

Feb. 20, 1940.

J. F. JOY

2,190,924

MINING MACHINE

Original Filed Aug. 11, 1933

4 Sheets-Sheet 1

*Fig. 1.*

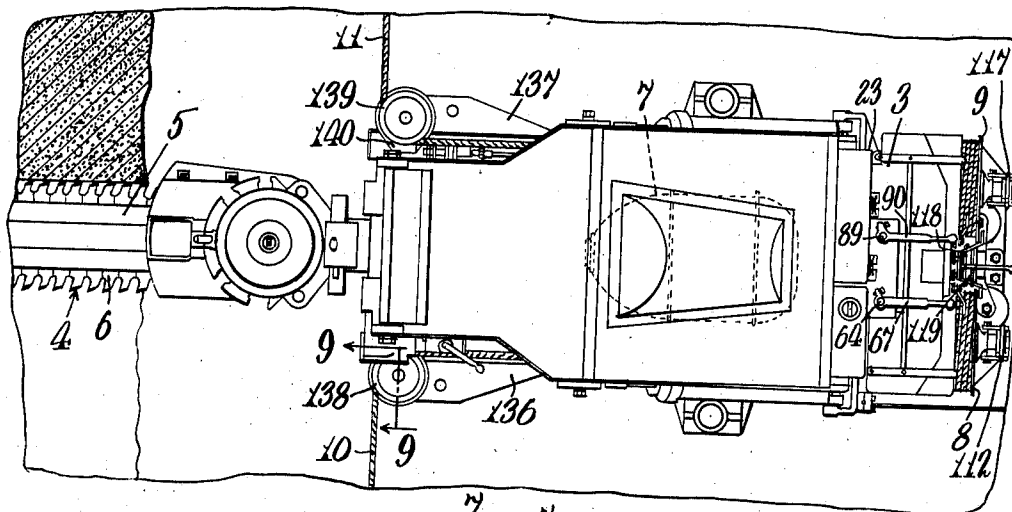
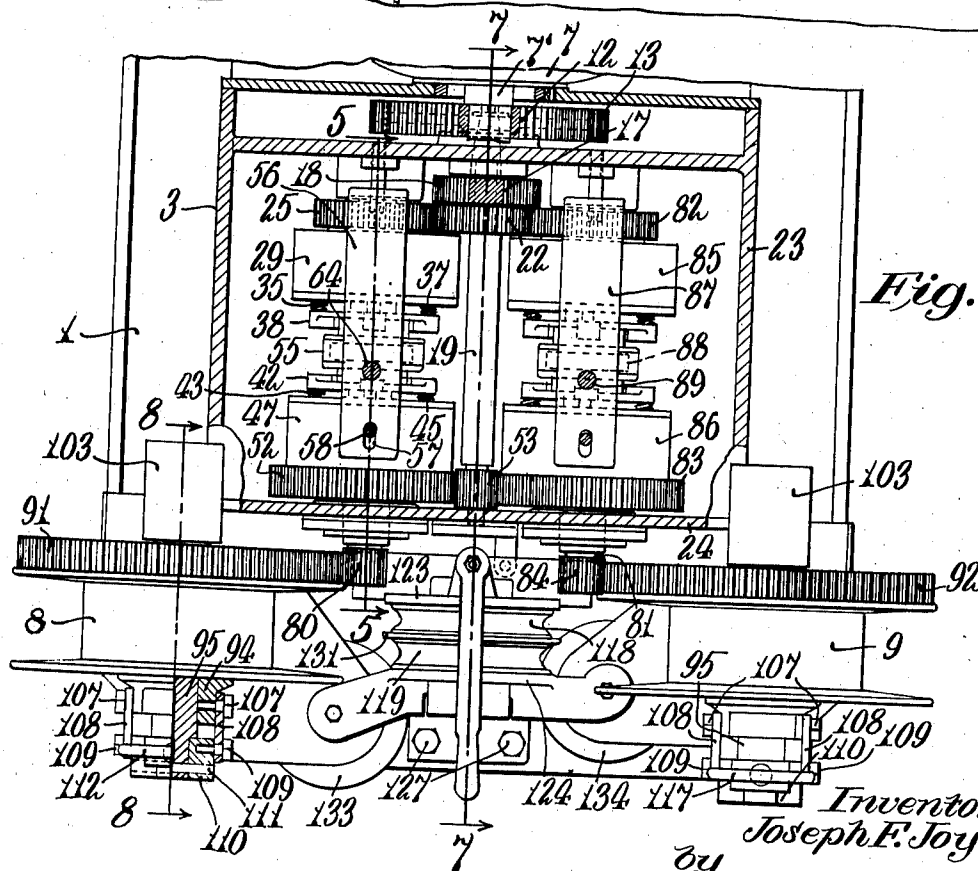


