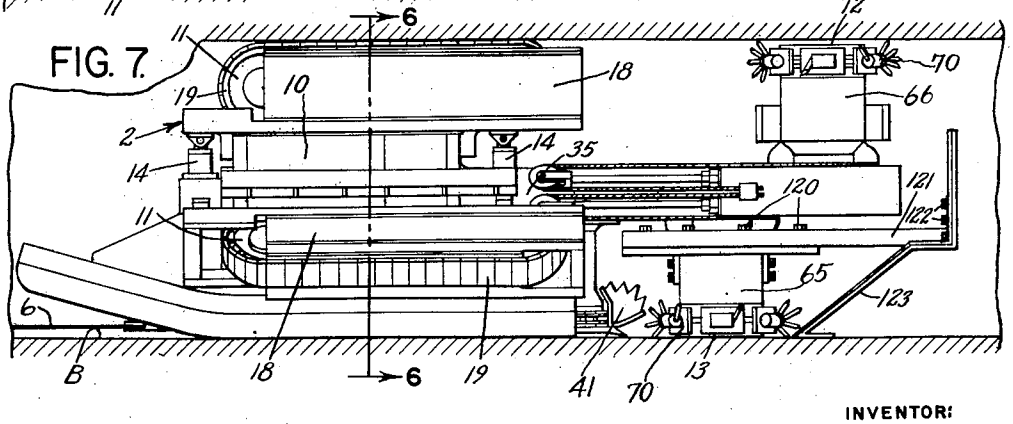


FIG. 7.



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FIG. 11.

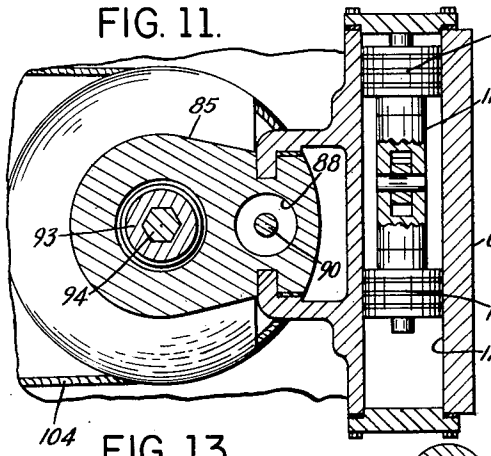


FIG. 12.

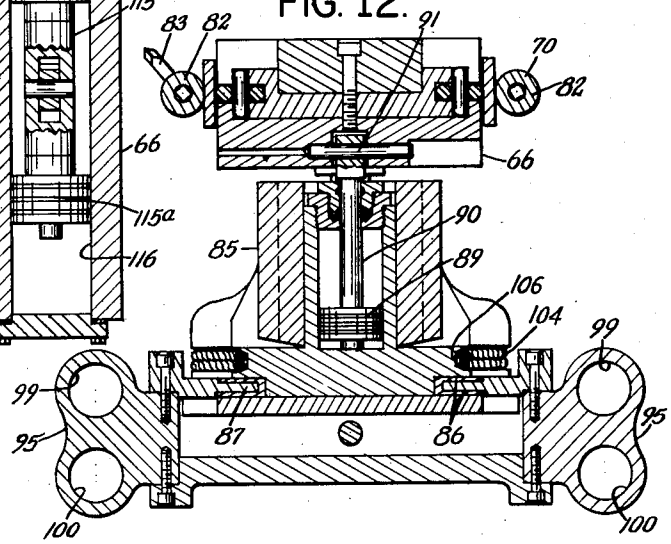


FIG. 13.

