Sept. 27, 1938. J. F. JOY ET AL 2,131,179

MINING MACHINE FEEDING MECHANISM

Filed March 30, 1936 4 Sheets-Sheet 1

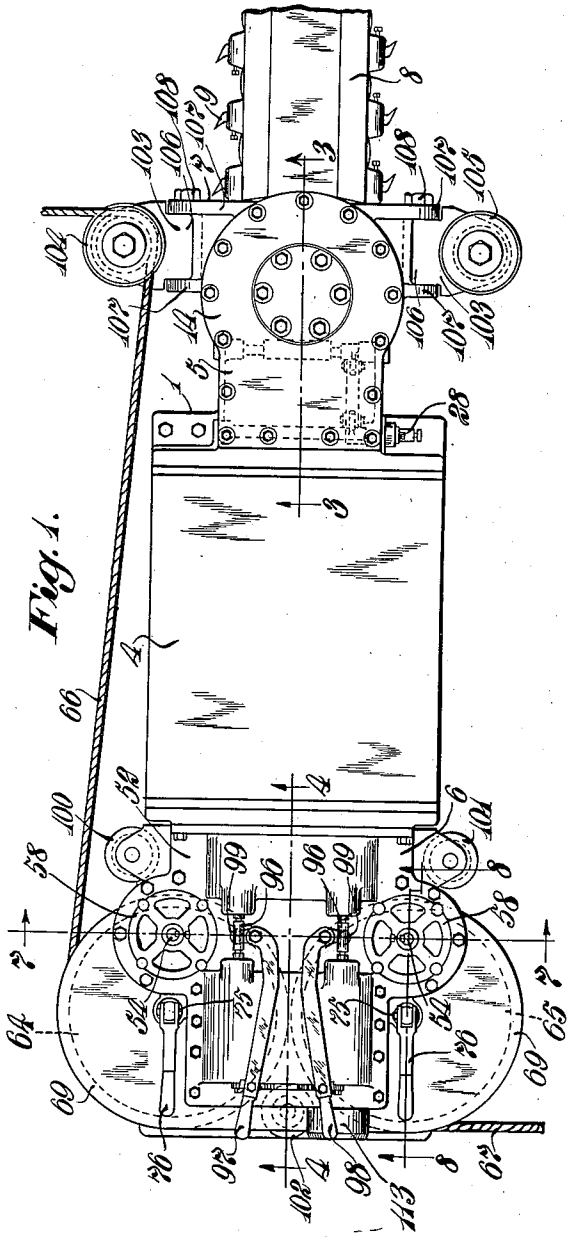


Fig. 1.

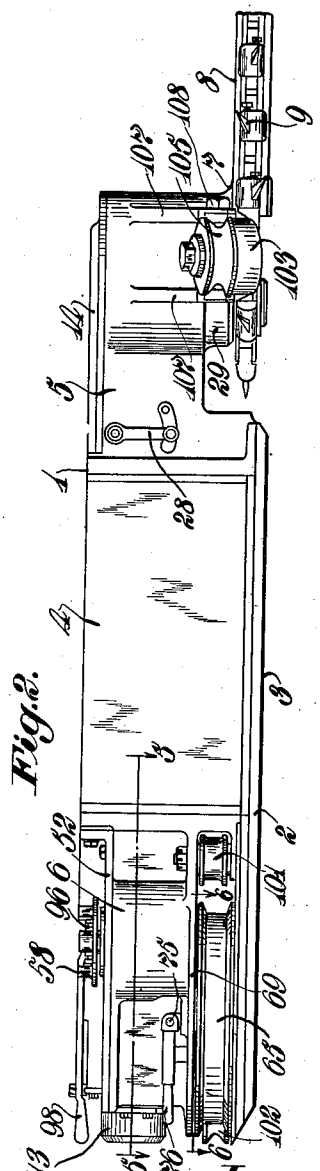


Fig. 2.

Inventors
Joseph F. Joy.
Cornelius G. Boudette.
by Louis A. Maxson.
Atty.

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Filed March 30, 1936 4 Sheets-Sheet 2

Fig. 3.

