Sept. 5, 1944. J. S. BELTZ 2,357,724

MINING MACHINE

Filed Feb. 27, 1941 6 Sheets-Sheet 1

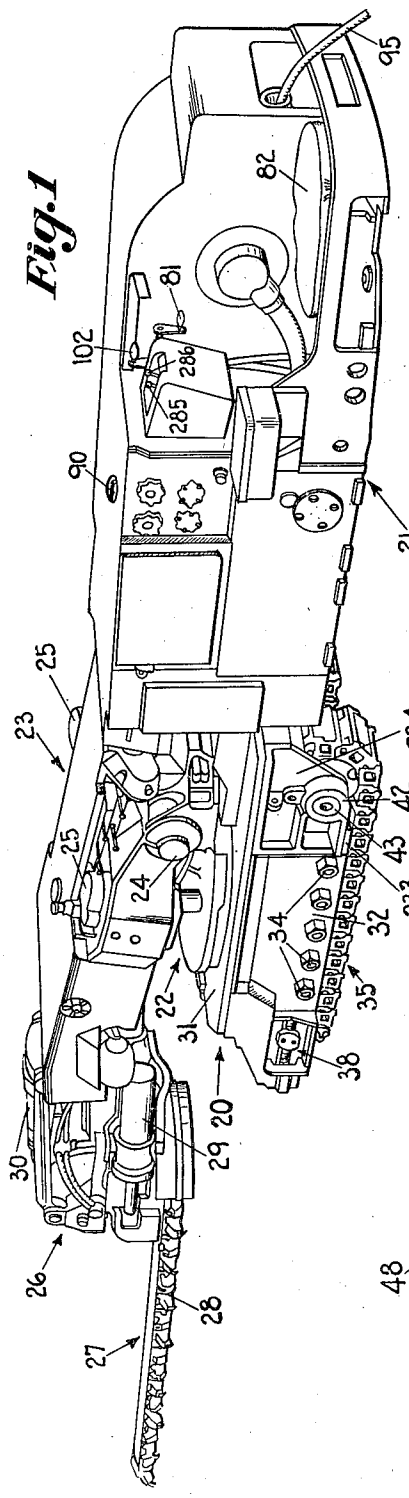

Fig. 1

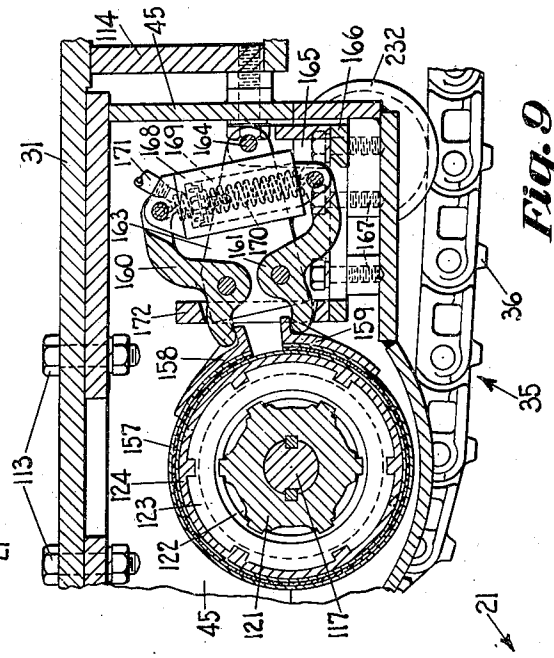

Fig. 9

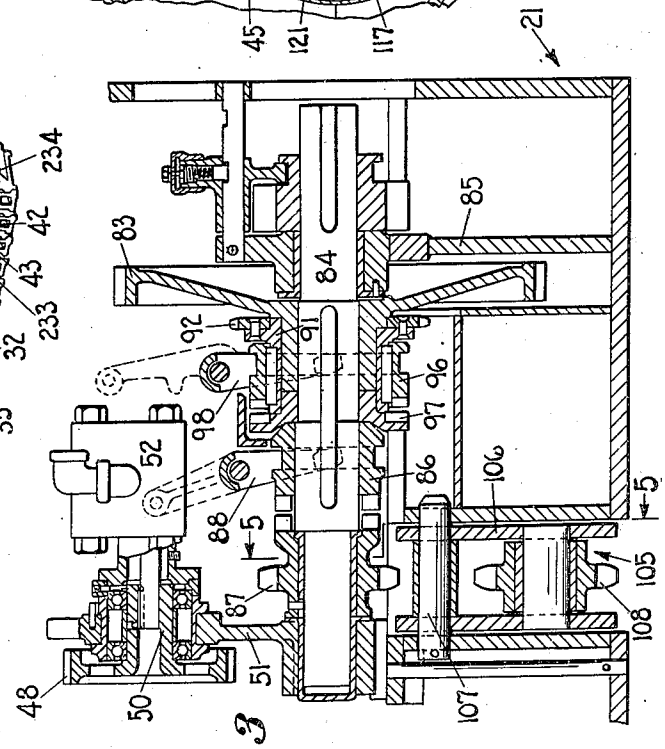

Fig. 3

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MINING MACHINE

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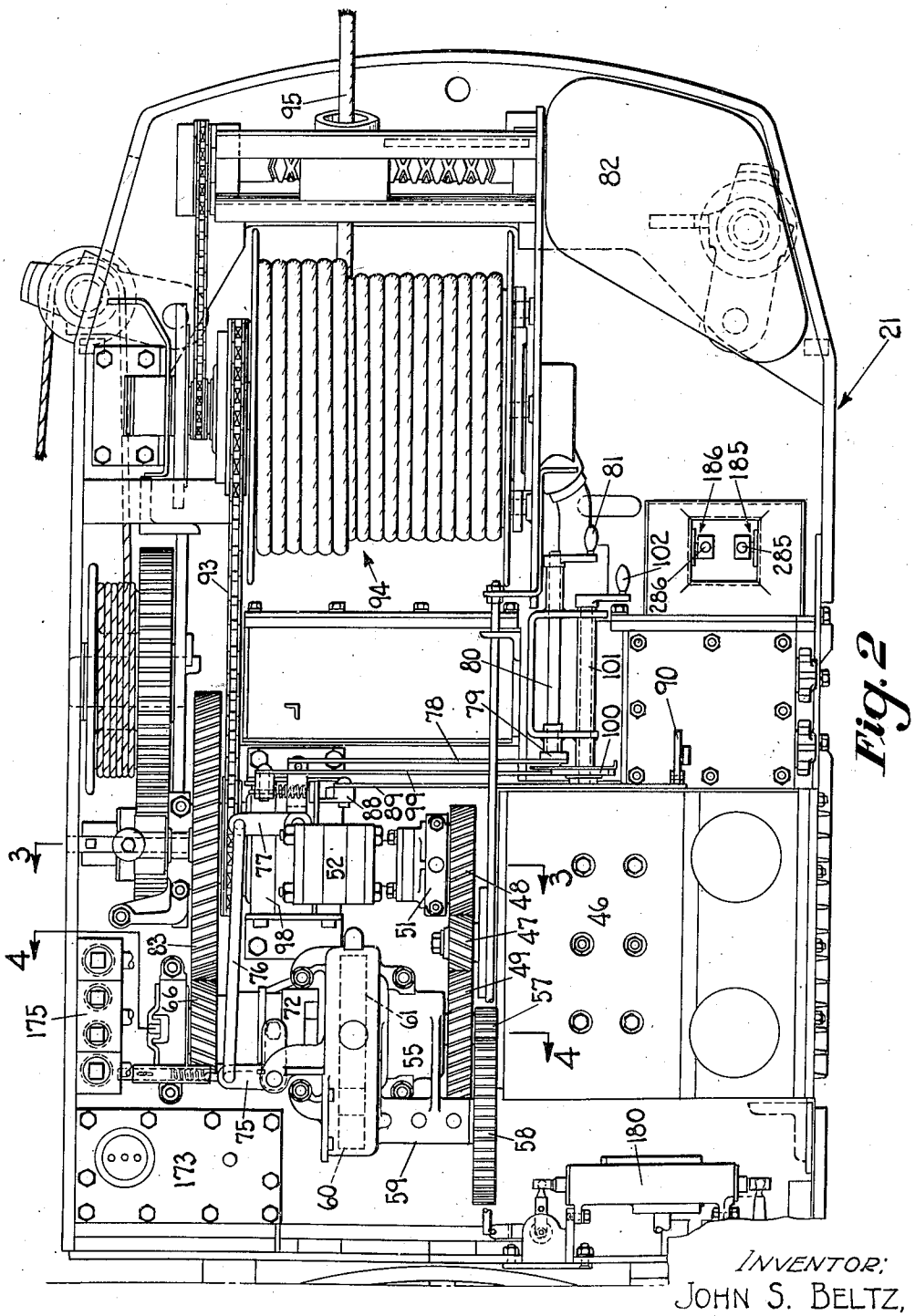