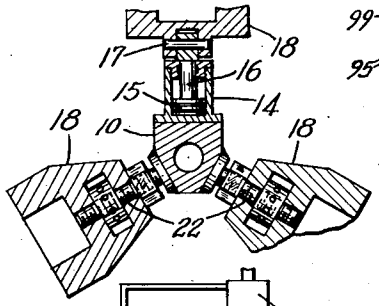
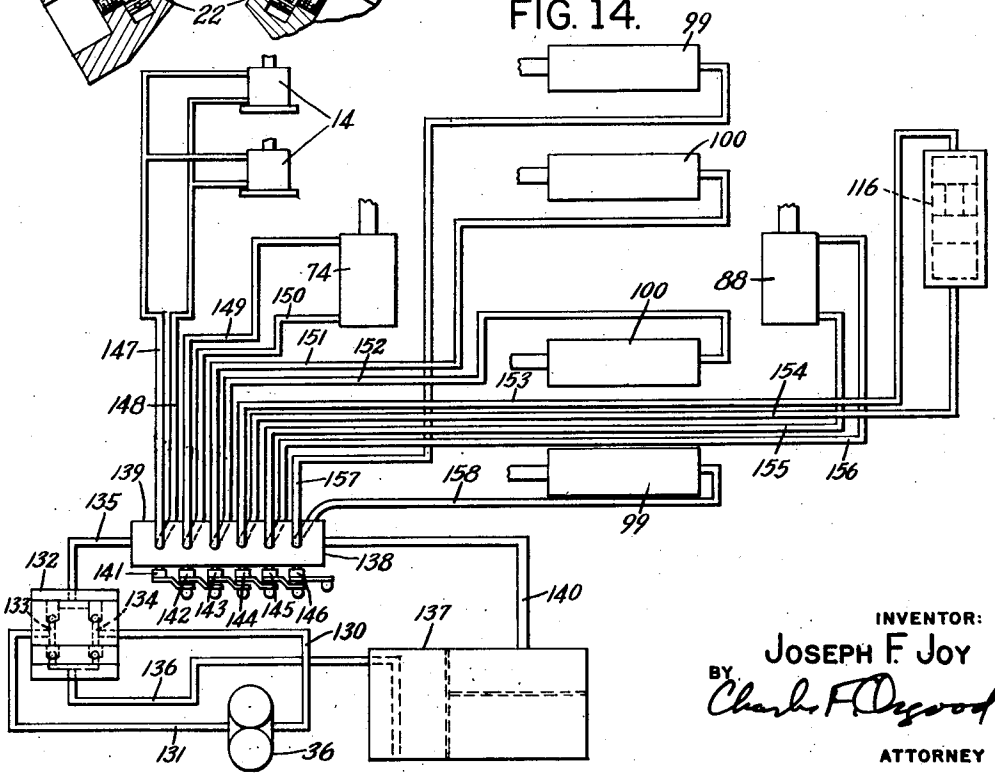


FIG. 14.



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2,796,246

COAL MINING MACHINE WITH LATERALLY SWINGABLE AND VERTICALLY ADJUSTABLE CUTTER BARS

Joseph F. Joy, Pittsburgh, Pa., assignor to Joy Manufacturing Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application June 30, 1952, Serial No. 296,325

7 Claims. (Cl. 262—9)

This invention relates to coal mining machines and more particularly to a coal mining machine of the type known as a sprag miner for removing roof supporting sprags between parallel horizontal bores formed in a coal seam.

In the method of mining coal as disclosed in my copending application, Serial No. 296,323, filed of even date herewith, parallel horizontal bores are formed in a coal seam by a machine known as a "bore miner" such as disclosed in my copending application, Serial No. 296,324, also filed on the same day as the present case. The parallel bores extend in horizontal parallelism with and ahead of the coal face and narrow sprags of coal are left between the bores to support the roof, and as mining progresses these sprags are mined and loaded out so that the roof may subside in back of the face. It is to the machine for removing such sprags of coal that the present invention particularly relates.

An object of the present invention is to provide an improved coal mining machine. Another object is to provide an improved mining machine especially designed for use with the so-called "bore and sprag" method of mining for removing the narrow sprags of coal between the parallel horizontal bores formed in the coal seam. A further object is to provide an improved coal mining machine which is designed to travel in a uniform horizontal bore desirably of circular cross section formed in a coal seam and having improved propelling devices engaging the bore-walls for supporting the machine and for feeding the machine in either of opposite directions within the bore. A still further object is to provide an improved mining machine known as a sprag miner and having having an improved cutter bar arrangement and improved adjusting mechanism therefor whereby the cutter bars may be positioned in a compact manner within the lateral limits of the machine to enable the latter readily to travel in the circular bore, and the adjusting mechanism including improved means for adjusting the cutter bars vertically and horizontally into sprag cutting position. Still another object is to provide an improved cutter bar arrangement embodying superimposed parallel horizontal cutter bars having endless cutter chains circulating orbitally in relatively opposite directions guided thereon, and a deflector plate associated with the lower cutter bar for directing the disintegrated coal being conveyed by the lower cutter chain toward the conveying means of the machine. Yet another object is to provide an improved sprag miner adapted to travel in a uniform bore desirably of circular cross section and having endless tractor treads engaging and firmly held against the bore walls for feeding the machine within the bore and including improved adjusting devices for adjusting the tractor treads and for holding the same firmly in engagement with the bore-walls during the feeding operation. These and other objects and advantages of the invention will, however, hereinafter more fully appear as the description proceeds.