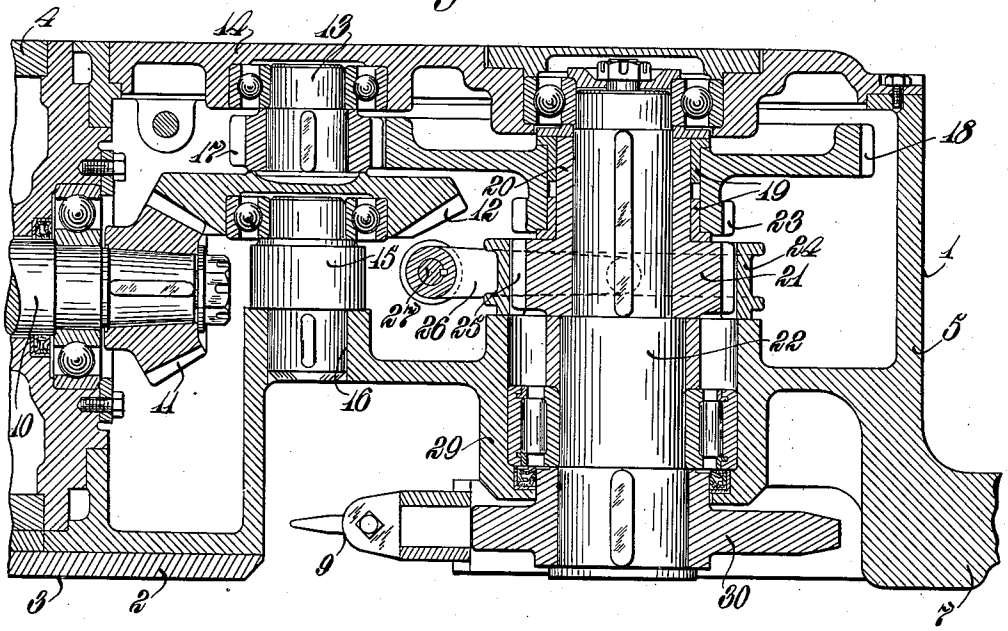
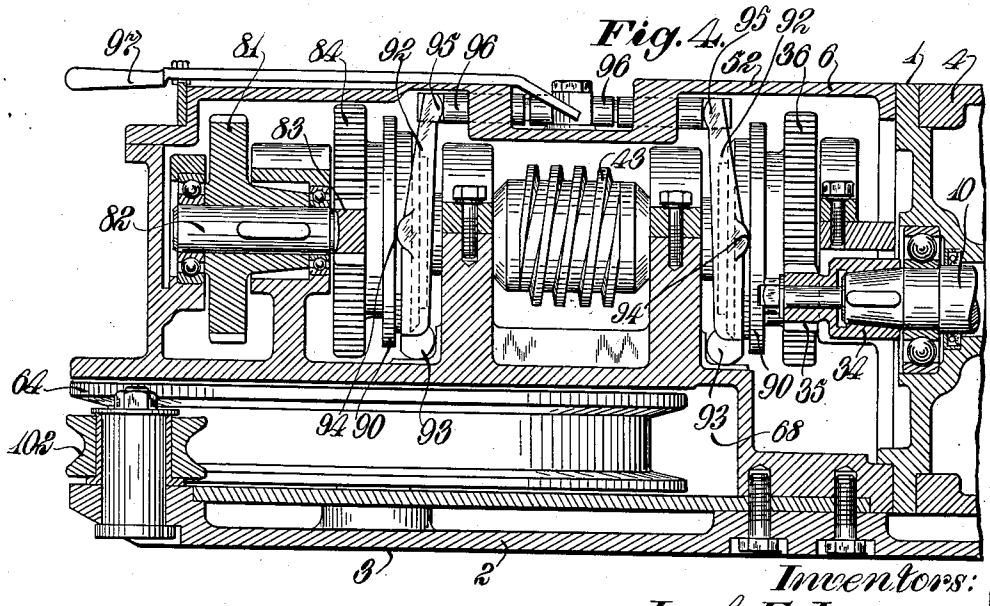


Fig. 4.



Inventors:
Joseph F. Joy.
Cornelius G. Boudette.
By Louis A. Maxson.
Atty.

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Filed March 30, 1936 4 Sheets-Sheet 3

Fig. 5.

