July 21, 1931. M. P. HOLMES 1,815,872

MINING MACHINE

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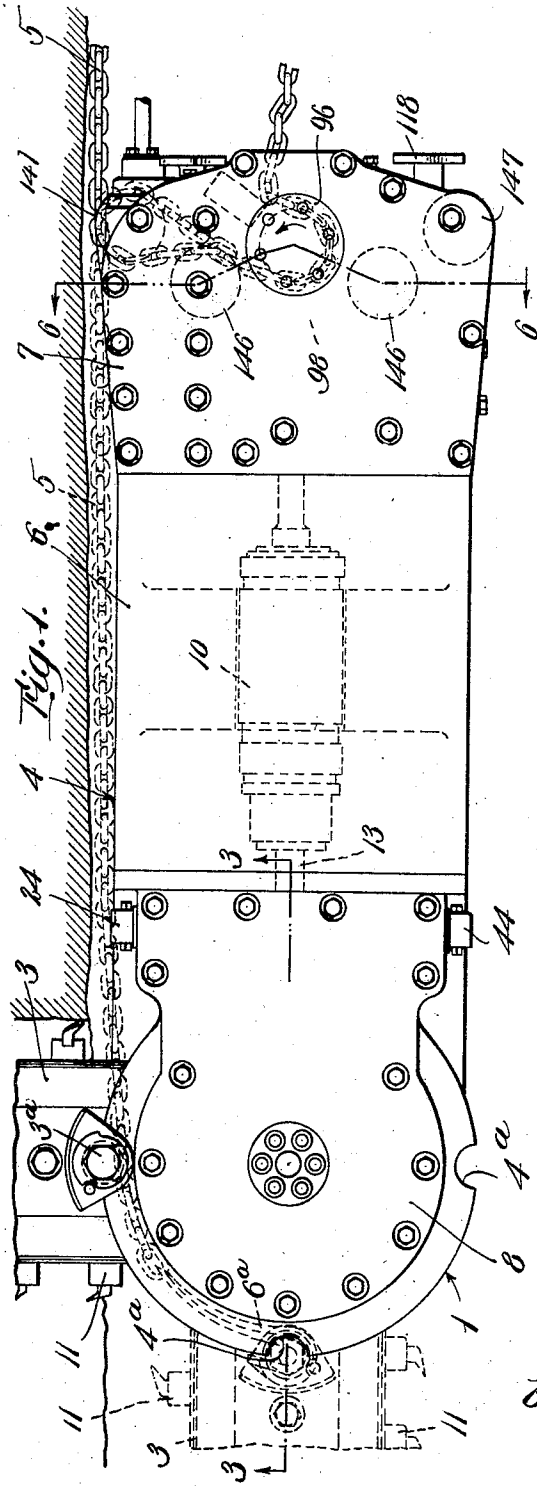

Fig. 1.

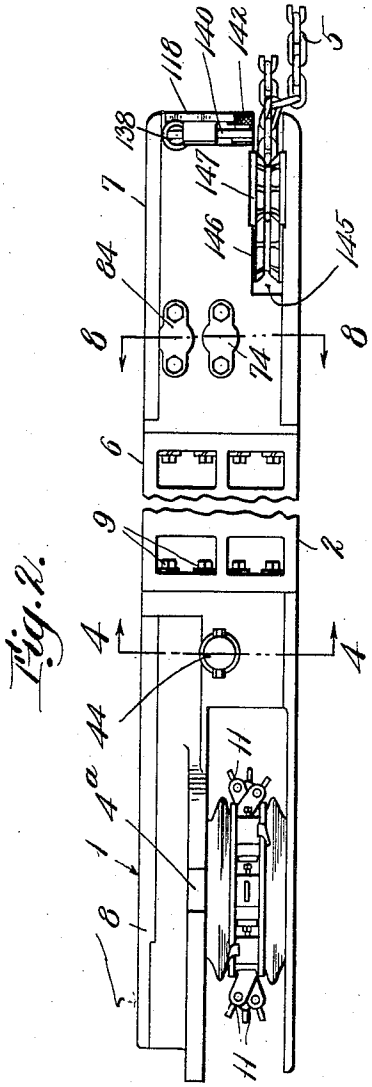

Fig. 2.

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MINING MACHINE

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Fig. 3.

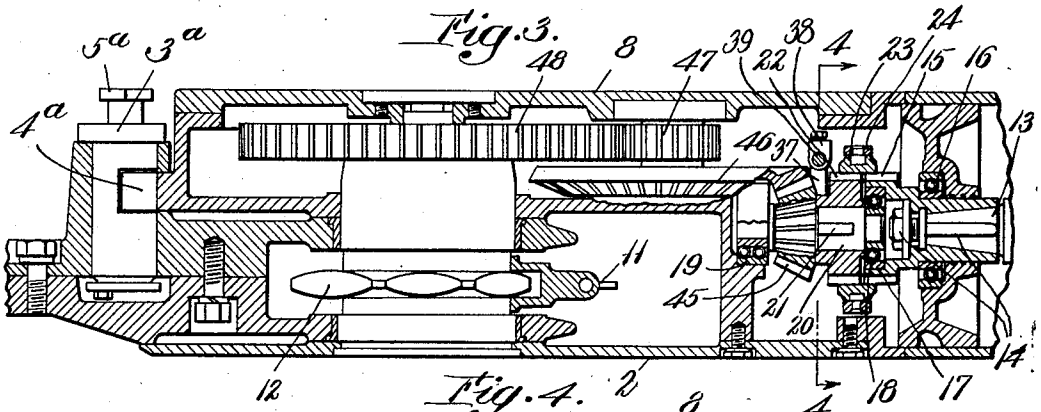


Fig. 4.

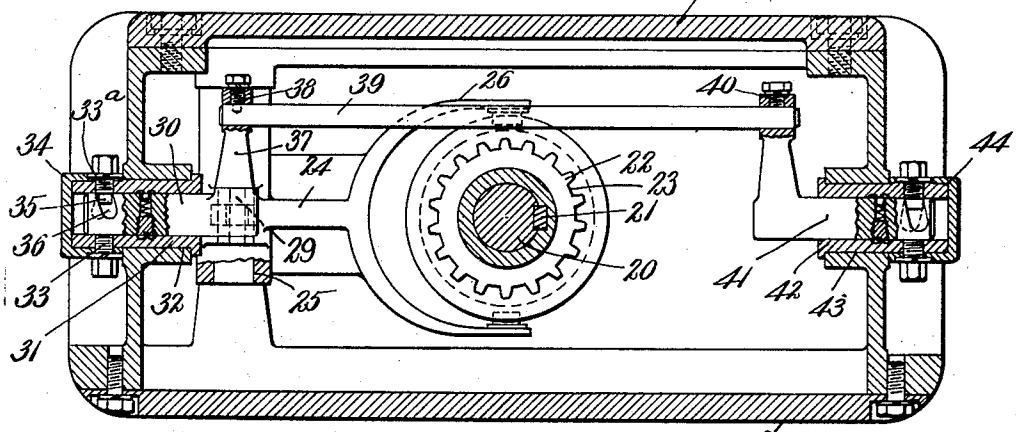


Fig. 6.