*Fig. 2.*

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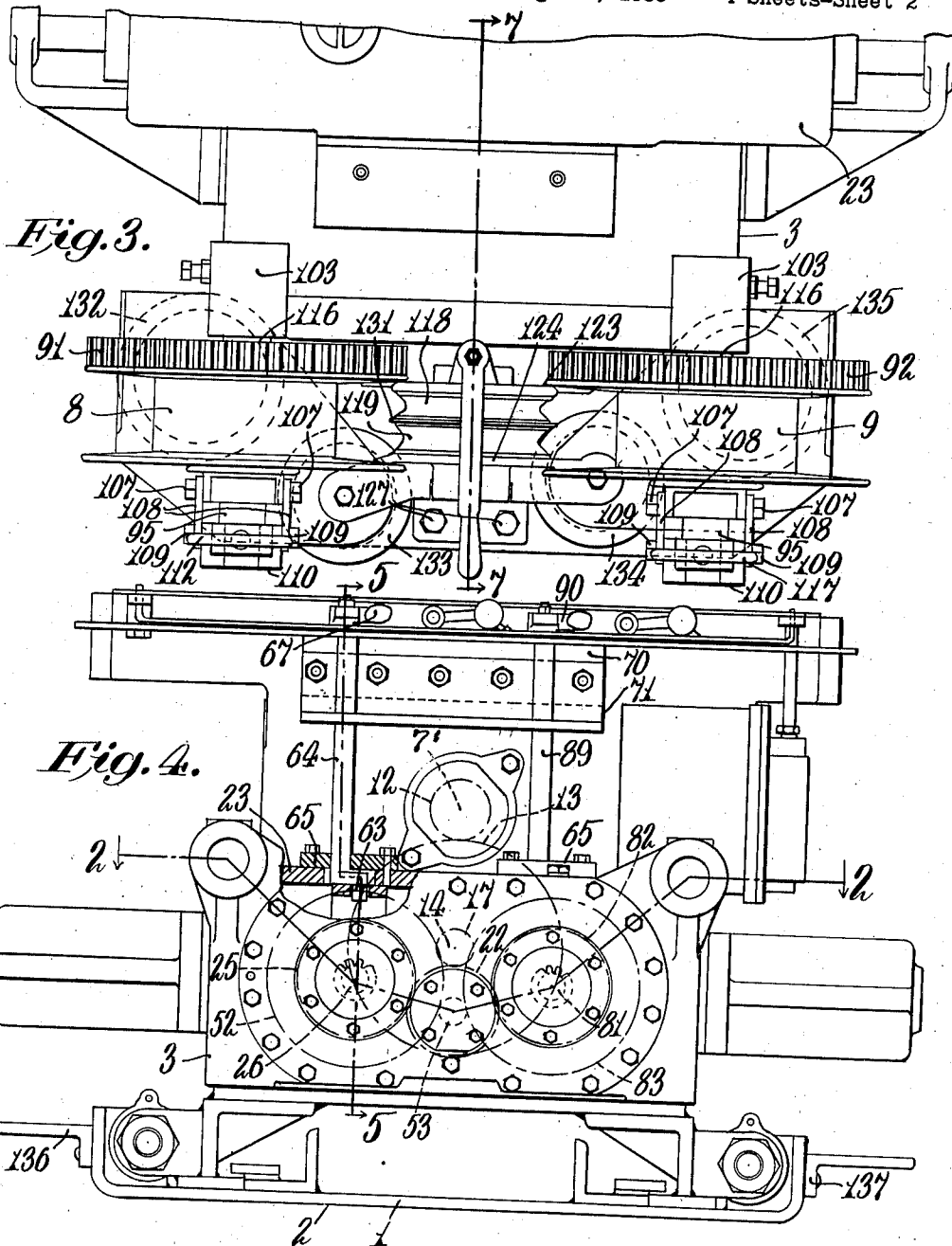
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2,190,924