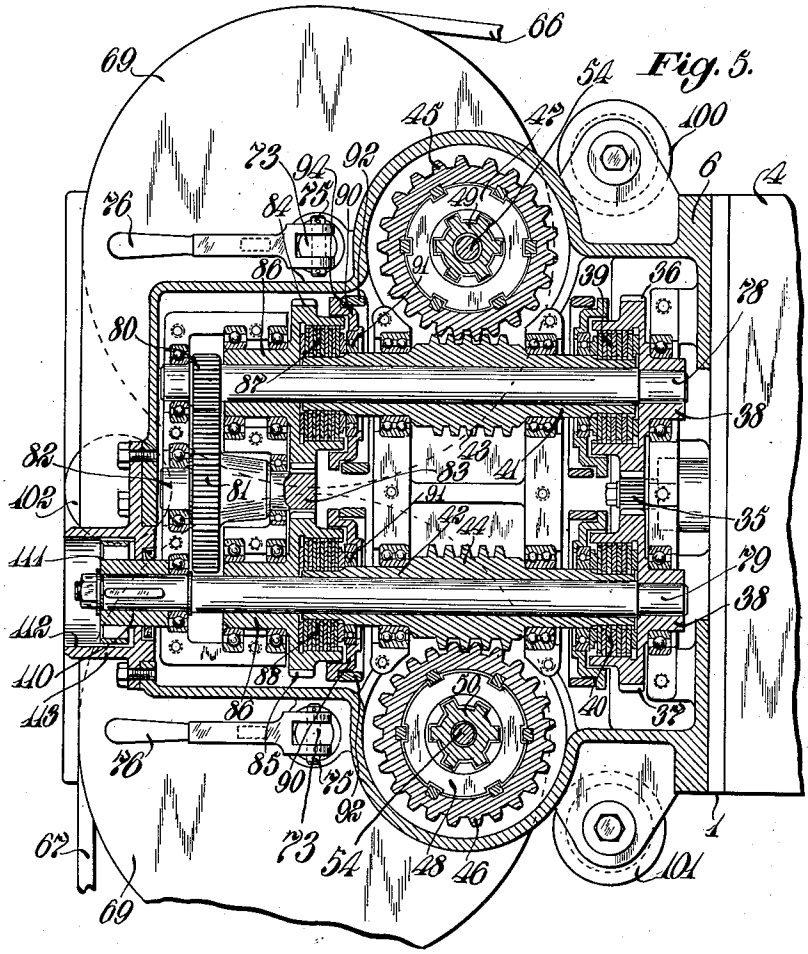
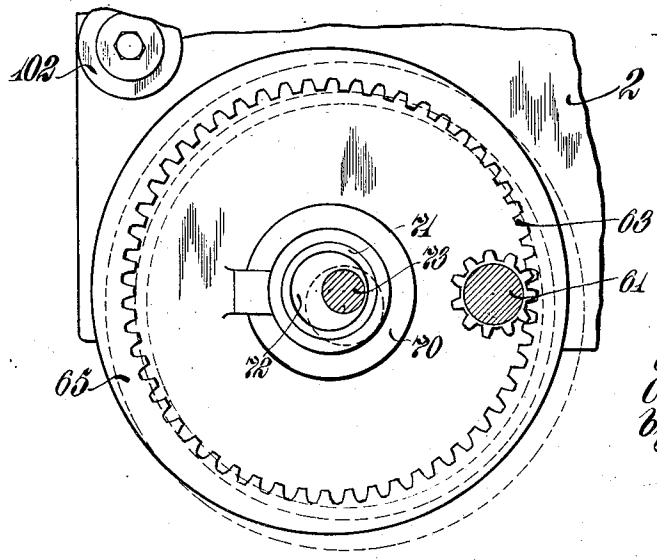


Fig. 6.



Inventors:
Joseph F. Joy.
Cornelius G. Boudette.
by Louis A. Maxson.
Atty.

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Filed March 30, 1936 4 Sheets-Sheet 4

Fig. 7.