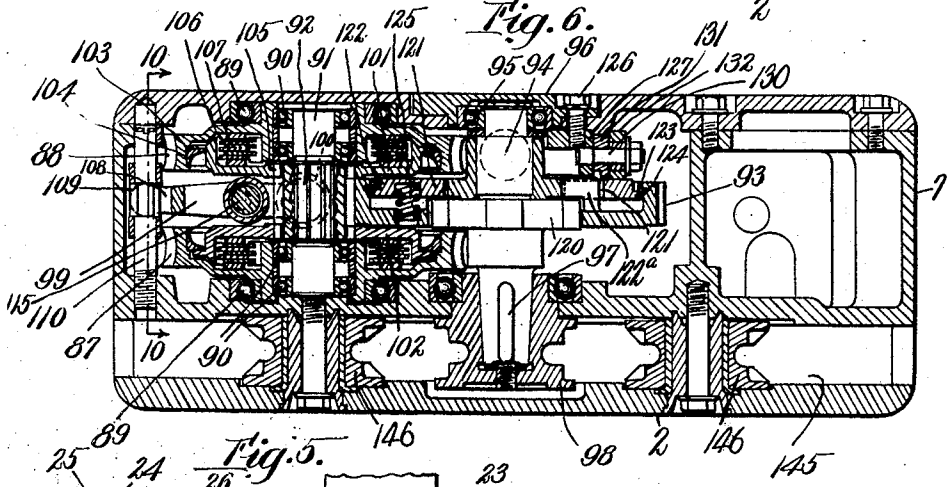
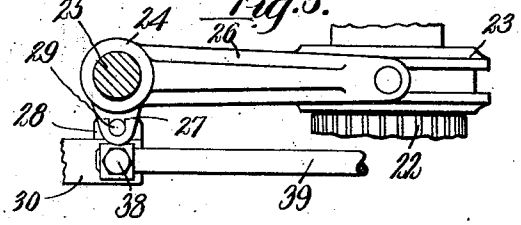


Fig. 5.



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MINING MACHINE

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Fig. 7.

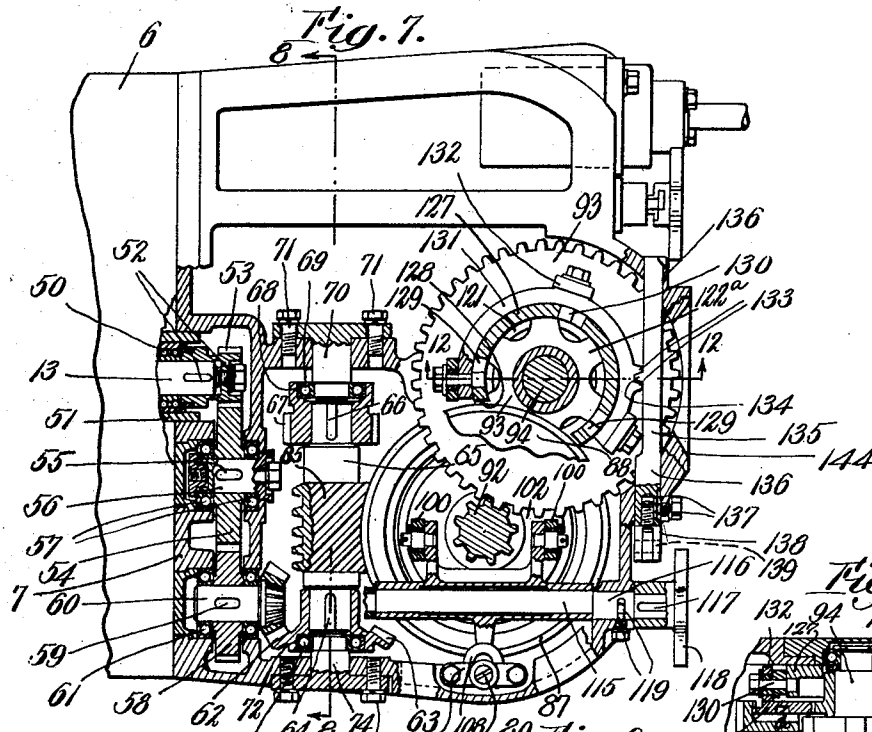


Fig. 12.

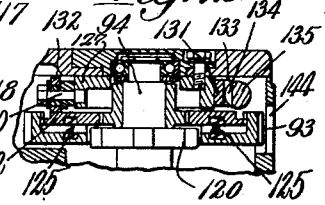


Fig. 8.

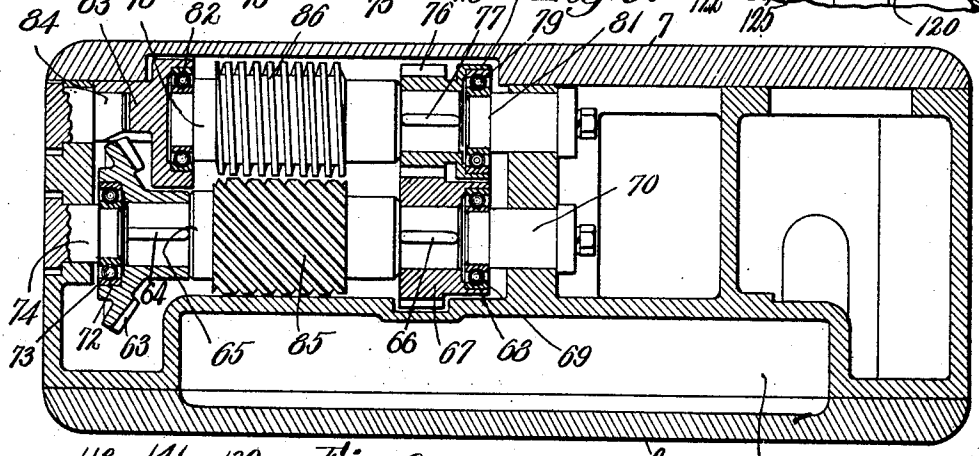
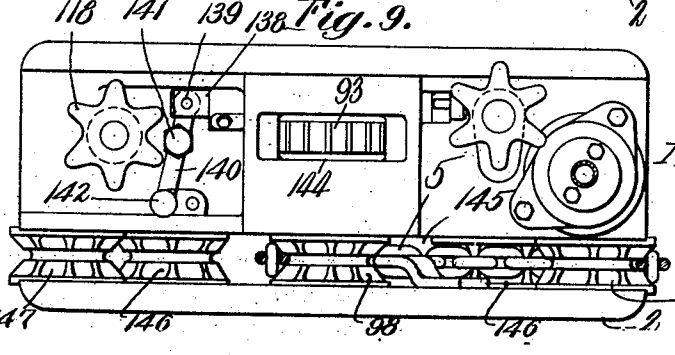