MINING MACHINE

Original Filed Aug. 11, 1933

4 Sheets-Sheet 2



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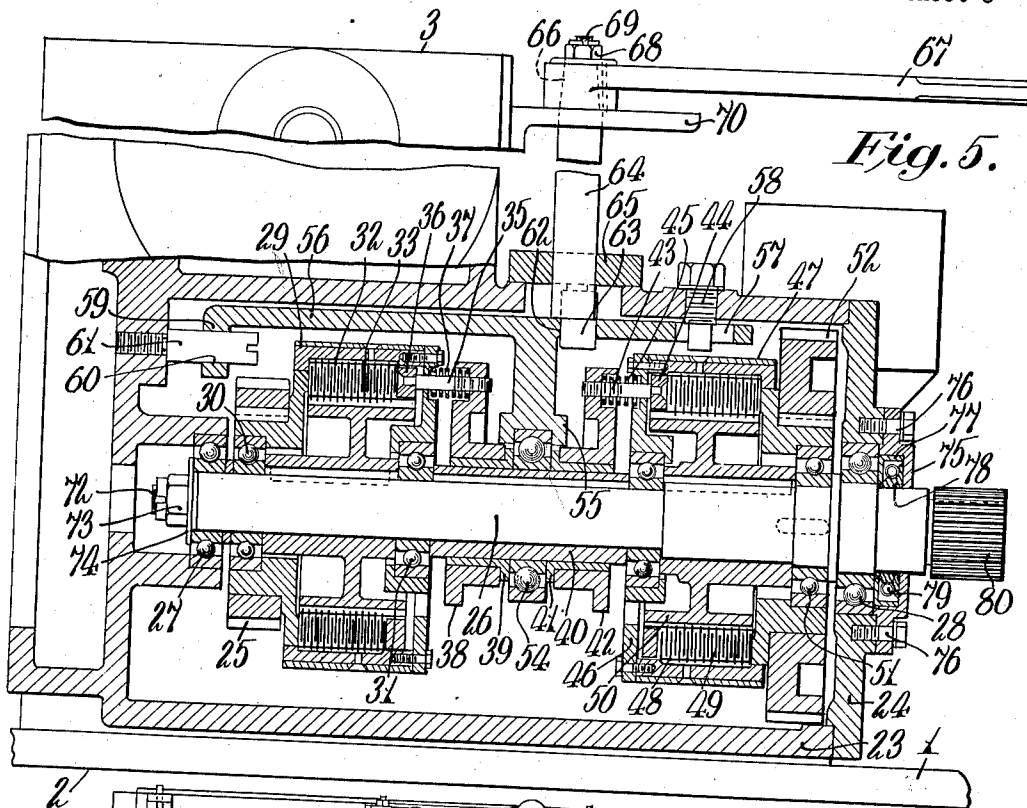
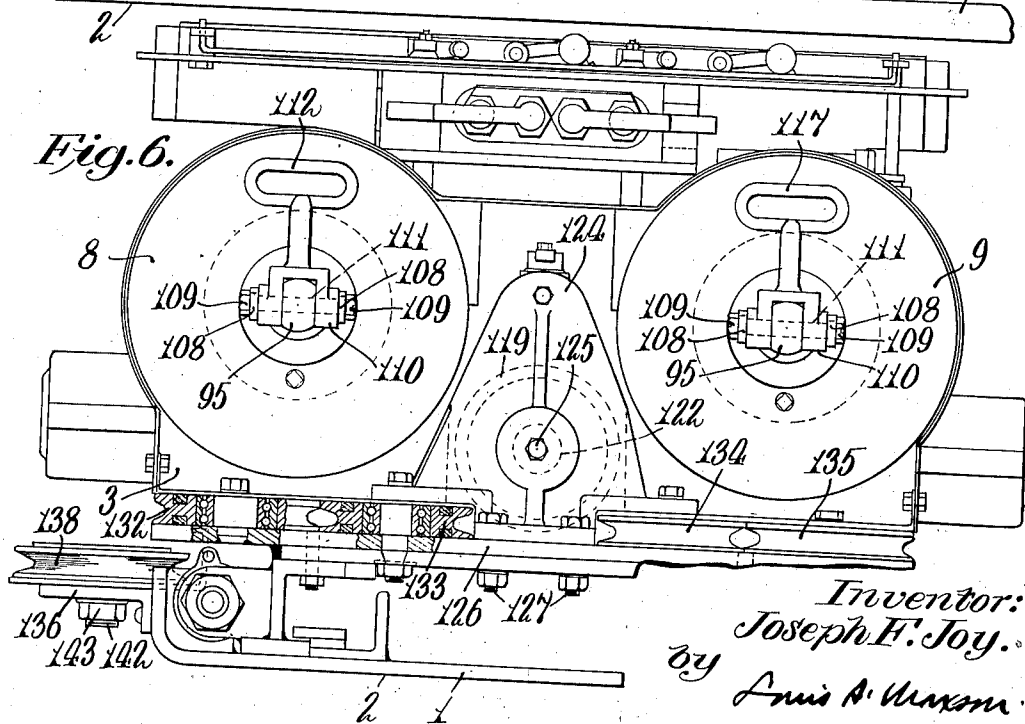
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2,190,924