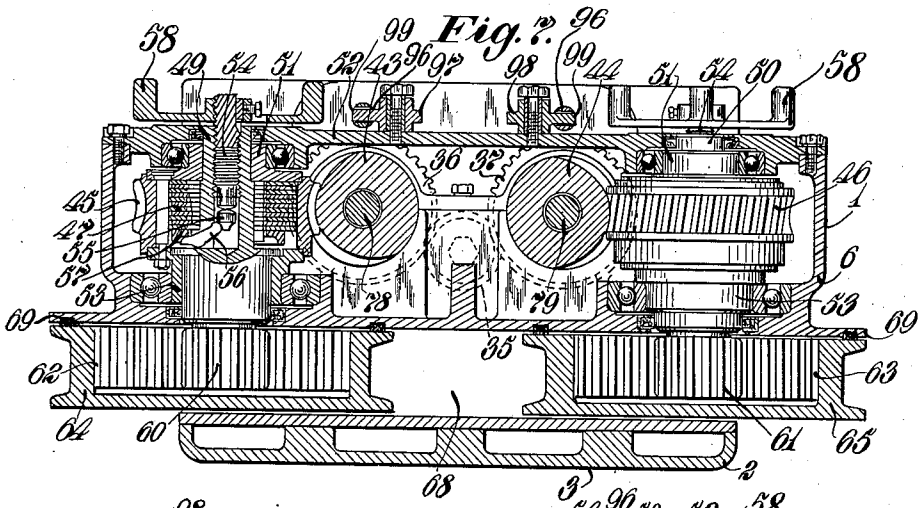


Fig. 8.

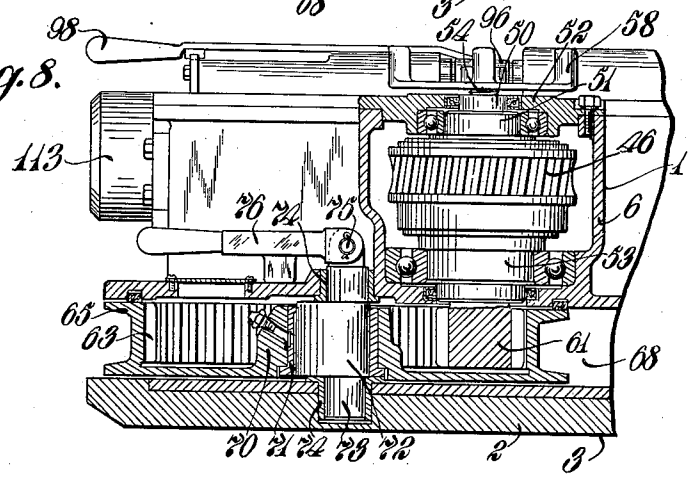


Fig. 9.

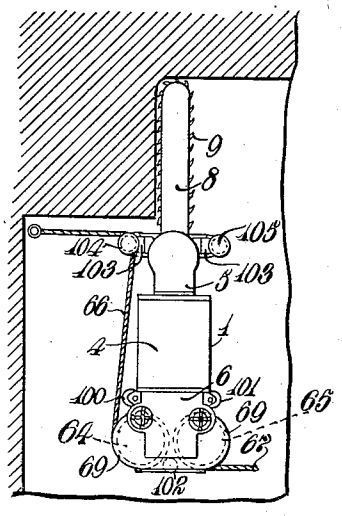
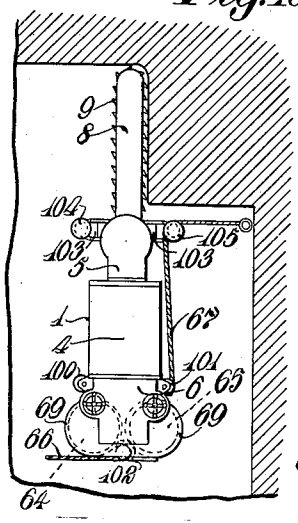


Fig. 10.



Inventors:
Joseph F. Joy.
Cornelius G. Boudette.
by Louis A. Haxson.
Atty.

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UNITED STATES PATENT OFFICE

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MINING MACHINE FEEDING MECHANISM

Joseph F. Joy and Cornelius G. Boudette, Claremont, N. H., assignors to Sullivan Machinery Company, a corporation of Massachusetts

Application March 30, 1936, Serial No. 71,655

5 Claims. (Cl. 262—30)

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.

An object of this invention is to provide an improved feeding mechanism for a coal mining machine. Another object is to provide an improved flexible feeding means for a coal mining machine of the flexibly fed, floor cutter type. Another object is to provide an improved feeding mechanism for a coal mining machine wherein relatively rotatable feed operating and controlling members respectively cooperating with flexible feeding and controlling elements, are employed for feeding and guiding the machine. Still another object is to provide an improved mining machine transmission mechanism wherein the feed operating and controlling members are driven at a plurality of speeds under frictional control at either speed. A still further object is to provide an improved mining machine feeding mechanism wherein a separate plural speed transmission mechanism is employed for driving each of the feed operating and controlling members whereby the said members may be independently driven at either high or low speeds. A still further object is to provide an improved arrangement of the feed operating and controlling members and their driving mechanism whereby an extremely compact feeding structure is obtained. Other objects and advantages of the invention will, however, hereinafter more fully appear.