Fig. 9.



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MINING MACHINE

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Fig. 13.

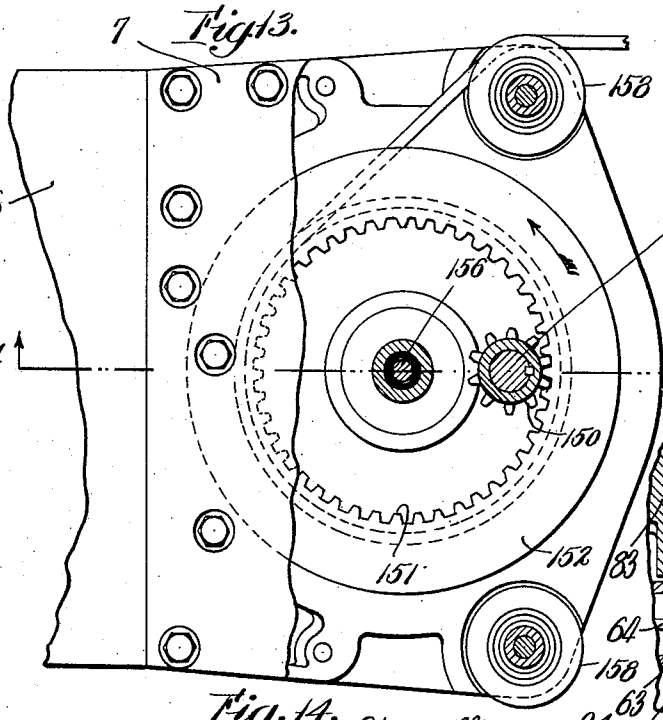


Fig. 15.

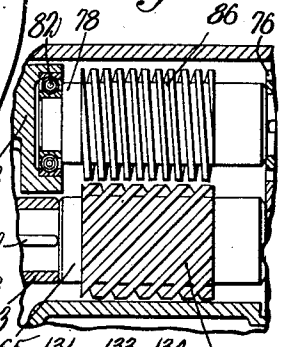


Fig. 14.

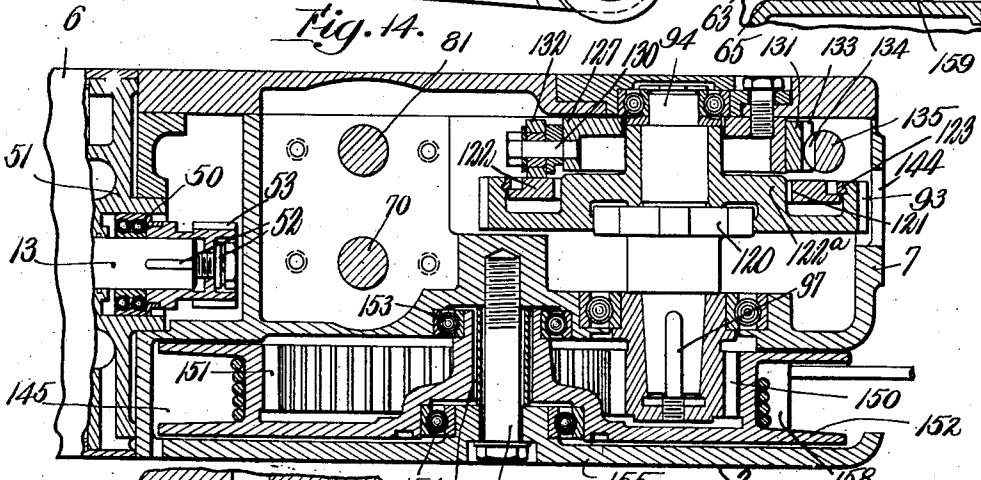


Fig. 10.

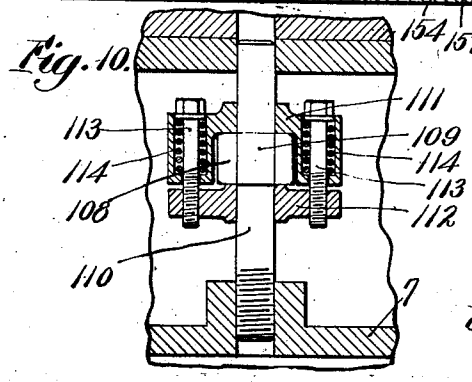
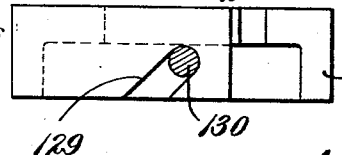


Fig. 11.



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UNITED STATES PATENT OFFICE

MORRIS P. HOLMES, OF CLAREMONT, NEW HAMPSHIRE, ASSIGNOR TO SULLIVAN MACHINERY COMPANY, A CORPORATION OF MASSACHUSETTS

MINING MACHINE

Application filed September 20, 1926. Serial No. 136,446.

This invention relates to mining machines and more particularly, but not exclusively, to coal mining machines of the flexibly fed longwall type.

This invention has for its object to provide an improved mining machine having exceedingly simple, rugged and compact feeding mechanism whereby the machine may be fed in an improved and simplified manner. A further object of this invention is to provide an improved mining machine of the flexibly fed type wherein either a feed chain or a feed rope may be utilized with a minimum of change. A further object of this invention is to provide an improved mining machine of the invertible type adapted to operate either as an undercutter or as an overcutter. Still another object of this invention is to provide an improved mining machine having improved, simplified and compact general arrangement of parts whereby the machine is enabled to operate in mines having narrow or low veins. These and other objects and advantages of this invention will, however, hereinafter more fully appear.