MINING MACHINE

Original Filed Aug. 11, 1933

4 Sheets-Sheet 3



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2,190,924

MINING MACHINE

Original Filed Aug. 11, 1933

4 Sheets-Sheet 4

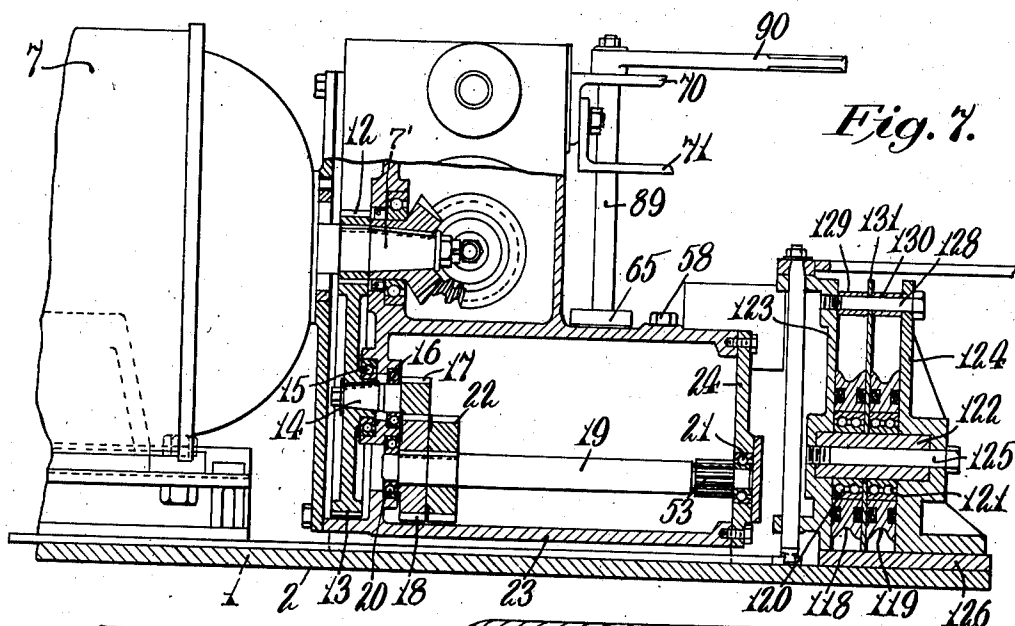


Fig. 7.

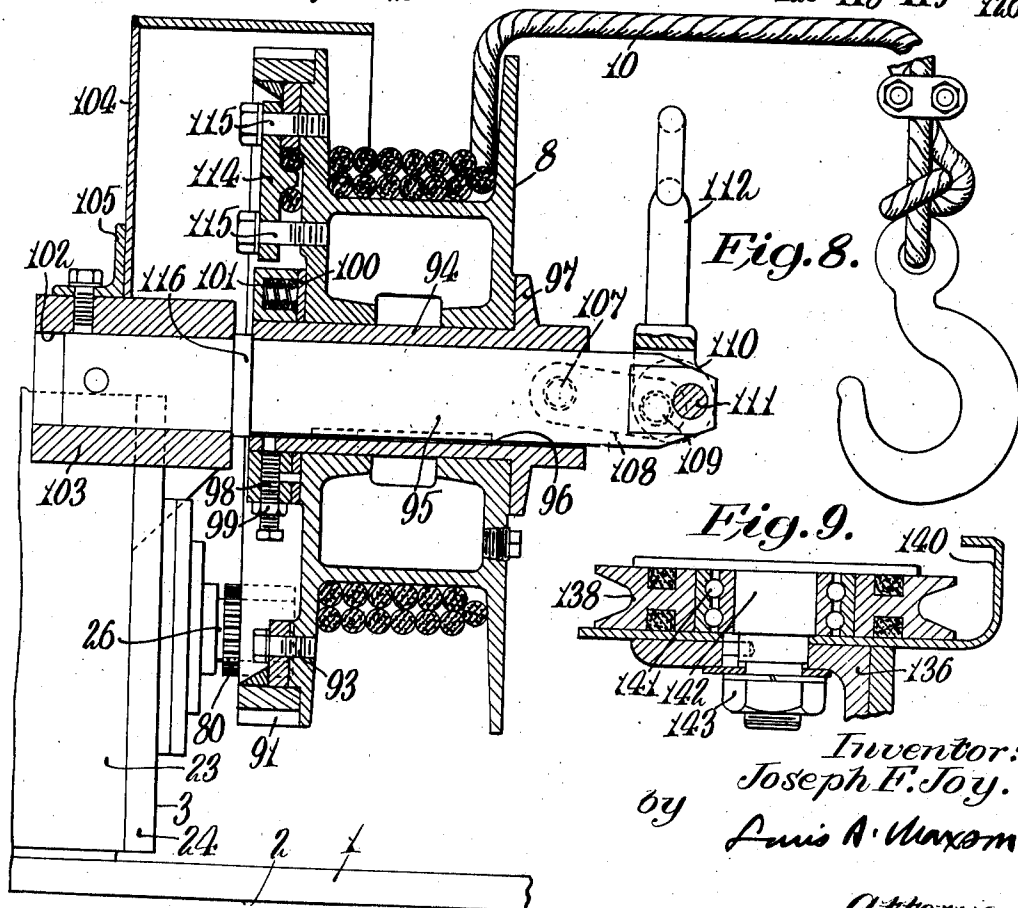


Fig. 8.

Fig. 9.

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## UNITED STATES PATENT OFFICE

2,190,924

## MINING MACHINE

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Original application August 11, 1933, Serial No.  
684,707. Divided and this application March  
11, 1936, Serial No. 68,269

5 Claims. (Cl. 262—28)

This invention relates to mining machines, and more particularly to improvements in the feeding mechanism of a coal mining machine of the flexibly fed, floor cutter type.

5 An object of this invention is to provide an improved mining machine feeding mechanism. Another object is to provide an improved feeding mechanism for a coal mining machine of the flexibly fed, floor cutter type wherein relatively  
10 rotatable feed operating and controlling members respectively engaging flexible feeding and controlling elements, are employed for feeding and guiding the machine. Still another object  
15 is to provide, in a feeding mechanism of the above character, improved driving means for the feed operating and controlling members whereby the latter may be driven in winding direction at either high or low speeds. A further object  
20 is to provide an improved driving mechanism for the feed operating and controlling members whereby the latter may be independently driven through separate plural speed transmission mechanisms, each transmission mechanism embodying high and low speed gear trains and a  
25 friction controlling clutch for each gear train. Other objects and advantages of the invention will, however, hereinafter more fully appear in the course of the following description and as more particularly pointed out in the appended  
30 claims.