Fig. 2

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MINING MACHINE

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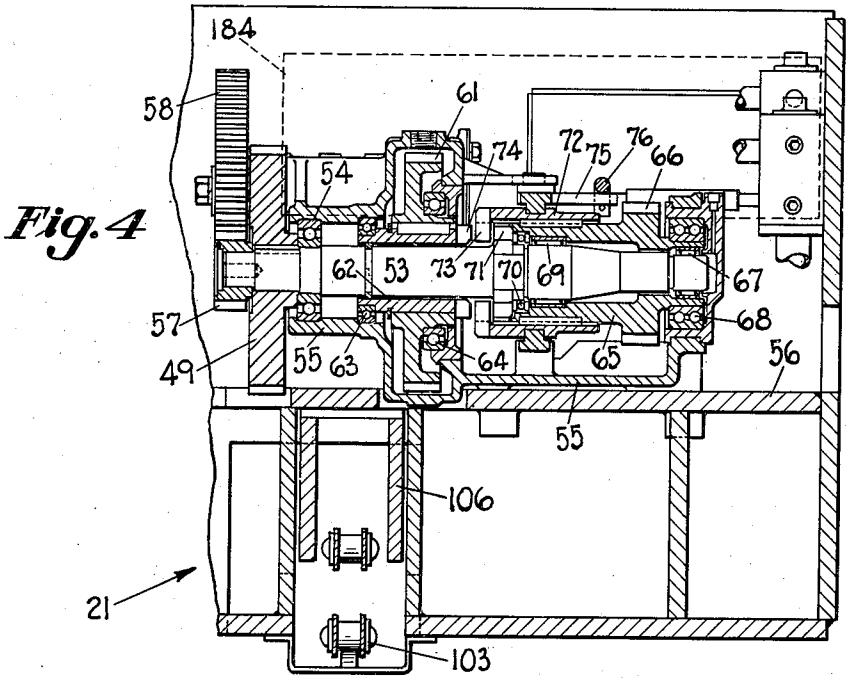


Fig. 4

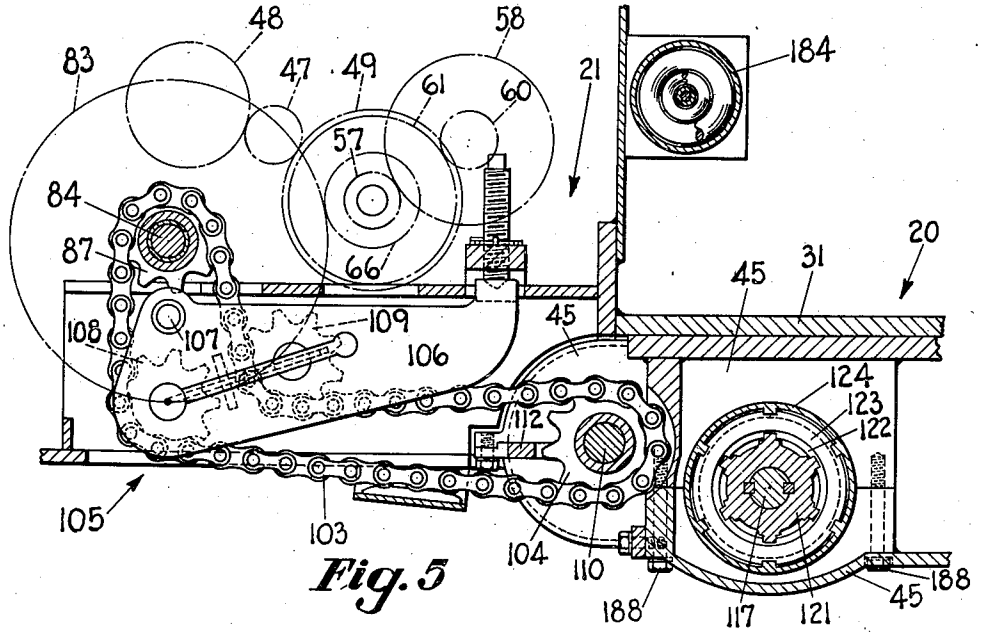


Fig. 5

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MINING MACHINE

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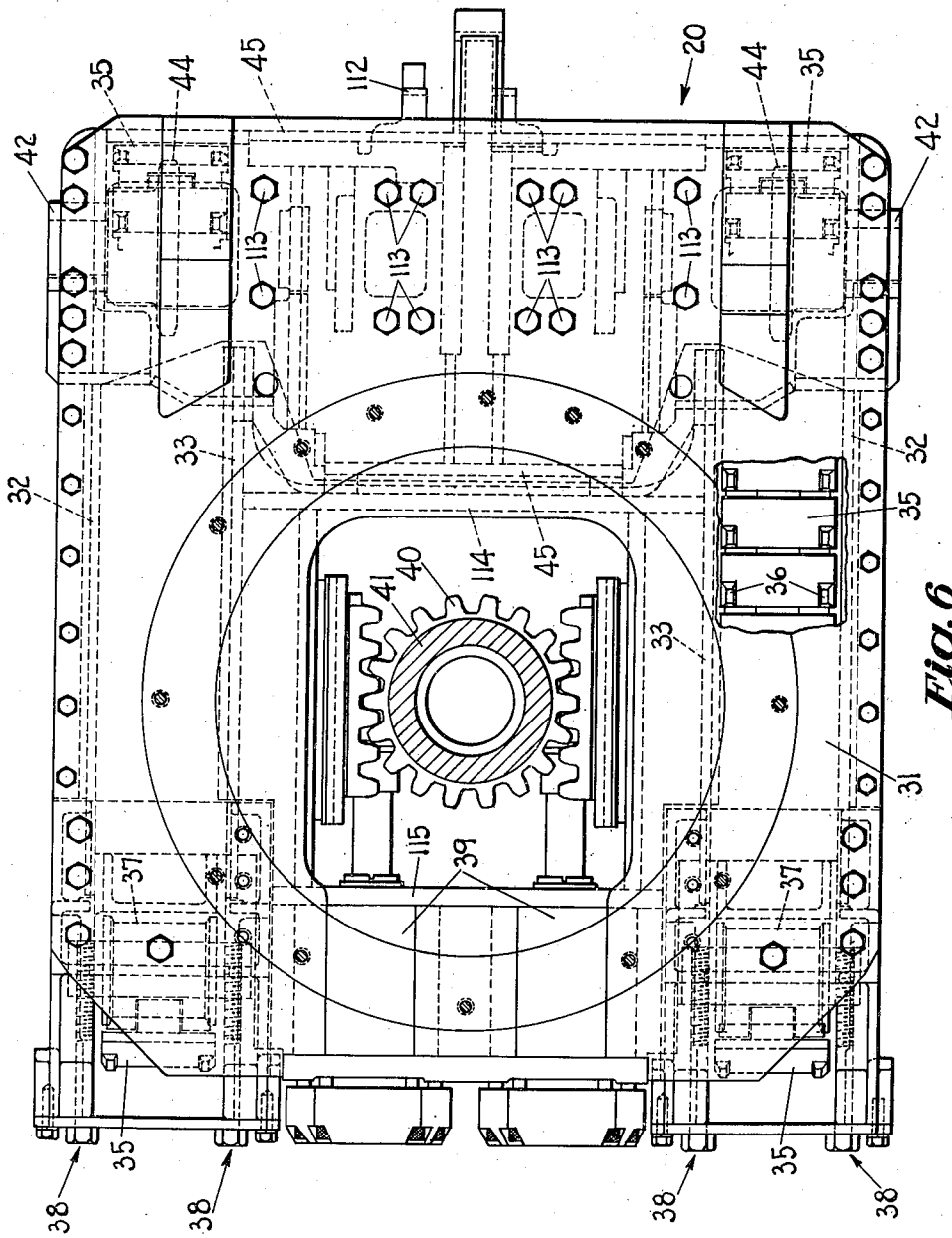