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

In these drawings,—

Fig. 1 is a plan view of a coal mining machine of the longwall type in which my improved feeding mechanism is incorporated, the cutter bar being illustrated in different positions.

Fig. 2 is a side elevation of the mining machine shown in Fig. 1, with a portion omitted.

Fig. 3 is a central, longitudinally extending, vertical sectional view taken substantially on line 3—3 of Fig. 1.

Fig. 4 is a transverse vertical sectional view taken on line 4—4 of Figs. 2 and 3.

Fig. 5 is a detail view partially in section illustrating the main power controlling clutch for the cutting mechanism.

Fig. 6 is a transverse vertical sectional view taken substantially on line 6—6 of Fig. 1 and illustrating a portion of the improved feeding mechanism.

Fig. 7 is a transverse, horizontal sectional view illustrating the feed gearing, parts being shown in elevation.

Fig. 8 is a transverse, vertical sectional view taken substantially on line 8—8 of Figs. 2 and 7.

Fig. 9 is an elevational view of the feeding end of the improved mining machine.

Fig. 10 is a detail sectional view taken on line 10—10 of Fig. 6.

Fig. 11 is a detail view illustrating a portion of the controlling clutch for the feed operating member.

Fig. 12 is a longitudinally extending, vertical sectional view taken substantially on line 12—12 of Fig. 7.

Fig. 13 is a fragmentary plan view, partially broken away in section to facilitate illustration, and illustrating a modified form of construction.

Fig. 14 is a central longitudinally extending, vertical sectional view taken on line 14—14 of Fig. 13.

Fig. 15 is a detail view illustrating a modified form of feed gearing when a feed drum and cable is substituted for the chain sprocket and feed chain.

In the form of the invention shown in Figs. 1 to 12 there is shown for purposes of illustration a mining machine designated as an entirety by the reference character 1 herein of the flexibly fed longwall type adapted to slide on its bottom 2 on the mine bottom. The machine carries at one end, herein the rear end, a pivoted cutter bar 3, the construction being such that after the cutter bar has been inserted under the coal face, the frame portion of the machine, generally indicated at 4, may be disposed substantially at right angles to the cutter bar and moved longitudinally along the face and relative to flexible feeding means of improved form herein including a flexible feeding member 5, herein a feed chain, likewise disposed along the face and operatively connected to the opposite end of the machine from the cutter bar.

Referring more particularly to the machine, it will be noted that the same herein comprises three separate sections, i. e., a motor section 6, a front feed section 7, and a rear cutter mechanism carrying section

8, the feed and cutter mechanism carrying sections being herein disposed at opposite ends of the motor section. The feed and cutter sections are rigidly connected to the motor section at points above the bottoms of the sections as by a series of bolt connections 9 preferably disposed in side pockets in the section 6 as illustrated in Fig. 2 in such manner as to form a rigid, exceedingly low compact frame slidable on the mine bottom. More particularly, it will be noted that herein the upper and lower surfaces of the three sections 6, 7 and 8 are, as preferably, disposed in the same planes in such manner as to unite to form a single shoe adapted to permit free movement of the machine thereon over the mine bottom. Herein it will be noted a locking pin 3^a is provided which is adapted to be received in any one of a plurality of cutaway portions 4^a on the frame section 8, these cutaway portions herein being so disposed on the frame as to enable the cutter bar to be locked in longitudinal and opposite lateral positions. Moreover, it will be noted that the pin 3^a carries at its upper end a projecting pin 5^a adapted to receive one end of a double-ended hook 6^a (see Fig. 1) to which either end of the feed chain 5 is connectable to swing the cutter bar about its pivot in a manner to be later described. It will also be noted that the machine is of the invertible type and if desired may be turned onto its upper plane surface to operate as an overcutter in a manner clearly described in my copending application Ser. No. 619,839, filed Feb. 19, 1923. Operatively connected to the rear end of a motor 10, which is herein preferably of the usual reversible electric type housed within the motor section 6, is the cutting mechanism including the cutter bar 3 and which is substantially the same as that described in my copending application mentioned above. More particularly, it will be noted that this cutting mechanism includes a cutter bit carrying cutter chain 11 adapted to be circulated about the outer edges of the bar 3 by a usual cutter chain sprocket 12 (see Fig. 3). Referring more in detail to the driving connections, it will be observed that the rear end of the horizontal longitudinally extending armature shaft 13 of the motor 10 has suitably secured thereto by a key and screw connection 14 a clutch member 15 journaled in a ball bearing 16 suitably carried within the frame section 6. As illustrated, the clutch member 15 is internally bored as at 17 to receive a ball bearing 18 within which and a bearing 19 carried by the frame section 8 a shaft 20 is journaled, the shaft 20 being alined with the armature shaft 13. The shaft 20 has secured thereto by a key 21 a clutch member 22 disposed coaxially with the armature shaft and the member 22 is adapted to be connected by means of an axially movable internally toothed clutch member 23 in driving relation with the clutch member 15. The shiftable clutch member 23 is adapted to be actuated longitudinally by means of a shipper yoke 24 (see also Figs. 4 and 5) herein in the form of a bell-crank pivoted at 25 on the frame section 8 and provided with arms 26 and 27 cooperating with the shiftable clutch member 23 and a bifurcated member 28 respectively. The bifurcated member 28 engages a vertical pin 29 carried by the arm 27 and is in turn suitably carried by a cylindrical member 30 slidably mounted within a sleeve 31 disposed within a transversely disposed bore 32 formed in the side of the frame section 8. Moreover, the sleeve 31 has secured thereto as by radial studs 33 an operating member or grasping portion 34 and one of the studs 33^a is provided with an inwardly projecting pin 35 cooperating with a cam slot 36 formed in the member 30. Furthermore, the member 30 is provided with an upstanding portion or arm 37 having secured thereto at 38 within its upper end a transversely disposed rod 39 which is in turn secured at its opposite end as by a screw 40 within the upper end of an upstanding portion or arm formed on a cylindrical member 41 similar to the member 30, the member 41 likewise being slidably disposed within a cylindrical sleeve 42 rotatably mounted within the bore 43 coaxial with the bore 32 and formed on the opposite sides of the frame section. The sleeve 42 has connected thereto in a manner heretofore described in connection with the sleeve 31, an operating member or grasping portion 44. It will herein be noted that the pin 33^a may be mounted in either of the sleeve members 34 or 44 and by rotating whichever one of the members 34 or 44 carries the pin 33^a, the member 30, the rod 39 and the member 41 may be slid transversely of the machine relative to the sleeves 31 and 42 and the shipper yoke will consequently swing about its pivot 25, thus connecting or disconnecting the shiftable clutch member 23 to or from the drive sprocket 15 and the clutch member 22. Again referring to the driving connections it will be observed that the shaft 20 has preferably formed thereon a bevel pinion 45 which meshes with a bevel gear 46 rotatable in a horizontal plane on a vertically disposed axis and has secured thereto and rotatable therewith a spur pinion 47 which meshes with a large spur gear 48 suitably connected to the chain sprocket 12 which cooperates with and drives the cutter chain 11 in a well known manner.