This application is a division of my copending application Serial No. 684,707, filed August 11, 1933, now matured into Patent No. 2,062,657, patented December 1, 1936.

35 In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these drawings—

40 Fig. 1 is a plan view of a coal mining machine embodying one illustrative form of the invention, shown cutting a horizontal kerf at the floor level.

Fig. 2 is an enlarged horizontal sectional view showing the driving connections from the motor  
45 through the speed changing mechanism to the feed operating and controlling members, the view taken substantially on line 2—2 of Fig. 4.

Fig. 3 is an enlarged plan view of the rearward portion of the machine showing details of the  
50 feeding drums and guiding sheaves.

Fig. 4 is an end elevational view partially in section of the transmission assembly with the feeding drums removed.

Fig. 5 is a view in longitudinal vertical section  
55 taken substantially on lines 5—5 of Figs. 2 and 4.

Fig. 6 is an end elevational view, partly in section, of the machine as a whole showing the feed operating and controlling members.

Fig. 7 is a view in longitudinal vertical section taken substantially on lines 7—7 of Figs. 2 and 3.

Fig. 8 is a central vertical section through a feed drum, showing its engaging and disengaging mechanism, taken substantially on line 8—8 of Fig. 2.

Fig. 9 is a section along the line 9—9 of Fig. 1,  
showing details of one of the guiding sheaves.

In this illustrative embodiment of the invention, the improved feeding mechanism is shown embodied in a coal mining machine of the flexibly fed, room and pillar, floor cutter type generally comprising a bottom skid plate 1 having a plane bottom surface 2 and adapted to rest upon and slide in any direction over the mine floor. Supported on the bottom skid plate 1 is a main base 3 in turn supporting at its forward end kerf  
20 cutting mechanism generally designated 4. The kerf cutting mechanism comprises an elongated plane cutter bar 5 having mounted for circulation about its margin an endless cutter chain 6. Mounted on the main base 3 is a motor 7 hav-  
25 ing its power shaft 7' horizontally disposed and extending longitudinally of the machine, and the cutter chain 6 of the kerf cutting mechanism is driven by the motor 7 in the manner clearly described in the copending application Ser. No. 684,707 above referred to.

Arranged in parallel relation at the rear end of the main base 3 on horizontal axes extending longitudinally of the machine and in the same transverse zone, are feed operating and controlling members 8 and 9 respectively cooper-  
30 ating with flexible feeding and controlling elements 10 and 11; the members 8 and 9 are herein in the form of cable winding or haulage drums.

Now referring to the improved driving connections between the motor 7 and the cable winding drums 8 and 9, it will be noted that keyed to the rear end of the motor power shaft 7' is a spur motor pinion 12 meshing with a large spur  
45 gear 13 keyed to a stub shaft 14. The stub shaft 14 is mounted in anti-friction bearings 15 and 16, the former surrounding the hub of the gear 13 on the stub shaft 14, the latter surrounding the stub shaft 14 itself. The stub shaft 14 terminates in a pinion 17 integrally secured thereto, and this pinion 17 in turn meshes with and communicates power to a gear 18 rigidly secured to a counter-shaft 19 which in turn is journaled at its opposite ends in anti-friction bearings 20 and  
55

21. A second gear 22 is also rigidly secured to the counter-shaft 19 (Fig. 7). The anti-friction bearings 15, 16 and 20 are seated in a gear housing 23, whereas the anti-friction bearing 21 is seated in an end plate 24 attached to the gear housing.

Meshing with the gear 22 is a gear 25 (Fig. 5) having an axis of rotation around a shaft 26 parallel to the shaft 19. The shaft 26 is journaled at one end in an anti-friction bearing 27 mounted in the gear housing 23, and at its other end in an anti-friction bearing 28 mounted in the end plate 24.

The gear 25 is keyed to the outer rotor 29 of a multiple disc clutch, and the outer rotor 29 is separated from the shaft 26 by anti-friction bearings 30 and 31. The outer rotor drivingly engages a plurality of plates 32 of the multiple disc clutch, the remainder of the plates 33 being keyed to the shaft 26. The plates are forced into contact by the action of push rods 35 on an annular pressure plate 36 against the action of the springs 37. The opposite ends of the push rods 35 are threaded into a shift plate 38 separated by the bushing 39 from the shift sleeve 40 which is splined to the shaft 26.