Fig. 6

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MINING MACHINE

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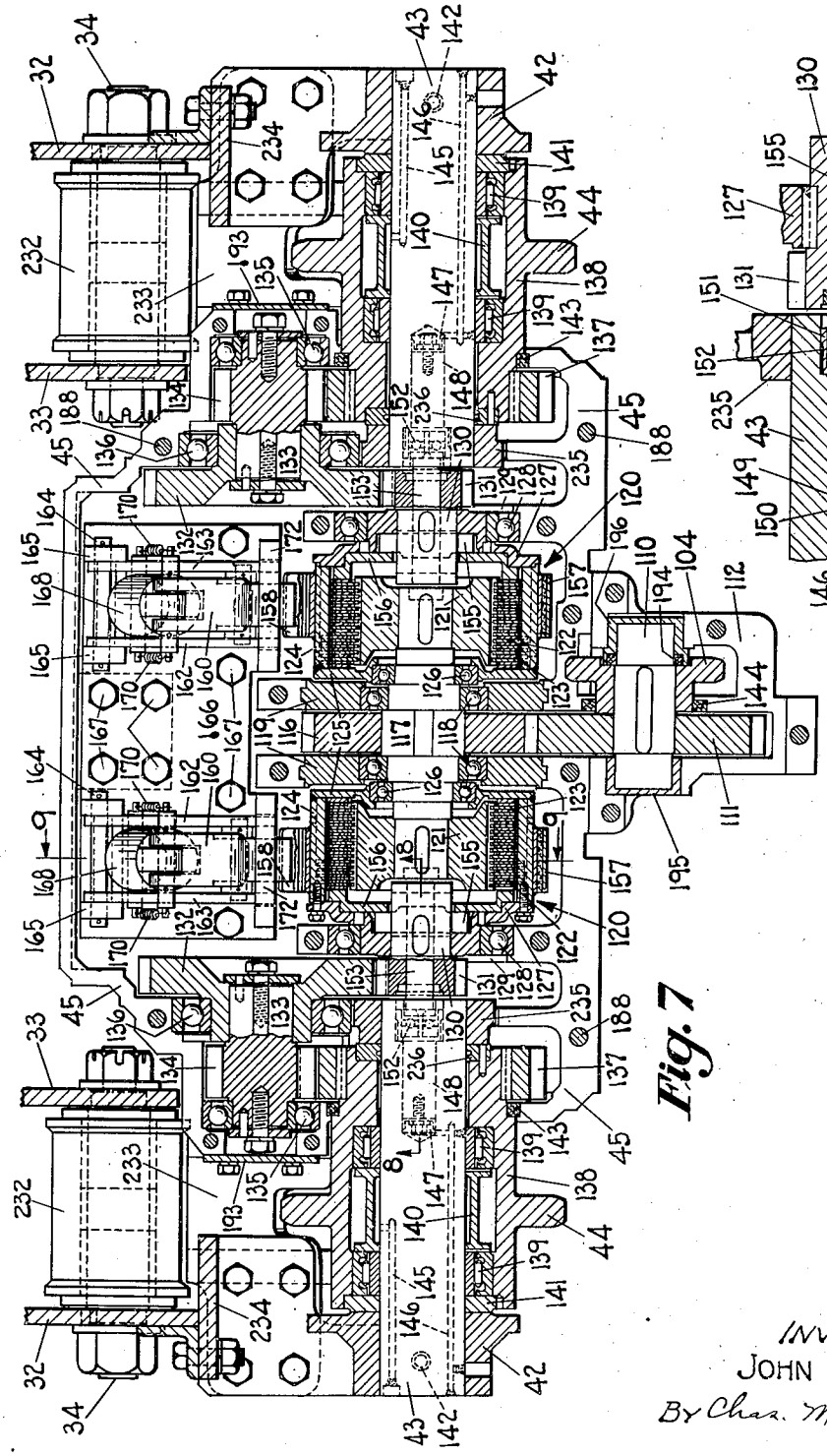

Fig. 7

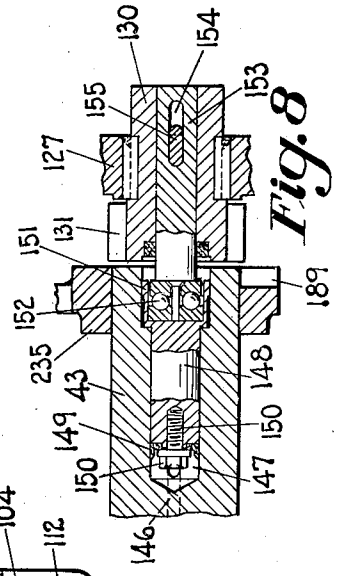

Fig. 8

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MINING MACHINE

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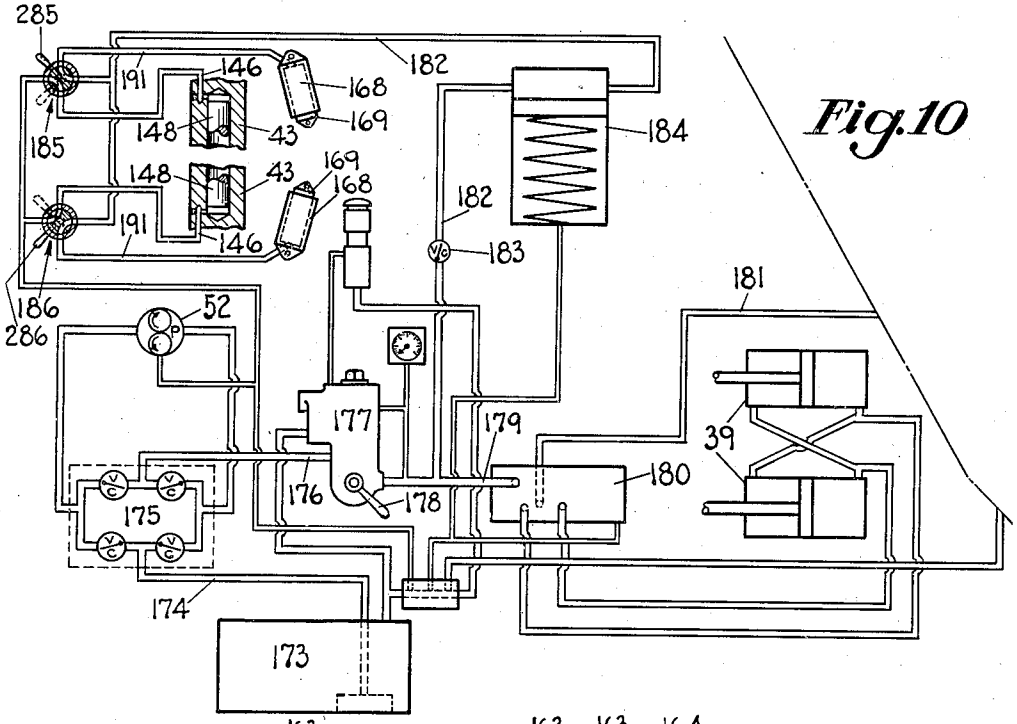


Fig. 10

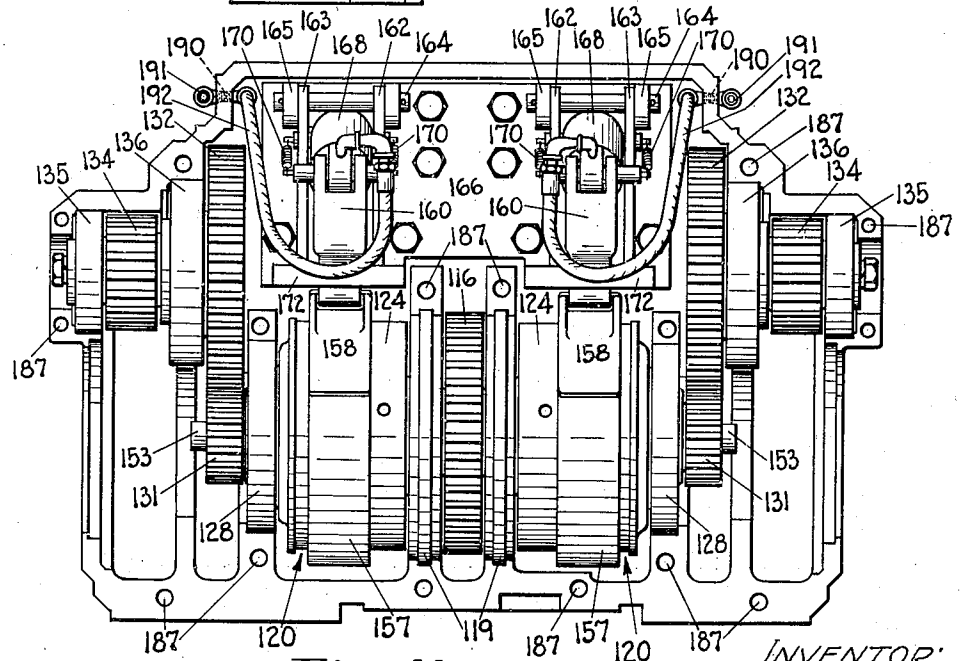


Fig. 11

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# UNITED STATES PATENT OFFICE

2,357,724

## MINING MACHINE

John S. Beltz, Columbus, Ohio, assignor to The Jeffrey Manufacturing Company, a corporation of Ohio

Application February 27, 1941, Serial No. 380,812

21 Claims. (Cl. 262—28)

This invention relates to a mining machine and particularly to a mining machine which is mounted upon crawlers or self-laying tracks.