More specifically describing the improved feeding mechanism, it will be observed that the forward end of the armature shaft 13 of the driving motor is journaled in a ball

bearing 50 suitably carried within the motor section 6. As clearly shown in Fig. 7, the forward end of the armature shaft 13 has secured thereto by a key and screw connection 52 a spur pinion 53 which meshes with a spur gear 54 keyed as at 55 to a shaft 56 journaled at its opposite ends in suitable ball bearings 57 carried within the feed frame 7. The gear 54 in turn meshes with a spur gear 58 keyed as at 59 to a shaft 60 arranged parallel with the shafts 13 and 56 and disposed in the same horizontal plane therewith. The shaft 60 is journaled at its opposite ends in ball bearings 61 suitably carried by the feed frame section. As clearly shown in Fig. 7, the shaft 60 has preferably formed integral therewith at its forward end a bevel pinion 62 which meshes with a bevel gear 63 keyed as at 64 to a horizontal shaft 65 arranged transversely of the machine in advance of the shafts 13, 56, and 60. The shaft 65 has secured thereto at its inner end by a key 66 a spur gear 67, the latter being internally bored at 68 to receive a ball bearing 69, the latter being supported by a projecting stud or dowel 70 suitably secured by screws 71 within the feed frame section. It will also be observed that the bevel gear 63 is internally bored at 72 to receive a ball bearing 73, the latter being likewise supported by a projecting stud or dowel 74 secured by screws 75 to the side of the frame section 7.

Referring more particularly to Fig. 8, it will be noted that the spur gear 67 meshes with a spur gear 76 keyed as at 77 to a shaft 78 disposed above and parallel with the shaft 65. The inner end of the shaft 78 is journaled in a ball bearing 79 carried within the bore 80 formed in the gear 76, the bearing 79 being supported by a projecting stud or dowel 81 similar to the dowel 70 heretofore described. The opposite end of the shaft 78 is journaled in a ball bearing 82 suitably carried within a detachable bracket member 83 supported and positioned by a dowel member 84 suitably rigidly secured to the feed frame section. It will be observed that by providing the detachable dowels 70, 74, 81, and 84 it is possible to remove the shafts 65 and 78 from their supports with facility, these dowels also providing an exceedingly simple bearing and supporting structure for the shafts. Furthermore, upon removal of the top plate and dowels, the shafts may be lifted bodily from the machine. The shafts 65 and 78 have respectively rigidly secured thereto intermediate their ends worms 85 and 86, the former having teeth of steeper lead than the teeth of the latter. The worms 85 and 86 rotate in opposite directions. As clearly shown in Fig. 6, the worms 85, 86 mesh respectively with worm gears 87 and 88 rotatable about a vertical axis and having hub portions journaled on ball bearings 89 suitably carried by the machine frame. As shown, the hub portions of the gears 87 and 88 each carry spaced alined ball bearings 90 within which the opposite ends of a vertically disposed shaft 91 are journaled. The shaft 91 has secured thereto intermediate its ends an elongated spur pinion 92 which meshes with a spur gear 93 connectible in a manner to be later described to a vertically disposed shaft 94 disposed in the longitudinal center of the machine and journaled in ball bearings 95, the upper bearing being suitably carried by a detachable cover plate 96. The shaft 94 has secured thereto by a key 97 a feed operating member 98 herein in the form of a chain sprocket adapted to cooperate with the feed chain 5 to feed the machine bodily over the mine bottom in a manner to be later described.

Improved mechanism is provided for alternatively frictionally connecting the fast and slow speed worm gears 87 and 88 to the shaft 91 and this mechanism specifically comprises a pivoted shipper yoke 99 carrying at its inner end suitable rollers 100 which are adapted to engage the plane surfaces of cylindrical clutch applying members 101 and 102, the members 101 and 102 being positioned within the gears 87, 88, respectively, by means of radially expansible split rings 103 seated within annular grooves 104 formed within the gears. As clearly shown in Fig. 6, the members 101 and 102 are each provided with internal gear teeth 105 which are interlocked with the teeth of the pinion 92. Furthermore, each of the members 101, 102 carries a series of clutch discs 106 which are interleaved with a corresponding series of clutch discs 107 carried by the hubs of the worm gears 87, 88. In accordance with the illustrative form the outer end of the shipper yoke 99 is provided with a bifurcated portion 108 straddling an enlarged portion 109 of a vertically disposed rod 110 threadedly connected at its lower end within the machine frame, the enlarged portion 109 having flattened sides which engage the inner sides of the bifurcated portion 108. The bifurcated portion 108 is provided with arcuate or rounded ends which engage upper and lower yokes 111 and 112, respectively engaging the upper and lower surfaces of the enlarged portion 109 of the rod. The lower yoke 112 has threadedly connected thereto bolts 113 which engage coiled springs 114 carried within recesses formed in the upper yoke 111. It will thus be evident that the bifurcated member 108 and the resiliently connected yokes 111, 112 form a yieldable pivoted mounting for the shipper yoke, the coiled springs 114 being adapted to yield upon overload of either of the controlling clutches. Improved means are provided for swinging the shipper yoke about its pivot comprising a crank pin or eccentric 115 formed integral with a rotatable rod 116 journaled at its opposite ends within bear-

ings suitably carried by the frame section 7. Secured to the outer end of the rod 116 by a key 117 is an operating handle 118 conveniently located at the forward end of the machine. Rotation of the rod 116 is limited by a pin and slot connection 119. It will thus be evident that rotation of the handle 118, and consequently the rod 116, effects swinging movement of the shipper yoke and consequently one or the other of the controlling clutches connecting the gears 87 and 88 to the shaft 91 is applied, causing rotation of the latter at either a fast speed in one direction, or at a slow speed in the opposite direction.