The shift sleeve 40 also carries at its other end, clutching mechanism identical in construction with the clutching mechanism just described. The clutching mechanism consists of a bushing 41 on which is supported the shift plate 42 into which is threaded the push rods 43 making contact with an annular shift plate 44 against the action of springs 45. The push rods 43 pass through the end plate 46 of the outer rotor 47 of a multiple disc clutch and force the clutch plates 48 drivingly connected to the outer rotor 47 into contact with the clutch plates 49 drivingly connected with the inner rotor 50 of the multiple disc clutch. The inner rotor 50 is keyed to the shaft 26, whereas the outer rotor 47 is separated therefrom by anti-friction bearings 51. Surrounding the outer rotor 47 and keyed to it is the gear 52 (Fig. 5) which meshes with a pinion 53 on the counter-shaft 19, the counter-shaft 19 terminating at its end opposite from the bearing 20, in the pinion 53 (Fig. 7).

Surrounding the shift sleeve 40 at its mid-point is the anti-friction bearing 54 engaged by the yoke portion 55 of the clutch shift rod 56. The clutch shift rod 56 is reciprocable longitudinally by its having at one end a slot 57 engaging a cap screw 58 threaded through the housings 23, whereas its other end is provided with a right angle portion 59 having a bore 60 slidably engaging a stud bolt 61 threaded through the housing 23. Operatively engaging a bore 62 in the clutch shift rod 56 is the crank portion 63 of a vertical shaft 64 passing through a cover plate 65 in the gear housing 23. At its upper end the vertical shaft 64 is provided with a tapered portion 66 which engages a correspondingly tapered portion of a hand lever 67 keyed thereto and held in place by a nut 68 screwed onto the threaded end 69 of the vertical shaft 64. The upper portion of the vertical shaft 64 passes through brackets 70 and 71 attached to the main base above the gear housings 23, and these brackets support the vertical shaft 64.

The shaft 26 at its inner end is provided with a threaded pinion 72 which is engaged by a nut 73 working against a washer 74 which abuts the anti-friction bearing 27, thereby holding the shaft 26 in place (Fig. 5). The outer end of the shaft 26 passes through an end plate 75 secured to the

gear housing 23 by the cap screws 76. The end plate 75 contains a spacer 77 holding in place the anti-friction bearing 23 and also the packing 78 secured in position by the retainer ring 79. The outer end of the shaft 26 terminates in a pinion 80 (Figs. 2 and 5) here shown integral with the shaft 26.

On the opposite side of the gear housing is a second set of clutches and gearing substantially identical in construction to the clutch-and-gear assembly just described; the entire assembly is shown in plan view in Fig. 2, which traces the complete power circuit from the motor 7 and its pinion 12 through the various clutches and gearing to the cable winding drums 8 and 9, described later. The second clutch-and-gear assembly on the shaft 81 (Fig. 4) has keyed to it a gear 82 (Fig. 2), which meshes with the gear 22 on the counter-shaft 19. A gear 83 (Fig. 2) on the other end of the shaft 81 meshes with the pinion 53 and corresponds to the gear 52 on the shaft 26. Since the second set of clutches and gearing on the shaft 81 is of substantially identical construction and operates in a similar manner, further description is unnecessary. The outer end of the shaft 81 terminates in a winding drum pinion 84 analogous to the winding drum pinion 80 on the shaft 26. The clutches 85, 86 (Fig. 2) are operated by the clutch shift rod 87 engaging the anti-friction bearing 38, the clutch shift rod 87 being operated by the vertical crank shaft 89 connected to the hand lever 90 in a manner similar to that of the hand lever 67 controlling the first set of clutches and gearing previously described.

The gearing and clutch assemblies just described serve as change-speed mechanism to provide two different speeds for the winding drum pinions 80, 84. When the hand lever 67 is moved to one side (Fig. 5) in such a manner that the clutch shift rod 56 is moved backward, the yoke portion 55 thereof likewise moves backward, carrying with it the shift plate 38 which actuates the push rods 35 to press together the plates 32 and 33 of the rearward multiple disc clutch; under these conditions the small gear 25 rotatably engages the shaft 26, and a high speed is imparted to the winding drum pinion 80 since the small gear 25 is driven by the gear 22 of almost equal size on the counter-shaft 19. If, however, the hand lever 67 is moved sidewise in the opposite direction, the clutch shift rod 56 moves forward, carrying with it the clutch shift plate 42 which actuates the push rods 43 to compress the plates 48 and 49 of the forward multiple disc clutch, thereby rotatably connecting the large gear 52 with the shaft 26, thus imparting a slower speed to the winding drum pinion 80, since the large gear 52 is now driven by the small pinion 53 on the counter-shaft 19. In Fig. 5, the mechanism is in a neutral state, neither clutch being compressed. The hand lever 90 actuates the right hand clutch assembly on the shaft 81 in a similar manner. This clutch mechanism is enclosed in an oil-tight dust-proof case and has enough discs to permit slippage under load indefinitely, thus providing not only for high and low speeds, but also for intermediate speeds when the clutches are but partially compressed. The cutting speeds may thus be adjusted according to the hardness of the material being cut.

Meshing with the winding drum pinions 80 and 84 are gears 91, 92 (Figs. 2 and 8) secured to the similarly constructed winding drums 8 and 9, as by bolts 93.