In the accompanying drawings there are shown for purposes of illustration one form and a modification which the invention may assume in practice.

In these drawings:

Fig. 1 is a side elevational view of a sprag miner constructed in accordance with a preferred illustrative embodiment of the invention and showing the miner supported in transport position on its launching carriage.

Fig. 2 is a plan view of the sprag miner and launching carriage shown in Fig. 1.

Fig. 3 is an enlarged horizontal section, with parts shown in plan, taken on line 3—3 of Fig. 1, and showing details of the bar swinging mechanism.

Figs. 4 and 4ª, taken together constitute an enlarged central longitudinal vertical section taken on line 4—4 of Fig. 2, with the sprag miner removed from its launching carriage and supported in the bore-hole.

Fig. 5 is a horizontal section taken on line 5—5 of Fig. 4ª, showing the endless machine conveyor.

Fig. 6 is an enlarged cross section taken on line 6—6 of Fig. 7, illustrating the manner of engagement of the tractor tread devices with the bore walls.

Fig. 7 is a side elevational view showing the machine in sprag cutting position in a bore-hole and illustrating the detachable deflector or guide plate associated with the bottom cutter bar.

Fig. 8 is a schematic view, on a reduced scale, showing the machine in travelling position in a bore-hole.

Fig. 9 is a schematic view, similar to Fig. 8, showing the machine in cutting and dislodging position with the cutter bars disposed at right angles with respect to the path of travel of the machine.

Fig. 10 is a schematic view, similar to Fig. 9, showing the deflector and bottom cutter bar and illustrating the manner of directing the loose coal being conveyed by the bottom cutter chain toward the endless conveyor of the machine.

Fig. 11 is a horizontal detail sectional view taken on line 11—11 of Fig. 4, showing details of the coal breaker cylinder.

Fig. 12 is a vertical section taken on line 12—12 of Fig. 4, showing the adjusting cylinder for the top cutter bar.

Fig. 13 is a fragmentary section showing the adjusting screw devices for the lower tread frames.

Fig. 14 is a diagrammatic view illustrating the hydraulic fluid system.

Fig. 15 is a view similar to Fig. 6, but on a reduced scale, showing a slightly modified miner operating in a bore of square cross section.

In Figs. 1 and 2 of the drawings, 1 generally designates the launching carriage and 2 generally designates the sprag miner, and the latter is mounted on the launching carriage during transport or tramming of the miner from one place to another about the mine. This launching carriage is fully disclosed in my copending application, Serial No. 296,324, above referred to, and includes a tractor base 3 adjustably supporting a circular guide frame 4 which receives the sprag miner 2 during transport and serves to guide and direct the miner during launching of the latter into a bore, and as the miner leaves the launching carriage and moves within the bore, it is entirely supported by the bore walls. Since the launching carriage does not per se enter into the present invention further detail description thereof is herein unnecessary other than to state that it carries an oscillatory conveyor drum 5 (Fig. 1) on which a shaker belt or conveyor strip 6 is wound together with suitable driven mechanism for effecting intermittent drum drive in a manner similar to that disclosed in my application, Serial No. 296,324, referred to above. The sprag miner 2 embodies a reactor mechanism, generally designated 7, with which the shaker belt

or conveyor strip is associated as will later be described in detail.

Now referring to the sprag miner 2 and particularly to the detail structure thereof, it will be noted that a central circular frame or body **10** (Figs. 4ª and 6) is supported by crawler devices **11** herein arranged 120° apart with respect to the machine frame with the upper crawler device vertically disposed, and these crawler devices engage the bore-walls (Fig. 6). This frame or body supports at one end thereof top and bottom superimposed horizontal cutter bars **12** and **13** which will later be described in detail. As shown in Figs. 4ª and 13, the central frame **10** carries at its upper portion vertically disposed fluid cylinders **14** containing reciprocable pistons **15** having upwardly projecting piston rods **16** pivotally connected at **17** to the upper one of the tread frames **18** of the crawler devices **11**. These tread frames are suitably guided for radial adjustment with respect to the machine frame **10** and guided for orbital circulation on each tread frame is an endless crawler tread chain **19**. Motors **20** carried by the tread frames within the orbits of the endless tread chains (Fig. 4ª) are connected through conventional reduction gearings **21** to suitable chain sprockets which engage and drive the tread chains in a well-known manner. These motors **20** are desirably of the reversible electric type and may be reversed to effect drive of the tread chains in either of opposite directions. Fluid under pressure may be supplied to the cylinders **14** to move the pistons upwardly to hold the upper tread chain in firm engagement with the top bore wall and when fluid is trapped in these cylinders the upper tread chain may be maintained in adjusted position. When the cylinders **14** are connected to exhaust the pistons may move downwardly to retract the upper tread chain when desired. The lower tread devices have conventional adjusting screw devices **22**, one of which is shown in Fig. 13, whereby the lower tread chains may be adjusted readily into predetermined positions and securely locked therein.