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

In these drawings,—

Fig. 1 is a plan view of a coal mining machine having embodied therein the illustrative form of the improved feeding mechanism.

Fig. 2 is a side elevational view of the mining machine shown in Fig. 1.

Fig. 3 is an enlarged view in longitudinal section taken substantially on line 3—3 of Fig. 1.

Fig. 4 is an enlarged view in longitudinal section taken substantially on line 4—4 of Fig. 1.

Fig. 5 is an enlarged horizontal sectional view taken substantially on line 5—5 of Fig. 2.

Fig. 6 is a detail horizontal sectional view taken substantially on line 6—6 of Fig. 2.

Fig. 7 is an enlarged cross sectional view taken substantially on line 7—7 of Fig. 1.

Fig. 8 is a detail vertical sectional view taken substantially on line 8—8 of Fig. 1.

Fig. 9 is a diagrammatic view showing the mining machine cutting from right to left in accordance with the room and pillar system of mining.

Fig. 10 is a diagrammatic view showing the mining machine cutting from left to right in accordance with the room and pillar system of mining.

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, although it will be evident that various features of the invention may be incorporated in coal mining machines of various other types.

The mining machine generally comprises a machine frame 1 supported on a bottom skid plate 2 having a plane bottom surface 3 and adapted to rest upon and slide in any direction over the mine floor. The machine frame comprises a central motor frame section 4, a front cutter frame section 5 and a rear feed frame section 6, the motor frame section being arranged centrally between the cutter and feed frame sections in the manner shown in Figs. 1 and 2. Formed integrally with the front cutter frame section 5 is a hanger 7 supporting a horizontal plane cutter bar 8 about the margin of which an endless cutter chain 9 is adapted to be circulated. Arranged within the motor frame section 4 is a motor, herein preferably of the reversible electric type, having its power shaft 10 horizontally disposed and extending longitudinally of the machine. Keyed to the forward end of the motor power shaft is a bevel gear 11 meshing with a horizontal bevel gear 12 herein formed integral with a vertical shaft 13. This shaft is journaled at its upper end within a ball bearing supported within a detachable cover plate 14 of the cutter frame section and at its lower end in a ball bearing seated within the recessed lower face of the bevel gear 12 and supported on a vertical stub shaft 15 secured within a vertical bore 16 formed in the cutter frame section. Keyed to the shaft 13 and arranged above the bevel gear 12 is a spur gear 17 meshing with a large spur gear 18 arranged for rotation about a vertical axis. The hub of the spur gear 18 is journaled on bearing sleeves 19 supported by a sleeve 20 formed integral with a clutch member 21 keyed to a vertical cutter chain drive shaft 22, herein arranged with its axis coincident with the axis of rotation of the spur gear 18. The hub of the spur gear 18 has clutch teeth 23 connectible by a sliding clutch member 24 with clutch teeth 25 formed integral with the clutch element 21. Engaging the clutch member 24 is a shipper yoke 26 keyed to a transverse operating

shaft 27 mounted in the cutter frame section and having an operating handle 28 conveniently located on the exterior of the cutter frame section, as shown in Figs. 1 and 2. When the clutch teeth 23 on the spur gear 18 are connected by the clutch member 24 with the clutch teeth on the clutch member 21, the vertical shaft 22 may be driven by the spur gear 18. The upper end of the shaft 22 is journaled within a ball bearing supported within the cover plate 14 and near its lower end within a roller bearing supported within a cylindrical bearing hub 29 formed integral with the cutter frame section. Keyed to the lower end of the shaft 22 is a chain sprocket 30 which engages and drives the endless cutter chain 9. It will thus be seen that when the clutch 24 is connected, the cutter chain may be rapidly circulated about the margin of the cutter bar by the motor through the bevel gearing 11, 12, spur gearing 17 and 18 and the vertical cutter chain drive shaft 22.