The winding drum 8 is rotatably mounted on

the flanged winding drum sleeve 94 (Figure 8) slidably secured to the winding drum shaft 95 as by a key 96. The flanged winding drum sleeve 94 has a collar 97 which retains the winding drum 8 in position on the winding drum sleeve 94. The collar 97 is held in place by the set screw 98 and lock nut 99 (Fig. 8), while between it and the winding drum 8 is the annular plate 100, compressed by the spring 101 to overcome entanglement of the cables 10 and 11 due to recoil when the drums are disengaged.

The shaft 95 is journaled in a bore 102 in a boss 103 on the main base. This boss 103 also supports the winding drum gear housing 104 bolted thereto by the angle member 105. Entering into the forward end of the winding drum sleeve 94 are the cap screws 107 (Figs. 2 and 8) which are engaged by links 108 attached at their opposite ends by cap screws 109 to an eccentric yoke member 110. The yoke member 110 is supported on a wrist pin 111 which passes through the end of the winding drum shaft 95, the eccentric yoke member 110 being actuated by a hand lever 112. Carried by the winding drum 8 is the cable 10 which at its inner end passes through the inner side flange of the winding drum 8 and is anchored thereto by the anchor block 114 held in position by the bolts 115.

The winding drum shaft 95 immediately back of the winding drum sleeve 94 has an enlarged portion 116 which abuts against the inner end of the winding drum sleeve 94 and also the outer end of the boss 103. When the hand lever 112 (Fig. 8) is pulled downward into a horizontal position, the winding drum shaft 95 is pulled backwards by the eccentric leverage of the eccentric yoke member 110 acting through the links 108 on the cap screws 107, thereby also pulling backward the winding drum 8 and disengaging the winding drum gear 91 from the winding drum pinion 80. In this way the winding drums may be made to operate as loose pulleys and to pay out the cables 10, 11 without causing the gearing mechanism to rotate. The right hand winding drum 9 is likewise engaged or disengaged from its winding drum pinion 84 by operating the hand lever 117 in the manner previously described for the corresponding hand lever 112 on the left hand winding drum 8.

Cooperating with the winding drums 8 and 9 are vertical sheaves 118 and 119 (Fig. 7) serving to guide the cable 10 of the winding drum 8 and the corresponding cable 11 on the winding drum 9. The sheaves 118 and 119 are rotatably mounted on the anti-friction bearings 120 and 121 inwardly supported upon the bushing 122 which is held in position between the sheave supports 123 and 124 by the bolt 125 secured to the base plate 126 mounted on the main base 1 by the bolts 127 (Fig. 6). A bolt 128 also cooperates with the bolt 125 to hold together the sheave supports 123 and 124 in spaced relationship with the aid of spacers 129, 130 and the partition 131.

The cables coming from the winding drums 8 and 9 are additionally guided by horizontal sheaves 132 and 133 for the left hand winding drum 8, and 134 and 135 for the right hand winding drum 9 (Fig. 6).

The bottom skid 1 at its forward end carries angle plates 136 and 137 which support (Figs. 1 and 9) additional sheaves 138 and 139, protected by a guard 140. All of these guiding sheaves are of the same construction and are mounted on similar anti-friction bearings 141. The sheave 138 is held in place by the stub shaft

142 on the threaded end of which is a nut 143 (Fig. 9).

The general mode of operation of the improved feeding mechanism may be summarized as follows: The machine is preferably transported over considerable distances within the mine by being carried on an ordinary mine truck which moves on the usual rails laid in various passages of the mine. Such a truck forms no part of the present invention. The machine may be drawn up on the truck by hooking the ends of the cables 10, 11 to the truck, starting the motor by shifting the hand lever (Fig. 1) of the motor controller and causing either of the winding drums 8 or 9 to be put into operation by moving the hand levers 67 or 99 respectively. Similarly, the machine may be moved off the truck by hooking the ends of the cables 10, 11 to anchor jacks, operating the winding drums and pulling the machine toward the anchor jacks. In each case the cables are guided by the sheaves 118 and 119, also by such of the sheaves 134, 135, 133, 132, 139 and 138 as may be most convenient in the particular instance.

In bringing the machine up to the face of the coal bank in the mine chamber, the cables 10 and 11 are extended to suitable anchor jacks located near the coal face, and as the cables are wound in by the drums, the machine is slid over the mine floor toward the coal face. The cables are also employed for moving the machine bodily in an endwise direction to sump the cutter bar beneath the coal bank. With the sumping cut completed, assuming that a horizontal cut has been made as in Fig. 1, the horizontal kerf may now be completed by the winding drums 8 and 9, the cables 10 and 11 therefrom being attached to anchor jacks located at a distance, and guided by the sheaves 138 and 139 (Fig. 1). By moving the hand levers 67, 99, either of the winding drums may be set in motion at any of the speeds provided by the transmission gearing or slipping clutches. The winding drum 9 winds in the cable 11, while the other winding drum 8 pays out the cable 10. The machine may then be fed transversely across the coal face, and thereafter the cutter bar is withdrawn from beneath the coal by moving the machine bodily rearwardly away from the coal face by means of the cables and drums. The drums 8 and 9 may be rotated at a relatively high speed for moving the machine rapidly over the mine floor, thereby to facilitate maneuvering of the machine. Other uses and advantages of the improved feeding mechanism will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and that the invention may be 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 mining machine, flexible feeding and guiding means for the machine for moving the latter bodily over the mine floor and for controlling the angular position of the machine with respect to the coal face including relatively rotatable feed operating and controlling members adapted to cooperate respectively with flexible feeding and controlling means, and motor operated means for said feeding and controlling members for independently rotating the latter at