The machine frame or body **10** includes a horizontal casing **25** of a motor **26**, the latter herein desirably a reversible electric motor, and a gear housing **27** is attached to the motor casing, and the motor shaft **28** has a spur pinion **29** fixed thereto and this pinion meshes with and drives a spur gear **30** keyed to a longitudinal shaft **31** herein arranged parallel to the motor shaft (Fig. 4ª) and suitably journaled within the gear housing **27**. Secured to the shaft **31** is a spur gear **32** meshing with and driving a spur gear **33** secured to a longitudinal shaft **34** desirably arranged in longitudinal-axial alignment with the motor shaft. Secured to and projecting forwardly from the gear housing **27** is a horizontal hollow frame or support **35**, and the shaft **34** is suitably journaled in bearings supported within the gear housing **27** and this hollow support. Mounted on this support is a conventional reversible fluid pump **36** driven by a spur gear **37** secured to and rotatable with the gear **33** and meshing with and driving a spur gear **38** secured to the pump driven shaft. The purpose of this pump will be later described.

Surrounding a frame portion **40** (Figs. 4ª and 6) projecting downwardly centrally from the machine frame or body **10** is an endless conveyor **41** comprising a conveyor chain **42** guided for orbital circulation along suitable guideways **43** and carrying usual lateral flights **44**. The lower crawler devices are desirably arranged 120° apart, 60° at each side of the vertical, as shown in Fig. 6, so as to straddle the conveyor **41** in the manner shown. This conveyor chain travels around a drive sprocket **45** at one end of the frame portion **40** and around a suitable curved guide **46** at the opposite end of the frame portion **40**, and this guide is adjustably mounted at **47** to permit adjustment of the chain tension in a well-known manner. Secured to the longitudinal shaft **34** is a bevel gear **48** meshing with and driving a bevel gear **49** keyed to the upper end of a vertical shaft **50** suitably journaled within bearings supported within a bracket **51** secured to the tubular support **35** and the frame portion **40**, as shown in

Fig. 4ª. The sprocket **45** is keyed to the lower end of the shaft **50**. Thus, during running of the motor **26** the endless conveyor **41** may be circulated orbitally along its guideways. The discharge end of the endless conveyor is elevated and extends above the shaker belt or conveyor strip **6**, in the manner shown in Fig. 4ª.

The reactor mechanism **7** for the shaker belt or conveyor strip **6**, as shown in Figs. 4ª and 6, is arranged longitudinally within the orbit of the endless conveyor **41** and comprises a plunger **55** having a rod **56** projecting outwardly from a longitudinally extending tubular guide **57** in which the plunger is reciprocably mounted, and the plunger is keyed at **58** to the guide walls to prevent rotation of the plunger in its guide. A coil spring **59** encircles the rod **56** within the guide and acts between the plunger **55** and a head member **60** for constantly urging the plunger in an endwise direction toward the right as viewed in Fig. 4ª. The rod **56** is detachably secured at **61** at its outer end to a bracket **62** detachably secured at **63** to the adjacent end of the shaker belt **6**. The winding drum **5** on the launching carriage **1** may be similar to that disclosed in my copending application Serial No. 296,324 mentioned above and serves to move the shaker belt in one direction against the action of the coil spring **59** and when the drum is released momentarily from its drive, the coil spring moves the shaker belt rapidly in the opposite direction. Thus, the shaker belt may be reciprocated on the bore-bottom to effect feed of the material received thereby with a jigging action within the bore in a direction away from the mining machine, i. e. a direction toward the left as viewed in Fig. 4ª.