An object of the invention is to provide an improved mining machine which is mounted upon power driven traction means such as crawlers, self-laying tracks, or individual wheels with solid or pneumatic tires, and to provide improved drive means for said traction means.

Another object of the invention is to provide a machine of the above general type in which improved driving and controlling means is provided for the traction means which is preferably of the crawler type.

A further object of the invention is to provide a mining machine with improved drive gearing interconnecting a driving motor and the traction means.

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 perspective view of the mining machine incorporating the features of my invention;

Fig. 2 is a plan view of the apparatus carried by the rear platform of the mining machine, with the cover plate removed;

Fig. 3 is a sectional elevational view taken on the line 3—3 of Fig. 2 looking in the direction of the arrows;

Fig. 4 is a sectional elevational view taken on the line 4—4 of Fig. 2 looking in the direction of the arrows;

Fig. 5 is a sectional elevational view taken on the line 5—5 of Fig. 3 looking in the direction of the arrows;

Fig. 6 is a plan view of the main frame of a mining machine showing the turntable pedestal in section and with a portion broken away to show one of the crawlers;

Fig. 7 is a sectional plan view showing that portion of the crawler drive gearing which is carried at the rear end of the main frame as shown in Fig. 6 of the drawings;

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

Fig. 9 is a sectional view taken on the line 9—9 of Fig. 7 looking in the direction of the arrows;

Fig. 10 is a piping diagram of that portion of the hydraulic system which is pertinent to the particular elements of improvement comprising my invention; and

Fig. 11 is a plan view of a dual drive unit adapted to be detachably connected to the frame supporting the crawler driving mechanism shown in Fig. 7.

It may be stated at the outset that the invention herein disclosed relates particularly to improvements in the mining machine which is fully disclosed in the application of Robert K. Jeffrey et al., Serial No. 206,448, for a Mining machine, filed May 6, 1938, now Patent No. 2,263,779, dated November 25, 1941, to which reference is made for a more detailed disclosure of certain features of the machine, which are not described in full detail herein. It is to be understood that unless the contrary fact is indicated, the machine herein disclosed will follow the construction of the machine in the above-mentioned application.

It should also be noted that the main distinction between the mining machine disclosed in the above identified application and the mining machine herein disclosed resides in the use in the latter of power driven traction means at opposite sides of the machine that can be individually controlled instead of power driven flanged wheels which can travel only on a mine track as shown in said above-identified application. In other words the mining machine herein disclosed contemplates individually operated and controlled traction means such as crawlers, self-laying tracks or ground engaging wheels, at opposite sides of the machine, to enable the latter to be very efficiently maneuvered in small or limited spaces in mines without the use of mine tracks comprising spaced rails. In some of its broader aspects the invention relates to a traction machine broadly, of which the mining machine disclosed is the preferred embodiment.

Referring particularly to Fig. 1 of the drawings, it will be seen that the mining machine of my invention comprises a main frame 20 to which is rigidly attached a rearwardly extending platform 21 which is disclosed in more detail in Fig. 2 of the drawings and upon which is supported a large number of mechanisms as hereinafter described more completely. Mounted directly upon the main frame 20 for turning movement about an upright axis, is a turntable 22 upon which is mounted a supplementary frame 23 which is pivotally attached at its rear end to the rear portion of the turntable 22 for pivotal movement about a substantially horizontal axis as provided by a pair of journal bearings, one of which is seen at 24. Swinging movement of the supplementary frame 23 about said horizontal axis is provided by a pair of spaced hydraulic motors or jacks, one of which is seen at 25, which

are interconnected between the supplementary frame 23 and the turntable 22, one on each side thereof. Adjacent its forward end the supplemental frame 23 carries a turnover head mechanism 26 which in turn carries an elongated cutter bar 27 which carries an endless cutter chain 28 provided with cutter bits, which chain and cutter bar co-operate to provide a kerf-cutting mechanism.

Swinging movement of the cutter bar 27 about an axis which is at right angles to the plane thereof and at its rear end, is provided by a pair of hydraulic piston motors or jacks, one of which is seen at 29. Swinging movement of the cutter bar 27 in a plane perpendicular to its own plane, is provided by another hydraulic motor or jack 30. The cutter chain 28 is driven from a motor which is housed within and forms part of the supplemental frame 23 through appropriate drive gearing extending through said supplemental frame 23 and the turnover head mechanism 26, all as disclosed in full detail in the above-mentioned Patent No. 2,263,779.

The mining machine of my invention is designed to operate in a trackless room or entry, though it may operate on stationary rails, these capabilities being provided by virtue of the self-laying tracks or crawlers which I provide.

Referring particularly to Figs. 1 and 6 of the drawings, it will be seen that the main frame of the mining machine comprises a top plate 31 which has rigidly attached thereto, as by bolts, a downwardly extending side plate 32 extending along each side thereof. Spaced inwardly of each side plate 32 is an auxiliary plate 33 which extends downwardly from said plate 31 and is rigidly attached thereto. The plates 32 and 33 co-operate to provide the framework for the crawlers or self-laying tracks. The crawler or self-laying track mechanism is substantially the same on each side of the machine and the main frame is substantially duplicated on each side so a description of one side will be understood as applying to both. Extending between the plates 32 and 33 is a plurality of bolts 34 (see Fig. 1) which support idlers adapted to support the lower run of an endless traction or crawler chain 35 which rests on the ground or mine floor and supports the mining machine. Two of said idlers are seen at 232 in Fig. 7.

The chain 35 is formed of a plurality of interconnected links each provided with a pair of lateral or edge lugs 36, as clearly illustrated in Fig. 6 of the drawings, the inside of each link of said chain being hollow to receive a drive sprocket as hereinafter described more completely. Adjacent its forward end the chain 35 passes over an adjustable idler and guide pulley 37 which is mounted for longitudinal adjustment on the main frame by chain tensioning mechanisms 38. It may be pointed out that the two guide pulleys 37 for the two crawlers are independently mounted and independently adjustable since they are mounted on independent stub shafts. This particular construction not only provides for the independent tensioning of the crawler chains, but also provides a space between the crawlers which is very desirable as it permits the location between said crawlers, of hydraulic motors or jacks 39 which extend forwardly from a gear 40 formed on a pedestal 41 which is rigidly attached to and forms part of the turntable 22 the axis of rotation of which is between the axes of rotation of sprockets 44 and guide pulleys 37. The motors 39 are oppositely acting and each carries a rack co-operating with the gear 40 which is operated by the piston thereof to swing the turntable 22 about its upright axis. This particular relation of parts makes possible the maintaining of the overall height of the mining machine at a minimum, which is extremely desirable since these mining machines frequently have to operate in very low vein coal.

The extending of the hydraulic motors 39 forwardly leaves sufficient space at the rear end of the main frame 20 for the drive gearing for the traction means including friction clutch means and brake means as hereinafter described more completely.

It may be stated that the plates 32 and 33 are properly constructed and reinforced adjacent their forward ends to provide for the adjustable supporting of the guide pulley 37 as above described. As clearly shown in Figs. 1 and 7 of the drawings, the rear end of the plate 32 is bolted to a casting 234 forming an integral part of a gear housing 45 attached by bolts to top plate 31. Casting 234 is provided with a hub 42 for a stationary shaft 43 which supports a drive sprocket 44 for the crawler chain 35, as hereinafter described in more detail. The rear end of the auxiliary plate 33 terminates before reaching the shaft 43, to provide space for the gear housing 45. A crawler shoe 233 for stripping crawler 35 from sprocket 44 is attached to casting 234. The opposite end of shaft 43 is supported in a ring 235 welded to housing 45.