either a high or a low speed including a motor shaft, a horizontal shaft extending longitudinally of the machine and driven by said motor shaft, a separate plural speed transmission mechanism for each member through which it, but not the other member, is driven, said transmission mechanisms including fast and slow speed gears driven by said second mentioned shaft and spaced longitudinally of the latter, parallel shafts, one individual to each transmission mechanism, arranged with their axes parallel to a line parallel with said second mentioned shaft and operatively connected to said members respectively, fast and slow speed terminal gears coaxial with said third and fourth mentioned parallel shafts respectively and driven by said first mentioned fast and slow speed gears, and clutches for selectively connecting said terminal gears to said third and fourth mentioned parallel shafts.

2. In a mining machine, flexible feeding and guiding means for the machine for moving the latter bodily over the mine floor and for controlling the angular position of the machine with respect to the coal face including relatively rotatable feed operating and controlling members adapted to cooperate respectively with flexible feeding and controlling means, and motor operated transmission means for said feeding and controlling members for independently rotating the latter at either a high or a low speed including a motor shaft horizontally disposed and extending longitudinally of the machine, a shaft parallel with said motor shaft and arranged with its axis lying in the longitudinal vertical center of the machine, said parallel shaft driven by said motor shaft, parallel shafts, one individual to the transmission means for each of said members arranged with their axes spaced equi-distantly from the longitudinal vertical center of the machine and operatively connected to said feed operating and controlling members respectively, fast and slow speed gears fixed to said second mentioned shaft and bodily spaced longitudinally thereof, fast and slow speed gears coaxial with said third and fourth mentioned parallel shafts respectively and driven by said first mentioned fast and slow speed gears, and clutches for connecting said last mentioned fast and slow speed gears to said third and fourth mentioned parallel shafts.

3. In a mining machine, flexible feeding and guiding means for the machine for moving the latter bodily over the mine floor and for controlling the angular position of the machine with respect to the coal face including relatively rotatable feed operating and controlling members adapted to cooperate respectively with flexible feeding and controlling means, and motor operated means for said feeding and controlling members for independently rotating the latter at either a high or a low speed including a motor shaft horizontally disposed and extending longitudinally of the machine, a pair of parallel shafts arranged with their axes parallel with the motor shaft axis, said parallel shafts operatively connected to said feed operating and controlling members respectively, a fourth shaft parallel with said motor power shaft and driven by the latter, high and low speed terminal gears arranged co-

axially with said second and third mentioned parallel shafts respectively, clutches for connecting said terminal gears in driving relation with said second and third mentioned parallel shafts, driving connections between said motor shaft and said high speed terminal gears, and driving connections between said fourth mentioned shaft and said low speed terminal gears.

4. In a mining machine, flexible feeding and guiding means for the machine for moving the latter bodily over the mine floor and for controlling the angular position of the machine with respect to the coal face including relatively rotatable feed operating and controlling members adapted to cooperate respectively with flexible feeding and controlling means, and motor operated means for said feeding and controlling members for independently rotating the latter at either a high or a low speed including a separate plural speed transmission means for each member through which it, but not the other member, is driven, each transmission means including coaxial fast and slow speed spur terminal gears, each transmission means including a shaft coaxial with the fast and slow speed terminal gears thereof and operatively connected to the member driven thereby and clutches for selectively connecting said terminal gears to their shaft, the shafts of said transmission means arranged on parallel horizontal axes, a third shaft parallel with said parallel shafts and arranged therebetween, and spur gears fixed to said last mentioned shaft in longitudinally spaced relation thereon and meshing with said fast and slow speed spur terminal gears of both transmission means.

5. In a mining machine, flexible feeding and guiding means for the machine for moving the latter bodily over the mine floor and for controlling the angular position of the machine with respect to the coal face including relatively rotatable feed operating and controlling members adapted to cooperate respectively with flexible feeding and controlling means, and motor operated means for said feeding and controlling members for independently rotating the latter at either a high or a low speed including a motor shaft, a horizontal shaft extending longitudinally of the machine, intermeshing reduction gearing connecting said horizontal shaft to said motor shaft, a separate plural speed transmission mechanism for each member through which it, but not the other member, is driven, said transmission mechanisms including fast and slow speed gears driven by said horizontal shaft and spaced longitudinally of the latter, parallel shafts, one individual to each transmission mechanism, arranged with their axes parallel to a line parallel with said horizontal shaft, fast and slow speed terminal gears coaxial with said third and fourth mentioned parallel shafts respectively and driven by said first mentioned fast and slow speed gears respectively, clutches for selectively connecting said terminal gears to said third and fourth mentioned parallel shafts, and intermeshing reduction gearings connecting said third and fourth mentioned parallel shafts to said members respectively.

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