The adjustable cutter bar structure will now be described in detail. As shown in Fig. 4 the longitudinally projecting support **35** carries a hanger **65** for the lower cutter bar **13** and an upstanding bracket **66** for supporting the superimposed top cutter bar **12**, and these cutter bars have guideways **67** and **68** respectively extending about their margins in which endless cutter bit carrying cutter chains **70** are guided for orbital circulation, and these chains travel in relatively opposite directions for a purpose to be later explained. The bottom hanger **65** is guided for vertical adjustment along suitable guides of a depending bracket **71** which is swiveled in bearings **72** to turn about a vertical axis on a circular bearing support **73** integral with the support **35**. The bracket **71** has a vertical cylinder bore **74** containing a reciprocable piston **75** having its downwardly extending piston rod **76** pivotally connected at **77** to the hanger **65**. Secured to the longitudinal shaft **34** is a bevel gear **76** meshing with and driving a bevel gear **77** secured to the upper end of a vertical tubular shaft **78** suitably journaled in bearings supported within the depending bracket **71**, and splined to this tubular shaft is an axially slidable shaft **79** secured at its lower end to a chain sprocket **80** which engages and drives the cutter chain **70** on the lower cutter bar **13**.

The endless cutter chains **70** are desirably of the reversible type and include chain blocks **82** by which reversible cutters **83** are carried, and when reverse cutting is desired, i. e. when the bars are swung to a right angle position at the opposite side of the machine from that shown in Fig. 9, the cutters **83** may be reversed on the chain blocks **82** and the motor **26** may be reversed to drive the chains in the opposite direction.

The upstanding bracket **66** which carries the upper cutter bar **12** is suitably guided for vertical adjustment relative to a guide bracket **85** which is swivelly mounted in bearings **86** supported by a circular bearing support **87** integral with the support **35**, to turn about a vertical axis parallel with and spaced longitudinally of the machine frame from the vertical axis of the bracket **71** for the lower cutter bar. The bracket **85** has a vertical cylinder bore **88** containing a reciprocable piston **89** having its upwardly extending piston rod **90** pivotally connected at **91** to the adjustable bracket **66** for the

top cutter bar. Secured to the longitudinal shaft **34** is a bevel gear **91** which meshes with and drives a bevel gear **92** secured to the lower end of a tubular vertical shaft **93** suitably journaled within bearings supported by the bracket **85**. Splined within this tubular shaft is an axially slidable shaft **94** to the upper end of which a drive sprocket **95** is secured, and this sprocket engages and drives the cutter chain of the top cutter bar.

The pivotal axes of the cutter bars lie in a central longitudinal vertical plane which includes the longitudinal median line of the machine, and arranged longitudinally along opposite sides of lateral projections **98** integral with the support **35**, at opposite sides of the pivotal axes, are pairs of superimposed parallel horizontal cylinder bores **99** and **100** (see Figs. 3 and 12) and these bores contain reciprocable pistons **101** having projecting piston rods **102** at the outer ends of which guide sheaves **103** are carried. Cables **104** and **105** pass around circular guiding grooves **106** and **107** on the swiveled brackets **71** and **85** respectively, and these cables are centrally secured to the brackets **71** and **85** respectively, and these cables pass around the guide sheaves **103** and are secured at their ends at **108** to the sides of the lateral projections **98**.

When fluid under pressure is properly supplied to the vertical cylinder bores **74** and **88** the pistons **75** and **89** may be moved to adjust the upper and lower cutter bars in a vertical direction to vary their distance apart, and when fluid is trapped in the cylinder bores the bars are locked in adjusted positions. Also when fluid under pressure is supplied to one of the cylinder bores **99** and **100** one end section of each cable may be drawn in while the other is paid out to effect swinging of the cutter bars about their respective pivots, and here also, when fluid is trapped in the cylinder bores the cutter bars are locked against swinging movement about their pivots. The control valve devices for controlling the fluid supply to the cylinder bores, for trapping fluid in the bores and for venting the bores will later be described.

Embodied in the top cutter bar **12** and extending centrally lengthwise thereof within the orbit of the cutter chain is an expansible coal breaker device **110** similar to that disclosed in my copending application, Serial No. 296,326 filed of even date herewith. This breaker device comprises a pair of oppositely movable vertical breaker plates **111** and **112** which are actuated by a rotary device **113** to which a lever arm **114** is secured, as shown in Fig. 4. This lever arm engages a reciprocable piston **115** having end piston heads **115a** fitting a transverse cylinder bore **116** formed in the guide bracket **66**. Thus when fluid is properly supplied to the cylinder bore **116** the piston may be moved to swing the lever arm to effect expansion of the breaker plates thereby to apply a breaking down pressure to the top of the projection or core of coal formed between the upper and lower kerfs provided by the cutter bars **12** and **13**, as later described. Since this breaker device may assume various forms and is fully disclosed in the copending application Serial No. 296,326 mentioned above further description thereof is herein unnecessary.