I shall now describe the complete driving connection between the driving motor and the two crawlers or self-laying tracks. Before describing this drive connection in detail it may be stated that the motor is of the reversible type and there is a two-speed reduction gearing with a clutch individual to each crawler and a brake associated with each crawler, and the controls are so connected that each crawler may be individually driven at two speeds in reverse directions, or the two crawlers may be simultaneously driven at the same speed in the same direction, this speed being adjustable by changing the driving gear ratio.

Referring particularly to Figs. 2, 3 and 4 of the drawings, it will be seen that I provide a reversible electric motor 46 which is mounted upon and carried by platform 21. Extending from one side of said motor is the armature shaft which carries the drive pinion 47 which continuously meshes with two gears 48 and 49. As best seen in Fig. 3 of the drawings, gear 48 is formed integral with a shaft 50 mounted in spaced anti-friction bearings and carried in a bearing box mounted upon an upright post 51. Removably connected to shaft 50 is a shaft of a hydraulic pump 52 which provides high pressure hydraulic fluid for the hydraulic system, a portion of which is described in detail hereinafter.

As best seen in Fig. 4 of the drawings, the gear 49 is keyed to a shaft 53 supported at one end in an anti-friction bearing 54 in a gear housing 55 mounted upon an elevated deck 56 carried by platform 21. The opposite end of the shaft 53 is supported as hereinafter described. Also keyed to the shaft 53 and positioned adjacent the gear 49 is a pinion 57 which continuously meshes with and drives a gear 58 keyed to a shaft which is journaled in a journal bearing formed in an extension 59 of said housing 55. The opposite end of said shaft to which gear 58 is keyed carries a pinion 60 (see Fig. 2) which

meshes with a gear 61 (see Figs. 1 and 4) which is keyed to a removable hub 62, which hub is journaled at one end by an anti-friction bearing 63 to the interior of the housing 55. The other bearing support for the gearing 61 is in the form of an anti-friction bearing seen at 64.

As clearly seen in Fig. 4 of the drawings, adjacent its right hand end, there is a cylindrical casting 65 provided with an integral gear 66 for a purpose hereinafter set forth. Adjacent their right-hand ends, the shaft 53 and the casting 65 have a roller anti-friction bearing 67 interposed between them, and at this position the external portion of the casting 65 is also supported in an anti-friction bearing 68 with respect to the housing 55. The left-hand end of the casting 65 is mounted upon an appropriate bearing surface on the shaft 53 by anti-friction roller bearing means 69, and a thrust bearing 70 is interposed between the left-hand end of the casting 65 and the hub of integral jaws 71 formed on the shaft 53.

Splined on the casting 65 for sliding movement along the axis of the shaft 53 is a clutch member 72 having a plurality of integrally formed jaws 73 which are adapted to mesh selectively with the aforementioned jaws 71, or with jaws 74 formed integral with the aforedescribed hub 62 or to assume a position between said jaws 71 and 74 and out of contact with both. In other words, when clutch member 72 is in the position illustrated in Fig. 4 of the drawings, there will be no driving connection to the crawlers. If it is shifted to the right from the neutral position illustrated in Fig. 4 so that jaws 71 and 73 become engaged, there will be a direct connection between the shaft 53 and casting 65, and this will effect the high speed or tramming connection between the driving motor 46 and the crawlers. If the clutch member 72 is shifted to the left, as seen in Fig. 4, so that jaws 73 and 74 become engaged, the low speed or sumping speed driving connection between the motor 46 and the crawlers will be effected because of the introduction of the speed reducing gearing including gears 57, 58, 60 and 61, as above described, in this gear train.

By reference to Fig. 2 of the drawings, it may be pointed out that the clutch member 72 is adjustable by a shipper 75 in the form of a bell crank which is operated by a rod 76 extending to a bell crank 77 which in turn is controlled by a rod 78 and a crank 79 carried on the end of a shaft 80 operable by operating lever 81 adjacent the operator's seat 82 at one rear corner of the mining machine platform 21.

Referring now particularly to Figs. 2 and 3 of the drawings, it is to be seen that the above-described gear 66 which is formed integral with the casting 65, continuously meshes with a large gear 83, the hub of which is keyed to a shaft 84 (Fig. 3) journaled in appropriate journal bearings carried by the aforedescribed post 51 and an upright plate 85 rigidly attached to and forming a part of the platform 21. Keyed to the shaft 84 but slidable along the axis thereof, is a clutch member 86 having jaws adapted selectively to engage and disengage co-operating jaws on the hub of a sprocket 87 which is freely journaled on said shaft 84. Adjustment of the clutch member 86 is effected by a pivoted shipper 88 operated by a rod 89 which extends to an operating handle 90.

Loosely journaled on the hub of the gear 83 is a hub 91 to which is riveted a sprocket 92 with which is associated a chain 93 (see Fig. 2) which drives an electric cable reel mechanism 94 having electric cable 95 associated therewith, by which power is delivered to the mining machine from an external source. The sprocket 92 is controlled by a jaw clutch comprising a shiftable clutch member 96 having jaws which co-operate with a clutch member 97 keyed to the shaft 84. A shipper 98 is provided for said clutch, said shipper 98 being operable by a rod 99 controlled by a crank 100 on the end of a shaft 101 which in turn is controlled by hand lever 102 (Fig. 2).

The gear train interconnecting the electric motor 46 and the crawlers, extends from the above-described sprocket 87 by way of an endless chain 103 (see Fig. 5) to a sprocket 104. Said chain 103 has a chain tensioning and guiding mechanism 105 associated therewith which includes a pivoted arm 106 formed by a pair of spaced plates which are pivoted to a pin 107 carried between stationary uprights on the platform 21, and between which spaced plates is journaled a pair of guide sprockets 108 and 109 over which the chain 103 travels.

Referring particularly to Figs. 5, 6 and 7 of the drawings, it will be seen that the sprocket 104 is keyed to a stub shaft 110 to which is also keyed a gear 111, the shaft 110 being journaled at opposite ends in a journal recess in the above-mentioned gear housing 45 and at the other end in a bracket 112 formed integral therewith. The housing 45 is a two-piece split housing thereby providing ready access to the mechanism within it, the upper portion of the housing being rigidly attached to and in effect forming a part of the main frame 20, the attaching bolts between the top of said split housing and the top plate 31 of said main frame 20 being seen at 113 in Fig. 6 of the drawings.

It may at this time be additionally pointed out that the main frame 20 also includes a number of cross-pieces one of which is seen at 114 and to which the forward end of the upper portion of the gear housing 45 is rigidly attached as by bolts (see Fig. 9). Another cross-piece forming part of the main frame is seen at 115 to which the cylinders of the hydraulic motors 39 are rigidly attached.

The aforedescribed gear 111 continuously meshes with and drives a central master gear 116 which is rigidly attached to a symmetrical stub shaft 117 which extends laterally to each side of the gear 116 in a similar construction. It may be stated that the operating mechanism extending to each side of the gear 116 is substantially identical but generally reversely connected, and so a description of the gear train to one side will apply equally to both sides. It may be pointed out, however, that the stub shaft 117 is mounted at its opposite ends in a pair of anti-friction bearings 118 which are supported in rings or plates 119 seated in sulcated plates or supports attached to the gear housing 45.

Co-operating with said shaft 117 is a friction clutch 120 comprising an inner member 121 which has a press fit with said shaft 117 and is keyed thereto. Mounted upon the member 121 for free axial movement but held against relative rotary movement is a plurality of stacked plates 122 placed between alternate stacked plates 123 which are mounted in a cylindrical clutch housing 124 for free axial movement while being held against relative rotary movement by means of co-operating lugs and recesses in a manner well understood in the clutch art.

The cylindrical housing 124 is closed at one end by an end plate 125 which is rigidly attached thereto as by welding, and which is mounted upon an anti-friction bearing 126 which in turn is supported by the shaft 117. The other end of the cylinder 124 is closed by a cover plate 127 which is removably bolted to the cylindrical housing 124 and is supported in an anti-friction bearing 128 which in turn is supported by an integral web or plate 129 formed within the housing 45. The cover plate 127, as best illustrated in Fig. 8 of the drawings, is both keyed and welded to a hollow pinion shaft 130 having a pinion 131 formed integral therewith. The pinion 131 meshes with a gear 132 which is keyed to a pinion shaft 133 having an integrally formed pinion 134, which shaft is mounted upon spaced anti-friction bearings 135 and 136 supported in the housing 45. Pinion 134 meshes with a gear 137 keyed to the hub 138 of the aforedescribed sprocket 44. Said hub 138 is mounted on spaced anti-friction bearings 139 carried by the aforedescribed shaft 43 and held in spaced relation by a collar 140.