Improved clutch mechanism is provided for connecting the spur gear 93 to the shaft 94 and this clutch mechanism specifically comprises external clutch teeth 120 formed on the flanged portion of the shaft 94. Internal clutch teeth 121 are formed on a clutch ring 122 movably mounted in a recessed portion of the gear 93 as clearly shown in Fig. 6 and these clutch teeth engage clutch teeth 122^a formed on the gear 93. The teeth 121 are adapted to cooperate with the clutch teeth 120 as hereinafter described. The clutch ring 122 is retained within the recess in the gear 93 by means of a radially expansible split ring 123, the latter forming a projecting shoulder with which a radial flange 124 on the clutch ring is adapted to engage. The clutch ring 122 is normally yieldably maintained against the ring 123 by means of coiled springs 125. As shown in Figs. 6, 7, 11 and 12, secured within the frame section 7 by screws 126 is an annular member 127 centrally cut away to receive the hub of the spur gear 93. Furthermore, the side of the member 127 is cut away as at 128 to clear the worm gear 88. The member 127 is provided with a depending flanged portion having formed therein inclined cam slots 129 with which radially located pins 130 carried by a rotatable shipper ring 131 cooperate, the shipper ring carrying a series of rollers 132 which engage the upper plane surface of the clutch ring 122, as clearly shown in Fig. 6. The shipper ring 131 is provided with laterally projecting lugs or teeth 133 with which a tooth or lug 134 formed on the horizontal rod 135 cooperates, the rod 135 being axially movable transversely of the machine and guided at its opposite ends in bores 136 formed in the machine frame. Rotative movement of the rod 135 is prevented by means of a pin and slot connection 137. As illustrated, the rod 135 has threadedly connected thereto an eye member 138 which is pivotally connected (see also Fig. 9) as at 139 to a lever 140, the latter in turn being pivotally connected intermediate its ends at 141 on the front end of the machine frame adjacent the handle 118 (see Fig. 9) and is provided with a grasping portion 142. From the foregoing description it will be evident that when the operator grasps the portion 142 and swings the lever 140 about its pivot, the rod 135 is moved axially and the clutch ring 131 is consequently rotated. Rotation of the clutch ring 131 causes the pins 130 carried thereby to move downwardly within the inclined cam slots 129 consequently moving the clutch ring 122 downwardly, thereby moving the clutch 120 into interlocking engagement with the clutch teeth 121 and 122^a, therby effecting rotation of the shaft 94 and consequently rotation of the feed sprocket 98. It will be obvious that the feed sprocket 98 may be rotated or remain idle while the gear 93 continuously rotates. It will also be evident that when the clutch 120, 121 is connected and upon application of the clutches 106, 107 controlling connection of the worm gears to the shaft 91, the feed sprocket may be rotated in one direction at a slow speed and in the opposite direction at a higher speed. As clearly shown in Figs. 7 and 12, the forward end of the frame section 7 is cut away as at 144 to permit the gear 93 to mesh with a truck driving gear of any suitable form, thereby to enable the mining machine to drive the wheels of its transport truck in a well known manner.

Operatively associated with the feed operating member 98 is also improved guiding means for the flexible feeding member 5. These means are herein disposed in a chamber 145 extending transversely through the frame section 7 and in which the feed operating member is also disposed and preferably comprise two sets of guide sprockets 146 and 147 suitably journaled on vertical axes, the sprockets 146 being disposed adjacent to the feed operating member slightly in the rear thereof, while the sprockets 147 are disposed at the opposite front corners of the machine.

In the form of the invention shown in Figs. 13 to 15 it will be observed that the feed sprocket 98 has been removed from the shaft 94 and a spur pinion 150 substituted therefor, the pinion 150 meshing with internal gear teeth 151 formed on a large winding drum 152 disposed in the chamber 145. As clearly shown in Fig. 14, the winding drum 152 is journaled on spaced alined ball bearings 153 and 154 suitably carried within the frame section 7. The bearings 154 are carried by a detachable bottom plate 155 rigidly secured to the frame by means including a bolt 156 arranged coaxial with the winding drum and extending there-through, a spacing sleeve 157 being interposed between the bottom plate and the frame section. As shown in Fig. 13, the two sets of chain guide sprockets 146, 147 have been removed and a pair of suitable guide rolls 158 are provided at the opposite front corners of the machine. The drum 152 is adapted to be

driven through transmission gearing at fast or slow speeds in the same direction. To obtain a fast or slow speed of the winding drum in the same direction, the worm 85 of the gearing described above in the preferred form of the invention has been removed and a worm 159 substituted therefor, the teeth of the worm 159 being inclined in an opposite direction from the teeth on the worm 85. As the controlling clutches and the transmission mechanism are otherwise the same as those described in the preferred form of the invention, further description and illustration of the same is herein deemed unnecessary.

In the operation of the improved coal mining machine it will be evident that by reason of the improved construction it is made possible to operate the machine with equal facility as an overcutter or bottom cutter by simply turning the machine over, the frame being so constructed as to permit it to work with equal facility on its top or its bottom, while the cutting and feeding mechanisms and even the lubricating arrangement are similarly adapted to this dual service. Moreover, it will be observed that in any relation the flexible feeding element is adapted to operate if preferred in substantially the same plane as the cutter bar and that in either position of the machine it is possible for the flexible feeding element to be so arranged as to swing the bar in the desired direction to insert it by a swinging movement under the coal and then to move the machine bodily longitudinally along the coal face. More specifically, it will be noted that with the bar unlocked in the longitudinal or transport position as indicated by dotted lines in Fig. 1, the end of the chain 5 is connected to the hook 6^a in the manner as indicated by dotted lines in Fig. 1 by extending the chain from the feed operating member 98, along the outer side of the guide sprocket 146 outwardly around the other side of the guide sprocket 147 and then longitudinally along the machine to the hook. Thus a pull upon the feed chain at a cutting speed produced by suitable operation of the handle 118 to connect the clutch 106, 107 controlling the connection of the slow speed worm gear 88 to the shaft 91 causes the cutter bar to be swung from its longitudinal position to the full line position illustrated in Fig. 1. After the bar assumes the full line position shown in Fig. 1, it is suitably locked against further movement. After the bar has been thus adjusted, the feed chain is then disconnected from the hook and connected as shown in full lines in Fig. 1, the same then only being reversed relative to the guide sprocket 147 and then disposed laterally in advance of the machine to a fixed abutment, whereupon by similarly operating the handle 118 the machine would move along the face at a slow or cutting speed. If, on the other hand, it is desired for the machine to cut in the opposite direction relative to the same face, it will be evident that by rearranging the parts to the opposite side of the machine, the same results may be obtained, the chain being extended around the other guide sprockets 146, 147 at that time. When it is desired to move the machine about the mine at a high speed, the operator manipulates the handle 118, applying the clutch 106, 107, connecting the fast speed worm gear 87 to the shaft 91, consequently causing the feed sprocket 98 to rotate in an opposite direction at a fast speed, the feed sprocket then acting to draw in the other end portion of the feed chain. It will also be noted that when a winding drum and a cable is substituted for the feed sprocket and feed chain, the operation is substantially the same as that described above except that the free end of the feed cable may be wound in at either a fast or a slow speed, the cable being extended around the guide rolls 158 during the various operations of the machine. However, when the machine cuts in the opposite direction the cable must be rewound in an opposite direction on the drum.