Detachably secured, as by screws **120**, to the lower guide bracket are horizontal bars **121**, and detachably secured, as by screws **122**, to the outer portions of these bars is an upright deflector or guide plate **123** which is inclined inwardly and downwardly as viewed in Fig. 7, into adjacency to the out-coming run of the bottom cutter chain at the trailing side of the bottom cutter bar so as to retain the loose coal in the path of the chain whereby the latter may move the coal inwardly to discharge onto the endless conveyor **41**. This endless conveyor conveys the disintegrated coal rearwardly longitudinally of the machine within the bore to discharge at its rearward end onto the shaker belt **6**. When it is desired to propel the machine through the bore-hole the deflector plate and bracket must be detached from the machine so as to permit the cutter bars to be swung horizontally about their pivots and to be adjusted vertically whereby they may be located in collapsed positions within the cross sectional confines of the bore-hole, as shown in Fig. 8.

As is also disclosed in my copending application, Serial No. 296,324, above referred to, the machine body **10** carries an adjustable key **125** (see Fig. 6) which is insertable at its outer portion in a key-slot **126** formed in the side-wall of the bore hole for preventing turning of the machine bodily about its longitudinal axis within the bore. The frame **10** also carries at the side thereof opposite from the key a horizontal platform **127** on which the machine operator may assume a reclined position during operation of the machine.

Now referring to the hydraulic fluid system shown diagrammatically in Fig. 14, it will be observed that the pump **36** which is reversible has its opposite sides connected by conduits **130** and **131** to a conventional reversing check valve device **132** which contains check valve controlled passages **133** and **134** whereby the pump may always discharge liquid under pressure to a conduit **135**, irrespective of the direction of operation of the pump. The valve device **132** has its suction side connected by a conduit **136** to a liquid tank **137**. Thus when the machine motor **26** is reversed to effect reverse cutting, the pump always effects discharge of liquid under pressure through the conduit **135** to the pressure passage of a valve box **138** of a conventional control valve mechanism **139**. The discharge passage of this valve box is connected to a conduit **140** back to the tank.

The valve box **138** has parallel bores which respectively contain control valves **141**, **142**, **143**, **144**, **145** and **146**, each provided with a suitable control handle. The bore containing the valve **141** is connected by branched conduits **147** and **148** to the opposite ends of the cylinders **14** for vertically adjusting the upper crawler tread device **11**, while the bore containing the valve **142** is connected by conduits **149** and **150** to the opposite ends of the cylinder **74** for adjusting the bottom cutter bar **13**. The bore containing the valve **143** is connected by conduits **151** and **152** to the cylinders **100** for swinging the bottom cutter bar, while the bore containing the valve **144** is connected by conduits **153** and **154** to the opposite ends of the cylinder **116** for operating the breaker device of the top cutter bar. The bore containing the valve **145** is connected by conduits **155** and **156** to the opposite ends of the cylinder **88** for vertically adjusting the top cutter bar **12**, while the bore containing the valve **146** is connected by conduits **157** and **158** to the cylinders **99** for swinging the top cutter bar.

In the modification shown in Fig. 15, the improved sprag miner is located in a bore of generally square or rectangular cross section and the lower crawler tread devices **11'** are shown arranged in parallel spaced apart vertical relation with the crawler chains running along the flat bottom of the bore or passageway and with the upper crawler device **11** centrally engaging the flat roof surface. The endless conveyor **41'** is shown disposed horizontally between the lower tread devices, and the lower tread frames are connected to the frame **40** by lateral axlelike portions **40'** secured to the frame portion **40**. Evidently, the passageway in which the sprag miner operates may assume various other shapes although the circular bore is desirable since with such circular arched-roof shape the need for roof propping or anchoring is substantially eliminated.

The general mode of operation of the improved sprag miner will be clearly apparent from the description given. The miner **2** may be transported or trammed about the mine while mounted on the launching carriage **1** and when the working place is reached the guide **4** of the carriage may be adjusted to direct the miner into a horizontal bore B in the coal seam, and as the miner leaves the car-