A bronze bushing 141 which seals the interior of the hub 138 is preferably interposed between the outer bearing 139 and the aforedescribed stationary hub 42. Bronze bushing 236 is attached to hub 138 and bears against ring 235 and shaft 43. A set screw 142 extends through the stationary hub 42 and into an appropriate recess in the shaft 43 to prevent its rotation as well as its longitudinal movement and to permit its removal when said set screw 142 is removed.

It is of course evident that the sprocket 44 is exposed and so packing 143 is interposed between the hub 138 and the housing 45 to provide an oil-tight housing 45 as all the mechanism within said housing preferably runs in oil. Similar packing is provided at 144 (Fig. 7) adjacent the hub of sprocket 104 for a similar purpose. Since the bearings 139 would not receive oil from the housing 45, a grease conduit 145 is provided in the shaft 43 which leads to said bearings thus providing for their proper lubrication.

Attention is now directed particularly to Figs. 7 and 8 of the drawings and to a hydraulic motor or jack which is employed to operate the clutch 120 to selectively effect a driving or non-driving connection between the shaft 117 and the sprocket 44. The shaft 43 is bored at 146 to provide a hydraulic conduit leading to a cylinder 147 formed by an appropriate bore within the stationary shaft 43. Appropriate flexible hydraulic conduits extend to the bored conduit 146 and to the hydraulic system hereinafter described more completely.

Within the cylinder 147 is a piston 148 provided at its head with a composition non-leaking packing ring 149 which is removably attached thereto as by cap screw 150. The bottom of the piston 148 is enlarged to form a cup 151 in which is received a thrust bearing 152 which abuts an operating piston 153 which extends slidably into the hollow pinion shaft 130 and rotates therewith. The thrust bearing 152 provides for free rotation between the non-rotary piston 148 and the rotary piston 153.

The piston 153 is provided with an elongated slot 154 into which extends a radially extending key 155 which, as clearly shown in Fig. 7 of the drawings, extends radially beyond the periphery of the pinion shaft 130 and is nested in a groove formed in the cover plate 127. This key 155 and the cover plate 127 of course always rotate together and with the shaft 130, but the key is free to move along the axis of the shaft 130 within the limits of the slot 154 under the influence of the piston 153. This key 155 is a pusher key which bears against a clutch applying disc or plate 156, the outer periphery of which is adapted to bear against the stacked friction clutch plates 122 and 123 associated with the clutch members 121 and 124.

It is thus evident that when hydraulic fluid is applied to the hydraulic motor or jack 148, the clutch 120 will be operated, and when hydraulic pressure is released from said hydraulic motor 148, the clutch 120 will be released. As hereinafter described, the two clutches which are associated with the opposite traction members are individually operable and they may be both applied at the same time either in like or unlike amounts, or either may be applied independently of the other.

In the interest of simplified construction and the resulting economy of space and material, I employ the cylindrical housing 124 of the clutch 120 as a brake-drum for a brake mechanism, there being a brake mechanism individual to each of the two crawlers or traction members. These brake members are of duplicate structure for the two duplicate clutches, and attention is now directed to Figs. 7 and 9 of the drawings and to the structure of these brake mechanisms. Associated with the housing or brake-drum 124 is a brake-hand 157 provided with appropriate brake lining. The free ends of the brake-band 157 are provided with operating brackets 158, 159 with which co-operate pivoted actuating levers 160 and 161 which are pivoted to the bracket formed by a pair of spaced plates 162 and 163 which in turn are pivoted by a pivot pin 164 to a stationary bracket 165 attached to a bottom plate 166 which in turn is attached as by cap screws 167 to the bottom of the housing 45 adjacent its forward end. The lever 160 is pivotally attached to a hydraulic jack cylinder 168 into which extends a piston 169 which is pivotally attached to the lever 161. Coil springs 170 urge the levers 160, 161 to non-brake applying position and are connected to their pivot pins which connect with the cylinder 168 and piston 169, respectively. A hydraulic conduit 171 leads to the interior of the cylinder 168. It is evident that when hydraulic fluid under pressure is supplied by the conduit 171 to the cylinder 168, the brake will be applied and when said hydraulic fluid is released, the brake will be released.

It is, of course, evident that there is always a direct mechanical connection between the clutch housing and brake-drum 124 and the associated traction mechanism, and thus the brakes are always applied directly to the crawlers without regard to whether any clutches whatever in the gear train are connected or disconnected.

It is to be noted by reference to Fig. 9 of the drawings, that the ends of the levers 160 and 161 are not physically connected to the brackets 158 and 159, though they have a working engagement therewith. This working engagement is maintained by a bracket 172 which has a guiding aperture therein through which the ends of said levers 160 and 161 extend.

It is of course evident that the entire gear train from the motor 46 leading up to and including the gear 116, is common to both of the crawlers. From the gear 116, however, this gear train branches and becomes individual to each crawler so that there is an individual friction clutch 120

and an individual braking mechanism individual to each crawler. The two-speed drive as well as the reversibility of the crawlers is provided in the gear train between the motor 46 and the gear 116, as is obvious from the above description. It is therefore evident that either crawler may be individually power-operated while the other is idle or has its brake applied, or both crawlers may be operated simultaneously in either direction and at either of two selected speeds for any speed of the motor 46. These speeds are generally designated as transportation and sumping speeds, the former being a relatively high speed, the latter a relatively low speed.

Attention is now directed particularly to Fig. 10 of the drawings where I have illustrated a portion of the hydraulic system of my invention and specifically that portion which is pertinent to the apparatus carried directly by the main frame and its extended platform 21. Said hydraulic system comprises a container 173 for the hydraulic fluid, such as oil, from which a feed pipe 174 extends to a valve assembly 175 adapted to insure proper feeding of hydraulic fluid to the pump 52 regardless of its direction of rotation since this pump may be driven in reverse directions by the reversible motor 46. The construction of this valve assembly is described in detail in the above-mentioned application, Serial No. 206,448.

The output of the pump 52 is delivered by a conduit 176 to a constant flow valve 177, the output of which may be variably adjusted by a handle 178, and when once adjusted is maintained constant. The hydraulic pressure line extends from said valve 177 by way of conduit 179 to a control valve 180 which controls the two hydraulic piston motors 39 to swing the turntable 22. A high pressure conduit 181 also extends from the valve 180 to the rest of the hydraulic system including the hydraulic motors 29 and 30 as described completely in the above-mentioned application, Serial No. 206,448.

Branching from the conduit 179 is a conduit 182 leading through a check valve 183 to a hydraulic fluid accumulator 184 which insures the presence of adequate hydraulic fluid under pressure to operate the brakes of the mining machine, for unless a control valve is operated, such as valve 186, there is a no-load by-pass provided for the pump 52. When any control valve is closed accumulator 184 is filled and in practice this has been found adequate for all purposes. From the accumulator 184 the high pressure conduit 182 extends to a pair of control valves 185 and 186 which are connected in parallel with said high pressure conduit 182. The valve 185 jointly controls one of the clutch mechanisms 120 and the brake actuating mechanism 168, 169, etc., associated therewith, thereby insuring that both said clutch and brake mechanisms can not be applied at the same time. In other words, the brake is automatically released when the associated clutch 120 is applied, and conversely when the clutch 120 is applied, the associated brake is automatically released. Obviously the clutch and brake associated with the same crawler should not be simultaneously applied. A similar condition exists as to valve 186, it being of course understood that valve 185 is individual to one crawler, and valve 186 is individual to the other crawler. Said control valves have operating handles 285 and 286 (Fig. 1).

The construction of the two valves 185 and 186 is obvious from mere inspection. For example, in the position of valve 185 illustrated, the brake mechanism associated therewith is applied and the clutch 120 associated therewith is free since its operating hydraulic motor or jack 148 is in clutch releasing position. If the handle 285 of the valve 185 is rotated counterclockwise approximately 45 degrees, the brake will be maintained in braking position since the hydraulic fluid will be locked therein, and if said handle is further rotated to the dotted line position which is approximately 90 degrees removed from the full line position, hydraulic fluid will be applied to the clutch operating motor, and the brake motor will be discharged. A similar description, of course, applies for the valve 186.