As a result of this improved construction it will be observed that an exceedingly low, comparatively short, compact machine is produced and one which is accordingly adapted to use in even the lowest commercially workable veins of coal. Furthermore, this improved construction enables an exceedingly compact machine to be obtained wherein the length thereof is reduced to a minimum. Further, by reason of the provision of a machine equally adapted to be operated on its top or its bottom, it will be noted that while retaining this low compact characteristic a machine is produced which is equally well adapted to use as an overcutter or an undercutter, depending upon the circumstances in the particular mine. Attention is also directed to the fact that the control mechanism for the feed is exceedingly simple, involving only two controlling members capable of being operated quickly and with facility. Furthermore, by reason of the improved arrangement of the feeding mechanism it will be observed that it is not only possible to reduce the manufacturing costs to a minimum, but to enable the whole mechanism to be readily accessible whenever desired even in low coal and that it is also made possible to compact the feeding mechanism vertically and longitudinally to a marked degree and at the same time that this is made possible it is also made possible to provide large friction clutches of ample capacity well adapted to stand up under the most severe demands of service. These and other advantages of my improved construction will, however, be clearly apparent to those skilled in this art.

While I have in this application specifi-

cally described one form and a modification thereof which my invention may assume in practice, it will be understood that these forms of the same are 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, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and driving connections between said motor and feed operating member comprising worms rotatable on transversely extending horizontal axes, worm gears meshing respectively therewith, and separate friction controlling clutches arranged coaxially with said worm gears for alternatively connecting the latter in operative driving relation with said feed operating member.

2. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member comprising worms rotatable on transversely extending horizontal axes, worm gears meshing respectively therewith, and separate friction controlling clutches arranged coaxially with said worm gears for alternatively connecting the latter in operative driving relation with said feed operating member to effect rotation of the latter at different speeds.

3. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member comprising worms rotatable on transversely extending horizontal axes lying in the same vertical plane, worm gears meshing respectively therewith, and means for alternatively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter at different speeds.

4. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member comprising worms rotatable on transversely extending horizontal axes, worm gears meshing respectively therewith and disposed on vertical axes, and means for alternatively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter at different speeds.

5. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member comprising worms rotatable at different speeds on transversely extending horizontal axes lying in the same vertical plane, and worm gears meshing respectively therewith and rotatable thereby at different speeds, said worm gears being adapted to drive selectively said feed operating member at different speeds.

6. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member comprising worms rotatable at different speeds on transversely extending horizontal axes, and horizontal worm gears meshing respectively therewith and rotatable thereby at different speeds, said worm gears being adapted to drive selectively said feed operating member at different speeds.

7. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member comprising worms rotatable at different speds on transversely extending horizontal axes, worm gears meshing respectively therewith, and separate friction controlling clutches arranged coaxially with said worm gears for selectively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter at different speeds.

8. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member comprising worms rotatable at different speeds on transversely extending horizonal axes, worm gears meshing respectively therewith, and separate friction controlling clutches arranged coaxially with said worm gears for selectively connecting said worm gears for selectively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter at different speeds.

9. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member comprising worms rotatable on transversely extending horizontal axes, worm gears meshing respectively

therewith and rotating in opposite directions, a spur gear arranged coaxially with said worm gears and operatively connected to said feed operating member, and means for alternatively connecting said worm gears in driving relation with said spur gear to effect rotation of the latter at different speeds in opposite directions.

10. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member comprising worms rotatable on transversely extending horizontal axes, worm gears meshing respectively therewith and rotating in opposite directions, a spur gear arranged coaxially with said worm gears and operatively connected to said feed operating member, and means for alternatively connecting said worm gears in driving relation with said spur gear to effect rotation of the latter at different speeds in opposite directions.

11. In a mining machine, a horizontal motor having its axis extending longitudinally of the machine, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and driving connections between said motor and feed operating member comprising worms rotatable on transversely extending horizontal axes, worm gears meshing respectively therewith, and separate friction controlling clutches arranged coaxially with said worm gears, one individual to each gear, for alternatively connecting the worm gears in driving relation with said feed operating member to effect rotation of the latter at different speeds.

12. In a mining machine, a horizontal motor having its axis extending longitudinally of the machine, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member comprising worms rotatable on transversely extending horizontal axes lying in vertical planes perpendicular to the central longitudinal vertical plane of the machine, worm gears rotating on vertical axes and meshing respectively therewith, a spur gear arranged coaxially with said worm gears and operatively connected to said feed operating member, and means for alternatively connecting said worm gears in driving relation with said spur gear to effect rotation of the later at different speeds.

13. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member comprising worms rotatable on transversely extending horizontal axes lying in the same vertical plane, worm gears meshing respectively therewith, a spur gear arranged coaxially with said worm gears, a spur gear arranged coaxially with said feed operating member and meshing with said spur gear, and means for alternatively connecting said worm gears in driving relation with said first mentioned spur gear to effect rotation of the latter at different speeds.

14. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member comprising worms rotatable on transversely extending horizontal axes lying in the same vertical plane, worm gears meshing respectively therewith, a spur gear arranged coaxially with said worm gears, a larger spur gear arranged coaxially with said feed operating member and meshing with said spur gear, means for alternatively connecting said worm gears in driving relation with said first mentioned spur gear to effect rotation of the latter at different speeds, and releasable means for connecting said last mentioned spur gear to said feed operating member.

15. In a mining machine, a motor having a motor pinion, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and driving connections between said motor and feed operating member comprising a spur gear meshing with said motor pinion, a spur gear meshing with said gear, a bevel pinion rotatable with said last mentioned gear, a bevel gear meshing with said pinion and rotatable on a horizontal transversely extending axis, a worm rotatable with said bevel gear, a worm gear meshing with said worm and disposed on a vertical axis, and driving connections between said worm gear and said feed operating member.