Now referring to the improved feeding mechanism, it will be noted that keyed to the rear end of the motor power shaft 10 is the hub 34 of a spur motor pinion 35. This motor pinion meshes with and drives in the same direction spur gears 36 and 37 each having a hub 38 journaled in a ball bearing supported within the feed frame section 6. These spur gears are arranged in parallel relation on horizontal axes extending longitudinally of the machine and spaced equi-distantly from the longitudinal center of the machine. The spur gears 36 and 37 are connectible by multiple disc clutches 39 and 40, of a usual design, respectively to shafts 41 and 42, these shafts arranged coaxially with the spur gears and herein tubular in form. The shafts 41 and 42 are suitably journaled within ball bearings supported within the feed frame section and have formed integral therewith worms 43 and 44, respectively, preferably having teeth of the same pitch and inclination and respectively meshing with worm wheels 45 and 46. These worm wheels are arranged on vertical axes at the outer sides of the worms in mesh with the latter in the manner shown in Figs. 5 and 7, and are connectible by multiple disc clutches 47 and 48, of a usual design, respectively to vertical shafts 49 and 50, herein arranged coaxially with the worm wheels. Each of these worm wheels is provided with an upper hub 51 journaled in a ball bearing supported within a detachable cover plate 52 of the feed frame section and a lower hub 53 journaled in a ball bearing suitably supported within the feed frame, and the vertical shafts are preferably journaled within these worm wheel hubs. Each of these disc clutches 47 and 48 is operated by means of a screw 54 threaded centrally within the upper end of the vertical shaft and engaging at its lower end a member 55 in turn engaging levers 56. These levers are engageable with the lower pressure plate 57 of the clutch. Fixed to the upper end of the screw shaft is a hand wheel 58. When the screw shaft is rotated to move the member 55 downwardly, the levers 56 are swung about their pivots to move the pressure plate 57 upwardly to compress the clutch discs, thereby to apply the clutch. Fixed to the lower ends of the vertical shafts 49 and 50 are spur gears 60 and 61 respectively meshing with large internal gears 62 and 63 formed within feed operating and controlling members 64 and 65 respectively. These feed operating and controlling members are herein in the form of cable winding or haulage drums having respectively wound thereon feeding and controlling cables 66 and 67. These cable winding drums are disposed on vertical axes parallel with the axes of the vertical shafts 49 and 50 and arranged in horizontal planes within a transverse chamber 68 formed within the lower portion of the feed frame section, the outer sides of the feed drums projecting laterally from the outer vertical side walls of the feed frame. Formed integral with the feed frame are semi-circular flange-like portions 69 forming closures for the upper sides of the drums, thereby to prevent access of dirt to the internal drum gears. Each of the drums 64, 65 has a hub 70 journaled on a bearing sleeve 71 supported by an eccentric shaft portion 72 integral with a vertical shaft 73. The shaft 73 is journaled within bearing sleeves 74, 74 supported within the feed frame section and has pivotally connected thereto, at its upper end at 75, a lever 76. When the shaft 73 is rotated by the lever 76, the eccentric shaft portion 72 moves the drum about the axis of the shaft 73 to move the teeth of the internal drum gear out of mesh with the spur driving gear, thereby to disconnect the drum from its drive.

Again referring to Figs. 5 and 7, it will be noted that the hubs 38 of the spur gears 36 and 37 are keyed to shafts 78 and 79 herein extending centrally through the tubular shafts 41 and 42 respectively. Fixed to the rear end of the shaft 78 is a spur gear 80 meshing with a spur gear 81 keyed to a longitudinally extending shaft 82 herein arranged parallel with the shaft 78. The shafts 78 and 82 are suitably journaled within ball bearings supported within the feed frame section, and the forward end of the shaft 82 terminates in a spur gear 83 meshing with spur gears 84 and 85 for driving the latter in the same direction. The spur gears 84 and 85 are arranged coaxially with the spur gears 36 and 37 respectively, and are each provided with a hub 86 journaled within ball bearings supported within the feed frame section, the shafts 78 and 79 extending centrally through the spur gear hubs, as clearly shown in Fig. 5. The spur gears 84 and 85 are connectible by multiple disc clutches 87 and 88, of a usual design, respectively to the tubular shafts 41 and 42. The spur gears 36 and 37 herein constitute the terminal high speed driving elements of the high speed transmissions, while the spur gears 84 and 85 constitute the low speed terminal driving elements of the low speed transmissions. The operating means for the disc clutches 39, 40, and 87, 88, in this instance, comprises clutch applying rings 90 supported on ball bearings 91 slidably mounted on the shafts 41 and 42. Engaging each of these clutch applying rings is a shipper yoke 92 pivotally mounted at 93 and engaging at 94 the adjacent plane surface of the clutch applying ring. The upper extremities of the clutch shipper yokes are bifurcated at 95 for engagement with the slotted ends of an axially reciprocable operating shaft 96. These operating shafts 96 are moved axially by means of operating levers 97 and 98, each having a projection 99 engaged within a transverse slot formed in the shaft 96. The lever 97 operates the clutch applying rings for the disc clutches 39 and 87, while the lever 98 operates the clutch applying rings for the clutches 40 and 88. It will thus be seen that upon application of the high speed clutches 39 and 40 controlling the connection of the high speed terminal driving gears 36 and

37 with the shafts 41 and 42, the cable winding drums may be driven in relatively opposite directions to wind in their respective cables at a relatively high speed, and when the high speed clutches 39 and 40 are released and the low speed clutches 87 and 88 are applied, the cable winding drums may be driven through the low speed terminal gears 84 and 85 in relatively opposite directions to wind in the cables at a relatively low speed.