In the operation of the mining machine of my invention it may be pointed out that the kerf-cutting mechanism is operated from a motor on the supplementary frame 23, which motor performs no other function. All adjustments of the cutter mechanism either by virtue of an adjustment between the cutter bar and the main frame, or by virtue of adjustment of the entire machine, is effected by power derived from the motor 46 carried on the platform extension 21 of the main frame 20. The traction means which are preferably as illustrated in the form of crawlers, though they may be wheels which may or may not be provided with rubber tires of the solid or pneumatic type, are individually operable as individual units, one on each side of the main frame. Said traction units may be operated, for example, at a high or tramming speed to move the mining machine rapidly from one working position to another, as for example, from one mine room to an adjacent mine room. Likewise, the machine may be operated both forwardly and reversely to turn the entire mining machine as is generally necessary in traveling from one room to the other, one traction crawler may be operated from the motor while the other is disengaged and the brake is applied. Likewise, the entire machine may be operated at a slow or sumping speed either to feed it rectilinearly forwardly or rearwardly. It is common practice, for example, in cutting a top, bottom or intermediate horizontal or inclined kerf, to swing the turntable 22 to one side and then to sump the entire machine forward while the cutter chain is in operation. Thereafter it is common to swing the turntable 22 and thus the cutter bar in an arcuate path, after which the kerf is completed by withdrawing the cutter bar all the while the cutter chain is in operation. This is frequently and generally done with the main frame 20 substantially stationary, but a similar kerf may even be cut by effecting the swinging movement or a portion thereof by operating one of the crawlers on one side of the machine while the other has its brake applied. There are some conditions encountered which make this type of swinging preferred.

It is obvious that due to the extreme flexibility of the machine it may be operated under a wide variety of conditions. It is further evident that the machine may be operated in a mine or in a portion of a mine in which there are no stationary rails because it lays its own track. On the other hand, it is entirely practical to operate the machine even on track rails because it is possible for the endless crawlers 35 to ride on the stationary rails and they are properly gauged for this type of operation. This type of operation will in general, however, be involved more in transporting the machine into the mine along established rails and in general the machine will

be used during a cutting operation in rooms which are not provided with stationary track rails.

It will be seen by referring to Fig. 7 that the hydraulic plungers 148 each acts axially of the friction clutch 120 with which it is associated. These hydraulic plungers are parts of hydraulic motors which are very compactly arranged, taking up no additional space, since they are imbedded in the stationary shaft bearings 43.

It should also be noted that by using hydraulic motors for the friction clutches 120 the latter may be applied with considerable power thus enabling the traction device on one side of the machine to feed the kerf-cutting mechanism on an upright axis while the other traction device on the other side of the machine is held by its hydraulic brake. Under certain circumstances such arcuate feeding of the kerf-cutting mechanism by swinging the whole machine on an upright axis may be desirable. However, in most instances it is preferred to employ the hydraulic motors 39 (Fig. 6) to operate the rack gearing to rotate the kerf-cutting mechanism by rotating the turntable 22 relatively to the base frame or the supporting frame 20 having the traction devices on opposite sides thereof. During such arcuate kerf-cutting operations both brakes may be applied to firmly lock the traction devices against movements relatively to the base frame thereby enabling the lugs 36 on the treads of the chain 35 to dig into the mine bottom to hold the machine against turning on an upright axis. Additionally, roof jacks and wall jacks may be employed about the supporting framework of the mining machine to hold the latter stationary when the kerf-cutter is fed arcuately on its pivot located at the rear end of the cutter bar within the orbit of travel of the chain cutter.

Under the usual and normal conditions of operation the hydraulic motors 39 (Fig. 6) are used to adjust the mining machine relative to the crawler tread truck on an upright axis and likewise the inclination laterally of the cutter bar is adjusted and locked in adjusted position. With the turntable locked in adjusted position and the cutter bar locked in adjusted position, the whole machine is moved forward at its slow speed by throwing in the clutch 73, 74 (Fig. 4) and by hydraulically applying both of the friction clutches shown in Fig. 7, and keeping both brakes released. In this manner a rectilinear sumping cut may be made into the face of the mine vein. Then the clutches may be released to stop forward feeding of the kerf-cutter and the brake-bands 157 both applied to hold the crawler tread truck stationary. Roof and wall jacks may be applied to hold the framework of the mining machine stationary and the kerf-cutter fed on its own pivot located at the rear end of the cutter bar.

By releasing the roof and wall jacks and operating the hydraulic motors 39 (Fig. 6) the mining machine may be centralized relative to the truck frame, re-anchored to the roof and ribs of the mine room and the kerf-cutter again fed on its rear end pivot. The mining machine may then be adjusted to incline laterally toward the left as viewed looking toward the working face and arcuate feeding operations repeated. Finally, by locking the turntable relative to the truck frame and by locking the cutter bar at an adjusted angle inclining laterally toward the left (looking forward) the brake-bands 157 may be released, the friction clutches 120 applied and the motor 46 reversed to secure a rectilinear withdrawal cut by the kerf-cutter, no roof or wall jacks being employed during such withdrawal cut.

Since such rectilinear sumping and withdrawal feeding movements are made by moving the whole machine forwardly and rearwardly along straight lines the machine at such times may be operated while on an ordinary mine track but obviously after the end of the track is reached the extension of the mine room need not await any additional track laying as the machine has crawler treads and can therefore lay its own track for continued operations beyond the end of the mine track.

Fig. 11 is a plan view of a detachable dual drive unit comprising the friction clutches 120, 120, the brake mechanism associated therewith, and the hydraulic motors 168, 168 for operating the brake mechanism, all shown in Fig. 7 operatively connected to the crawler tread driving mechanism. It should be noted that Fig. 7 is a sectional plan view taken through the centers of the horizontal stationary shaft bearings 43, 43, the latter not being in section, however. The housing 45 is sectional, the lower section supporting the friction clutches, the brakes and the hydraulic motors 168, 168 as shown in Fig. 11. The lower section of the housing 45 is provided with holes 187, 187 for receiving bolts 188, 188 (Fig. 7) by means of which the sections are secured together with liquid tight gaskets intervening.

It should be particularly noted that the lower housing section shown in Fig. 11 is on the underside. By jacking up the front end of the main frame 20 (Fig. 1) the bolts 188, 188 may be removed and the drive unit shown in Fig. 11 removed from the bottom of the crawler tread chassis. In order to effect such removal, however, the set screws 142 must first be loosened and the shaft bearings 43, 43 moved axially and outwardly sufficiently to afford clearances for the operating plunger 153 to extend into the notches 189, one of which is shown in Fig. 8 which is a sectional elevation taken on the line 8—8 of Fig. 7, looking in the direction of the arrows.

It should also be noted that the rings 235, 235 are each integral with the top portion of the gear housing 45 and therefore stay in place when the bottom section is removed as part of the unit shown in Fig. 11. The projecting ends of the plungers 153 are moved downwardly along the slots 189; these projecting ends of the plungers 153 being shown in plan in Fig. 11. It will also be seen by reference to Fig. 11 that the removed unit includes the rings 119, 119 mounted on the ball bearings 118, 118 (Fig. 7). When the top and bottom sections of the housing 45 are bolted together the rings 119, 119, are seated in sulcated supports rigid with the gear housing 45.

By means of liquid tight fittings 190, 190, pipes 191, 191 are connected to the flexible hose sections 192, 192 which lead to the hydraulic motors 168, 168 as shown in Fig. 11. For the sake of clearness these flexible hose sections are omitted from Fig. 7. The operation of the motors 168, 168 can readily be understood by reference to the pipe diagram shown in Fig. 10.

When the unit shown in Fig. 11 is bolted in place it occupies the position shown in Fig. 7 and the upper and lower sections of the housing 45 afford a complete closure for the operating gearing including some gearing additional to that

in the unit of Fig. 11. This complete closure may be filled with lubricant such as oil. To prevent the escape of the oil, closure plates 193, 193 are secured to the housing 45 as shown in Fig. 11 and gaskets 143, 144 and 194 are provided where relatively rotating parts are located. The journal bearings 195, 196 are cup-shaped as shown in Fig. 7, to co-operate with the gaskets 144, 194 to prevent escape of the enclosed lubricant. When the unit shown in Fig. 11 is removed the gear 111 remains in the housing 45 because the housing section 112 remains bolted to the upper section of the housing 45. When the unit of Fig. 11 is assembled as shown in Fig. 7, the shaft bearings are held in proper positions by the set screws 142, 142.

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 I therefore wish not to be restricted to the precise construction herein disclosed.

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

1. A machine comprising a main frame, a self laying track traction unit at each side of said main frame, a common drive motor for said traction units, a speed reduction drive gearing interconnecting said drive motor and each traction unit including a friction clutch and a brake individual to each said traction unit, and means comprising a hydraulic system including separate hydraulic motors and a single control lever operable to different positions for alternately energizing said motors thereby alternately applying the brake and clutch associated with each traction unit.