riage guide its crawler tread devices **11** engage the walls of the bore hole to effect supporting of the miner in the bore and to effect propulsion of the miner through the bore. During traveling of the miner longitudinally within the bore the upper and lower horizontal cutter bars **12** and **13** may be adjusted vertically by the fluid cylinders **74** and **88** and swung horizontally about their pivots lengthwise of the miner by the fluid cylinders **99** and **100** into collapsed positions so that the cutter bars are at that time confined within the lateral limits of the miner within the bore, as shown in Fig. 8. When the miner assumes a position in the bore with the cutter bars located at the adjacent end of a roof supporting sprag S of coal, as shown in Fig. 9, the hydraulic cylinders **99** and **100** may be operated to swing the cutter bars horizontally about their respective pivots to the right angle positions shown in Fig. 9, and by trapping liquid in the cylinders the bars are locked in the cutting position shown. The deflector or guide plate **123** and the supporting bars **121** may then be attached to the miner at the trailing side of the lower cutter bar in the position shown in Figs. 9 and 10. The motor **26** may be operated to effect circulation of the cutter chains **70** of the upper and lower cutter bars in relatively opposite directions and as the miner is advanced in the bore by the crawler devices the cutter chains cut horizontal top and bottom kerfs in the sprag of coal at one side of the bore to form a projection or core of coal between the kerfs. At proper intervals the breaker device **110** within the upper cutter bar **12** may be operated to dislodge fragments of the projection or core from the solid, and the dislodged coal is conveyed by the outcoming run of the bottom cutter chain inwardly toward the center of the machine and the deflector or guide plate **123** serves to retain the loose coal in the path of the lower cutter chain (Fig. 10) so that the coal is effectively conveyed toward the machine-conveyor. The endless conveyor **41** received the loose coal discharged from the lower cutter chain and conveys the coal received thereby longitudinally of the machine within the bore and discharges the coal onto the shaker belt **6** which extends outwardly in the bore along the bore-bottom, and the shaker belt rapidly conveys the loose coal with a jigging action outwardly from the bore. As the miner is advanced in the bore the cylinders **74** and **88** may be operated to adjust the cutter bars gradually in a vertical direction to increase their distance apart so that the cutter bar may move gradually to the top and bottom of the bore, and even above the top and below the bottom of the bore as disclosed in my copending application, Serial No. 296,323, mentioned above. During reverse cutting, i. e. when the machine is operating in the reverse direction or along an opposite face, the motor **26** may be reversed, the deflector **123** is detached from the miner, the cutter bits are reversed on the cutter chains and the cutter bars may be swung into right angle positions at the opposite side of the machine, and thereafter a different reversely constructed deflector **123** may be attached to the miner in a position for reverse operation. If desired the deflector **123** may be constructed so that it may merely be transposed with respect to its supporting bars **121** so that the same deflector may be employed in either of the reversed positions of the cutter bars. The top cutter bar **12** is offset longitudinally of the miner from the bottom cutter bar **13**, as shown in Fig. 7, so that the breaker device **110** may act on the top of the projection or core of coal outwardly of its point of attachment with the solid coal so that dislodgement of the core is made relatively easily. The lower tread devices may be adjusted by the screw devices **22** (Fig. 13) into proper predetermined relation with the lower portion of the bore walls and the cylinders **14** may be operated to hold the upper tread device firmly against the roof of the bore, so that the miner may be effectively propelled within the bore during the cutting and dislodging operation, as well as during traveling of the machine wherein the cutter bars are collapsed and positioned to extend lengthwise of the machine within the confines of the bore walls. The miner of the modification shown in Fig. 15 operates in essentially the same manner as the embodiment above described.

As a result of this invention an improved coal mining machine is provided having improved devices for propelling the machine within a mine passageway or bore and having improved cutting and dislodging mechanism whereby the coal at one side of the passageway or bore may be efficiently cut and dislodged. The improved sprag miner of the present invention is designed for operation in a horizontal bore formed in the coal seam ahead of the coal face and by the provision of the improved cutting and dislodging mechanism the roof supporting sprag of coal at the face may be rapidly dislodged and loaded out. By the provision of the improved arrangement of the cutter bars and the adjusting and positioning devices therefor the cutter bars may be positioned lengthwise of the machine within the lateral limits thereof so that the machine may readily travel within a bore of circular cross section, and the cutter bars may be readily adjusted into lateral cutting and dislodging positions. These and other advantages of the invention will be clearly apparent to those skilled in the art.