For guiding the feeding and controlling cables 66 and 67 with respect to the cable winding drums there are arranged at the opposite sides of the machine frame in advance of the drums, horizontal guide sheaves 100 and 101, while arranged midway between the drums at the rear thereof is a horizontal guide sheave 102. Supported at the opposite sides of the cutter frame section at the forward end of the machine are vertically swingable hangers 103 supporting horizontal guide sheaves 104 and 105. Each of the hangers 103 is provided with a lug 106 projecting between lateral lugs 107, 107 formed integral with the cutter frame section, and a bolt 108 passes through the lugs 106, 107 to provide a horizontal pivotal mounting for the hanger.

The machine is preferably transported over considerable distances within the mine by being carried on an ordinary mine truck which moves on the usual track rails laid in various passages of the mine. Such a truck forms no part of the present invention, other than its association with the driving means on the machine by which the truck is propelled. Referring again to Fig. 5, it will be noted that keyed to the rear end of the shaft 79 is the hub 110 of a truck driving member 111. This truck driving member is arranged within a socket 112 formed in a housing 113 attached to the rear end of the feed frame section. When the mining machine is slid rearwardly in position on its transport truck, a truck driving element on the truck is adapted to enter the socket 112 to engage the truck driving member 111 so that the truck wheels may be driven by the motor of the machine through the motor pinion 35, spur gear 37 and shaft 79.

The general mode of operation of the mining machine will be clearly apparent from the description given. To position the machine for cutting from right to left in the manner shown diagrammatically in Fig. 9, the feed cable 66 is extended from the feed drum 64 forwardly along the advancing side of the machine and around the front guide sheave 104 to a suitable anchor jack located at the coal face. The controlling or guiding cable 67 is extended directly from the controlling drum 65, laterally and forwardly from the receding side of the machine to a suitable anchor jack located at the right hand rib. The low speed clutches 87 and 88 are then applied to effect rotation of the drums in a direction to wind in the cables, the feed cable 66 and the controlling cable 67 moving the machine in an endwise direction to sump the cutter bar beneath the coal and the cable 67 controlling the sumping movement of the machine. Upon completion of the sumping cut, the anchor jack at the face is knocked down and the feed cable extended from the guide sheave 104 transversely across the coal face to a suitable anchor jack located at the left hand rib, as shown in Fig. 9, and as the cable 66 is wound in by the feed drum 64, the machine is fed transversely across the coal face to cut a horizontal kerf thereunder. During the transverse cutting operation, the controlling cable 67 guides the machine, it being understood that at that time the controlling drum is disconnected from its drive and merely pays out the cable 67 as the machine is fed laterally under the control of the multiple disc clutch 48, the latter at that time acting as a brake against the stationary worm wheel or so-called "dead gear" 46. When it is desired to wind in the controlling cable during the transverse cutting operation, the friction clutch 88 may be applied to effect rotation of the controlling drum 65 in cable winding direction, thereby to swing the machine to vary the angular position of the cutter bar with respect to the coal face. Upon completion of the transverse cutting operation, the feed cable 66 is extended rearwardly to an anchor jack located at the rear end of the machine, and as the feed winding drum is rotated in a direction to wind in the feed cable, the machine is moved rearwardly with respect to the coal face to withdraw the cutter bar from beneath the coal. The machine may be fed rapidly over the mine floor by either of the cable winding drums under the control of the high speed clutches 39 and 40. During cutting from left to right, as shown diagrammatically in Fig. 10, the cable 67 is extended from the drum 65 around the guide sheave 101 and the front guide sheave 105, laterally from the machine to an anchor jack located at the right hand rib, while the cable 66 is extended from the drum 64 around the rear guide sheave 102 and laterally from the machine to a suitable anchor jack located at the left hand rib, the drum 65 at that time acting as a feed drum, while the drum 64 acts as a controlling drum. The machine is sumped in, fed transversely across the face and withdrawn from the face in the same manner as that described above in regard to the right to left cutting operation. Of course, when it is desired to change the direction of cutting, it is necessary to reverse the motor, reverse the position of the cutter bits of the cutter chain, and rearrange the cables on the drums. Other uses and advantages of the improved mining machine 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 we claim as new and desire to secure by Letters Patent is:

1. In a mining machine feeding and controlling mechanism, feed operating and controlling members respectively adapted to cooperate directly with flexible feeding and controlling connections, and operating and controlling means for said members for effecting rotation of the latter in one direction including self-locking worm gearings individual to each of said members, means for driving either of said worm gearings at will irrespective of the drive of the other, and friction devices for connecting said members for drive by their respective worm gearings when the latter are driven, and for brakingly connecting said members to said worm gearings when the latter are not driven to provide a controlled reverse rotation of said members.

2. In a mining machine feeding and controlling mechanism, feed operating and controlling members respectively adapted to cooperate di-

rectly with flexible feeding and controlling members, and operating and controlling means for said members for effecting rotation of the latter in one direction including a transmission mechanism for each member through which it, but not the other member is driven, one transmission mechanism including elements driven through an element of the other transmission mechanism, said transmission mechanisms including self-locking worm gearings individual to each of said members and means for effecting drive of either of said worm gearings irrespective of the drive of the other, and friction devices for connecting said members for drive by their respective worm gearings when the latter are driven and for brakingly connecting said members to said worm gearings when the latter are not driven to provide a controlled reverse rotation of said members.

3. In a mining machine feeding mechanism, the combination with relatively rotatable feed operating and controlling members respectively adapted to cooperate directly with flexible feeding and controlling elements, of motor operated means for independently rotating said members in a direction to draw in their respective flexible elements including a separate transmission mechanism for each member through which it, but not the other member, is driven, each transmission mechanism comprising a gear train, self-locking worm gearing, a clutch for rendering said gear train effective to drive said worm gearing, and a friction clutch for connecting said worm gearing to its respective member, said friction clutch for said controlling member operative to act as a friction drag brake for said controlling member when said first mentioned clutch of said controlling-member-transmission is released and while said feed operating member is being rotated in a direction to draw in its cooperating flexible element through its respective transmission without releasing the friction clutch of the latter, said drag brake acting to brake rotation of said controlling member in a direction to pay out its cooperating flexible element and said worm gearing associated with said controlling member acting as a stationary reaction means for said drag brake.

4. In a mining machine feeding mechanism, the combination with relatively rotatable feed operating and controlling members respectively adapted to cooperate directly with flexible feeding and controlling elements, of motor operated means for independently rotating said members at either high or low speeds in a direction to draw in their respective flexible elements including a separate plural speed transmission mechanism for each member through which it, but not the other member, is driven, each transmission mechanism comprising high and low speed gear trains, self-locking worm gearing driven through said gear trains, clutches for selectively rendering said gear trains effective to drive said worm gearing, and a friction clutch for connecting said worm gearing in driving relation with its respective member, said friction clutch for said controlling member operative to act as a friction drag brake for variably controlling rotation of said controlling member when said first-mentioned clutches of said controlling-member-transmission are released and while said feed operating member is being rotated in a direction to draw in its cooperating flexible element through its transmission mechanism without releasing the friction clutch of the latter, said drag brake acting to brake rotation of said controlling member in a direction to pay out its cooperating flexible element and said worm gearing associated with said controlling member acting as a stationary reaction means for said drag brake.

5. In a mining machine feeding mechanism, the combination with relatively rotatable feed operating and controlling members respectively adapted to cooperate with feeding and controlling elements, of motor operated means for independently rotating said members including a separate transmission for each member through which it, but not the other member, is driven, each transmission mechanism including a gear train, a clutch for rendering said gear train effective to drive its respective member, self-locking worm gearing, and a friction clutch for connecting said worm gearing to its respective member, the clutch of the gear train and the friction clutch of said feed operating member being connectible to effect drive of the latter while the clutch of the gear train of the controlling member is released and said friction clutch for the controlling member being operable to act as a friction drag brake for frictionally resisting rotation of said controlling member while the clutch of its gear train is released and its gear train is continuously driven but disconnected from its worm gearing by its clutch, said worm gearing of said controlling member acting as a stationary reaction means for the drag brake at that time.

JOSEPH F. JOY.
CORNELIUS G. BOUDETTE.