2. In apparatus of the class described, the combination with a frame, traction means for said frame including a stationary shaft supporting a rotary traction member, a motor on said frame for driving said traction means, gearing interconnecting said motor and said traction means including a clutch, and hydraulic actuating means for said clutch including a conduit formed in and extending through said stationary shaft.

3. In apparatus of the class described, the combination with a frame, traction means for said frame including a stationary shaft supporting a rotary traction member, a motor on said frame for driving said traction means, gearing interconnecting said motor and said traction means including a clutch, and hydraulic actuating means for said clutch including a hydraulic cylinder formed in said shaft and a clutch operating piston therein.

4. In apparatus of the class described, the combination with a frame, traction means for said frame including a stationary shaft supporting a rotary traction member, a motor on said frame for driving said traction means, gearing interconnecting said motor and said traction means including a clutch, and hydraulic actuating means for said clutch including a hydraulic cylinder formed in said shaft.

5. In a machine, the combination with a frame, of traction means for said frame including a drive sprocket, a stationary shaft mounted on said frame and supporting said sprocket, drive gearing connected to the hub of said sprocket including a friction clutch, and means extending into said stationary shaft for actuating said clutch.

6. In a machine, the combination with a frame, of traction means for said frame including a drive sprocket, a stationary shaft mounted on said main frame and supporting said sprocket, drive gearing connected to the hub of said sprocket including a friction clutch, and means comprising a hydraulic motor formed in said stationary shaft for actuating said clutch.

7. A mining machine comprising a supporting frame, propelling mechanism therefor, power transmission means between said motor and said propelling mechanism, said power transmission means including hydraulically actuated controlling mechanism, a sectional housing for enclosing said power transmission means to run in oil, and means for securing the sections of the housing together, part of the power transmission mechanism being connected to one of the housing sections and removable therewith as a unit from the other section.

8. In apparatus of the class described, the combination with a frame, traction means for said frame including a stationary shaft supporting a rotary traction member, a motor on said frame for driving said traction means, gearing interconnecting said motor and said traction means including a friction clutch, means mounting said clutch and stationary shaft whereby their axes are in substantial alignment, reduction gearing between said clutch and said rotary traction member, and means comprising a hydraulic piston motor within said stationary shaft operable to control said clutch.

9. In apparatus of the class described, the combination with a frame, traction means for said frame including a stationary shaft supporting a rotary traction member, a motor on said frame for driving said traction means, gearing interconnecting said motor and said traction means including a friction clutch, means mounting said clutch and stationary shaft whereby their axes are in substantial alignment, reduction gearing between said clutch and said rotary traction member, and means within said stationary shaft operable to control said clutch.

10. In a machine, the combination with a frame, of endless crawler traction means for said frame, a drive sprocket for said crawler traction means, a stationary shaft mounted on said frame and supporting said drive sprocket, drive gearing connected to drive said sprocket including a clutch having its axis of rotation in substantial alignment with the axis of said stationary shaft, and means including a hydraulic piston motor mounted in said stationary shaft for operating said clutch.

11. In a machine, the combination with a frame, of endless crawler traction means for said frame, a drive sprocket for said crawler traction means, a stationary shaft mounted on said frame and supporting said drive sprocket, drive gearing connected to drive said sprocket including a clutch, and means including a hydraulic piston motor mounted in said stationary shaft for operating said clutch.

12. In a machine, the combination with a frame, of endless crawler traction means for said frame, a drive sprocket for said crawler traction means, a stationary shaft mounted on said frame and supporting said drive sprocket, drive gearing connected to drive said sprocket including a clutch having its axis of rotation in substantial alignment with the axis of said stationary shaft,

and means mounted in said stationary shaft for operating said clutch.

13. In a machine, the combination with a frame, of endless crawler traction means for said frame, a drive sprocket for said crawler traction means, a stationary shaft mounted on said frame and supporting said drive sprocket, drive gearing connected to drive said sprocket including a clutch, and means mounted in said stationary shaft for operating said clutch.

14. In a mining machine, the combination with a main frame, of a turntable, crawler type traction means adjacent each side of said main frame comprising a pair of laterally spaced forward guide pulleys, a pair of sprockets, one at each side and at the rear end of said main frame and endless crawler chains, one at each side of said main frame and extending between a drive sprocket and a guide pulley, drive gear means for said sprockets including clutches and gears having axes substantially aligned with and positioned between said sprockets, means mounting said turntable on said main frame for rotation on an upright axis rearwardly of said forward guide pulleys and forwardly of said sprockets, a pedestal extending downwardly from said turntable, hydraulic piston motor means located forwardly of said pedestal and positioned in a space between said forward guide pulleys, and means operatively connecting said piston motor means to said pedestal whereby operation of said piston motor means will rotate said turntable relative to said main frame.

15. In a mining machine, the combination with a main frame, of a turntable, crawler type traction means adjacent each side of said main frame comprising a pair of laterally spaced forward guide pulleys, a pair of sprockets, one at each side and at the rear end of said main frame and endless crawler chains, one at each side of said main frame and extending between a drive sprocket and a guide pulley, drive gear means for said sprockets, means mounting said turntable on said main frame for rotation on an upright axis rearwardly of said forward guide pulleys and forwardly of said sprockets, a pedestal extending downwardly from said turntable, hydraulic piston motor means located forwardly of said pedestal and positioned in a space between said forward guide pulleys, and means operatively connecting said piston motor means to said pedestal whereby operation of said piston motor means will rotate said turntable relative to said main frame.

16. In a mining machine, the combination with a main frame, of crawler type traction means adjacent each side of said main frame comprising a pair of laterally spaced forward guide pulleys, a pair of sprockets, one at each side and at the rear end of said main frame and endless crawler chains, one at each side of said main frame and extending between a drive sprocket and a guide pulley, means for driving said sprockets, a turntable operating pedestal extending on an upright axis rearwardly of the axes of rotation of said forward guide pulley and forwardly of the axes of rotation of said sprockets, hydraulic motor means located forwardly of said pedestal and positioned in a space between said forward guide pulleys, and means operatively connecting said hydraulic motor means to said pedestal.

17. In a mining machine, the combination with a main frame, of crawler type traction means adjacent each side of said main frame comprising a pair of laterally spaced forward guide pulleys, a pair of sprockets, one at each side and at the rear end of said main frame and endless crawler chains, one at each side of said main frame and extending between a drive sprocket and a guide pulley, means for driving said sprockets including clutches having axes substantially aligned with and positioned between said sprockets, a turntable operating pedestal extending on an upright axis rearwardly of the axes of rotation of said forward guide pulley and forwardly of the axes of rotation of said sprockets, hydraulic motor means located forwardly of said pedestal and positioned in a space between said forward guide pulleys, and means operatively connecting said hydraulic motor means to said pedestal.

18. In apparatus of the class described, the combination with a main frame, of spaced traction devices of the endless crawler type adjacent each side of said main frame, drive gearing for said traction devices, said drive gearing being positioned at an end of said main frame and between said traction devices, and turntable adjusting motor means positioned between said traction devices and located at the other end of said main frame, said motor means being constructed as a part of said main frame.

19. In apparatus of the class described, the combination with a main frame, of spaced traction devices adjacent each side of said main frame, drive gearing for said traction devices, said drive gearing being positioned at an end of said main frame and between said traction devices, and motor means positioned between said traction devices and located at the other end of said main frame, said motor means being constructed as a part of said main frame.

20. A mining machine including a main frame, traction means adjacent opposite sides of said main frame for moving it rectilinearly, a turntable mounted above said main frame for swinging movement about an upright axis, said main frame including longitudinally extending side members and transversely extending members all rigidly connected together and forming a central opening, said turntable having an operating pedestal extending downwardly into said opening, mechanism positioned within said opening for swinging said pedestal, drive gearing for said traction means adjacent the rear of said main frame and behind the turntable pedestal, and hydraulic piston motor means for operating said mechanism including a cylinder rigidly attached to the frame member across the front of said main frame, said motor means being positioned longitudinally between said traction means.

21. A mining machine including a main frame, traction means adjacent opposite sides of said main frame for moving it rectilinearly, a turntable mounted above said main frame for swinging movement about an upright axis, said main frame including longitudinally extending side members and transversely extending members all rigidly connected together and forming a central opening, said turntable having an operating pedestal extending downwardly into said opening, mechanism positioned within said opening for swinging said pedestal, drive gearing for said traction means adjacent the rear of said main frame and behind the turntable pedestal, and motor means for operating said mechanism including a part rigidly attached to the frame member across the front of said main frame.

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