While there are in this application specifically described one form and a modification which the invention may assume in practice, it will be understood that this form and this modification of the same are shown for purposes of illustration and that the invention may be further modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a coal mining machine adapted to move endwise along a coal face, a self-propelled frame, superimposed horizontal top and bottom cutter bars mounted on said frame at one end of the latter to swing horizontally into lateral cutting positions about parallel vertical axes spaced apart in relatively fixed relation longitudinally of the machine and lying in the central longitudinal vertical plane of said frame, with the top cutter bar spaced outwardly longitudinally of the machine from the bottom cutter bar when said cutter bars are in their lateral cutting positions, means for swinging said cutter bars horizontally about their respective pivotal axes laterally into parallel right angle positions with respect to the path of travel of said frame at the same side of the latter, endless cutter chains respectively guided for orbital circulation about the margins of said cutter bars for cutting parallel horizontal kerfs in the solid coal to form a projection of coal between the kerfs, and a breaker device for applying a dislodging pressure to the outer top surface of the projection of coal between said cutter bars to dislodge the coal from the solid.

2. A coal mining machine as set forth in claim 1 wherein power devices are provided for independently adjusting said cutter bars in a vertical direction relative to said machine frame while said vertical axes remain relatively stationary as regards movement longitudinally of said frame to vary the vertical distance apart of said cutter bars.

3. In a coal mining machine as set forth in claim 1 wherein a deflector plate is attached to the machine and extends longitudinally in parallelism with the bottom cutter bar at the trailing side of the latter when said bottom cutter bar is in its lateral cutting position and the machine advances endwise along the face for retaining the dislodged coal in the path of the bottom cutter chain whereby said chain may convey the loose coal inwardly toward the longitudinal center of said frame, and a conveyor is provided on said machine frame for receiving the coal discharged from said bottom cutter chain.

4. In a coal mining machine, a self-propelled frame movable in a bore of circular cross section formed in a coal seam and having propelling devices for supporting

said frame with its bottom disposed a substantial distance above the bottom of said bore for propelling the machine longitudinally within the bore, cutting and dislodging mechanism carried by said frame at one end thereof and positionable at one end of the bore laterally at right angles with respect to the path of travel of the machine for cutting and dislodging the solid coal which provides one sidewall of the bore the full height of the latter, and power devices for adjusting said cutting and dislodging mechanism laterally relative to said frame and for adjusting the height of said mechanism to vary the vertical range of operation thereof with respect to the top and bottom walls of the bore, said cutting and dislodging mechanism including parallel horizontal top and bottom cutter bars having endless cutter chains guided for orbital circulation thereon, said power devices for adjusting said mechanism including devices for moving said bars in a vertical direction to vary their vertical distance apart, the lateral adjustment of said cutter bars being a pivotal adjustment and said cutter bar being swingable about parallel vertical axes spaced apart longitudinally of the machine, and said power devices effecting swinging of said cutter bars horizontally about their respective pivots.

5. A coal mining machine comprising a cutting mechanism including parallel horizontal top and bottom cutter bars mounted to swing about parallel vertical axes permanently spaced apart longitudinally of the machine, means for propelling the machine in an endwise direction, means for swinging said cutter bars horizontally about their respective pivotal axes into parallel right angle positions with respect to the path of travel of the machine, and means for adjusting said bars vertically to vary their distance apart while the parallel relation of said bars and their pivotal axes remain undisturbed.

6. A coal mining machine comprising a cutting mechanism including parallel horizontal top and bottom cutter bars mounted to swing about parallel vertical axes spaced apart longitudinally of the machine, means for propelling the machine in an endwise direction, means for swinging said cutter bars horizontally about their respective pivotal axes into parallel right angle positions with respect to the path of travel of the machine with one cutter bar disposed outwardly with respect to the other, said bar swinging means including parallel superimposed horizontal extensible power devices and connections between said extensible devices and said cutter bars respectively, said connection for said outermost cutter bar extending longitudinally past and at opposite sides of the pivotal axis of the innermost cutter bar, and means for adjusting said bars vertically to vary their distance apart.

7. A coal mining machine comprising a cutting mechanism including parallel horizontal top and bottom cutter bars mounted to swing about parallel vertical axes spaced apart longitudinally of the machine, means for propelling the machine in an endwise direction, means for swinging said cutter bars horizontally about their respective pivotal axes into parallel right angle positions with respect to the path of travel of the machine with one cutter bar disposed outwardly with respect to the other, said bar swinging means including parallel superimposed horizontal extensible power devices and connections between said extensible devices and said cutter bars respectively, said connection for said outermost cutter bar extending longitudinally past and at opposite sides of the pivotal axis of the innermost cutter bar, said connections between said extensible power devices and said cutter bars being arranged in parallel horizontal planes respectively above and below horizontal planes which include the longitudinal axes of said extensible power devices respectively, said cutter bars being swingable horizontally about their pivots relative to said power devices, and means for adjusting said bars vertically to vary their distance apart.

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