16. In a mining machine, a motor having a motor pinion, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and driving connections between said motor and feed operating member comprising a spur gear meshing with said motor pinion, a spur gear meshing with said gear, a bevel pinion rotatable with said last mentioned gear, a bevel gear meshing with said pinion and rotatable on a horizontal transversely extending axis, a worm rotatable with said bevel gear, a worm gear meshing with said worm and disposed on a vertical axis, and driving connections between said worm gear and said feed operating member including a controlling clutch.

17. In a mining machine, a motor, feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member including a horizontal shaft extending transversely of the machine, a second shaft arranged parallel with and above said shaft, gearing connecting said shafts, fast and slow speed worms carried by said shafts respectively, worm gears meshing with said worms, and means for alternatively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter at different speeds.

18. In a mining machine, a motor, feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member including a horizontal shaft extending transversely of the machine, a second shaft arranged parallel with and above said shaft, gearing connecting said shafts, fast and slow speed worms carried by said shafts respectively, worm gears meshing with said worms, and means for alternatively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter at different speeds.

19. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member comprising a horizontal shaft extending transversely of the machine, a second shaft arranged parallel with and above said shaft, gearing connecting said shafts, fast and slow speed worms carried by said shafts respectively, worm gears meshing with said worms, and means including friction clutches arranged coaxially with said worm gears for alternatively connecting the latter in driving relation with said feed operating member to effect rotation of the latter at different speeds.

20. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means and plural speed driving connections between said motor and feed operating member comprising a horizontal shaft extending transversely of the machine, a second shaft arranged parallel with and above said shaft, gearing connecting said shafts, fast and slow speed worms carried by said shafts respectively, worm gears meshing with said worms, and means including friction clutches arranged coaxially with said worm gears for alternatively connecting the latter in driving relation with said feed operating member to effect rotation of the latter at different speeds.

21. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member including a horizontal shaft extending transversely of the machine, a second shaft arranged parallel with and above said shaft, gearing connecting said shafts, fast and slow speed worms carried by said shafts respectively, worm gears meshing with said worms, a spur gear arranged coaxially with said worm gears and operatively connected to said feed operating member, and means for alternatively connecting said spur gear in driving relation with said worm gears to effect rotation of said spur gear at different speeds.

22. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member including a horizontal shaft extending transversely of the machine, a second shaft arranged parallel with and above said shaft, gearing connecting said shafts, fast and slow speed worms carried by said shafts respectively, worm gears meshing with said worms, a spur gear arranged coaxially with said worm gears and operatively connected to said feed operating member, and means for alternatively connecting said spur gear in driving relation with said worm gears to effect rotation of said spur gear at different speeds including friction clutches arranged coaxially with the latter.

23. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member including a horizontal shaft extending tranversely of the machine and disposed in a vertical plane perpendicular to the central longitudinal vertical plane of the machine, a second shaft arranged parallel with said shaft, gearing connecting said shafts, fast and slow speed worms carried by said shafts respectively, worm gears meshing with said worms, a spur gear arranged coaxially with said worm gears and operatively connected to said feed operating member, and means for alternatively connecting said spur gear in driving relation with said worm gears to effect rotation of said spur gear at different speeds including friction clutches arranged coaxially with said worm gears and one individual to each of the same.

24. In a mining machine, a motor, and feeding means driven thereby including a

feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member including a horizontal shaft extending transversely of the machine, a second shaft arranged parallel with and above said shaft, gearing connecting said shafts, fast and slow speed worms carried by said shafts respectively, worm gears meshing with said worms, a spur gear arranged coaxially with said worm gears and operatively connected to said feed operating member, and means for alternatively connecting said spur gear in driving relation with said worm gears to effect rotation of said spur gear at different speeds including friction clutches arranged coaxially with the latter.

25. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member including a bevel pinion rotatable on an axis parallel with the motor axis, a bevel gear meshing therewith, a horizontal shaft extending transversely of the machine and to which said bevel gear is secured, a second shaft arranged parallel with and above said shaft, gearing connecting said shafts, fast and slow speed worms carried by said shafts respectively, worm gears meshing with said worms, and means for alternatively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter at different speeds.

26. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member including a bevel pinion rotatable on an axis parallel with the motor axis, a bevel gear meshing therewith, a horizontal shaft extending transversely of the machine and to which said bevel gear is secured, a second shaft arranged parallel with and above said shaft, gearing connecting said shafts, fast and slow speed worms carried by said shafts respectively, worm gears meshing with said worms, and means for alternatively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter at different speeds.

27. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member including a bevel pinion rotatable on an axis parallel with the motor axis, a bevel gear meshing therewith, a horizontal shaft extending transversely of the machine and to which said bevel gear is secured, a second shaft arranged parallel with and above said shaft, gearing connecting said shafts, fast and slow speed worms carried by said shafts respectively, worm gears meshing with said worms and rotating on a vertical axis, and means for alternatively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter at different speeds.

28. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member including a bevel pinion rotatable on an axis parallel with the motor axis, a bevel gear meshing therewith, a horizontal shaft extending transversely of the machine and to which said bevel gear is secured, a second shaft arranged parallel with and above said shaft, gearing connecting said shafts, fast and slow speed worms carried by said shafts respectively, worm gears meshing with said worms and rotating on a vertical axis, and means for alternatively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter at different speeds.

29. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and fast and slow speed transmission means between said motor and feed operating member whose elements all rotate on relatively fixed axes during drive of said feed operating member at different speeds, said transmission means including worm gears each rotatable about a vertical axis and selectively operable to drive said member at different speeds in opposite directions.

30. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and fast and slow speed transmission means between said motor and feed operating member whose elements all rotate on relatively fixed axes, during drive of said feed operating member at different speeds, said transmission means including worm gears each rotating on a vertical axis and selectively operable to drive said member at different speeds in opposite directions.

31. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and fast and slow speed transmission means between said motor and feed operating member including worms rotatable on axes lying in the same vertical plane extending transversely of the machine and coaxially arranged worm gears meshing respectively with said worms, and means for

only alternatively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter at fast and slow speeds.

32. In a mining machine, a horizontal motor having a low compact casing resting directly on the mine bottom, the vertical dimension of the motor substantially determining the height of the machine, and feeding means driven by said motor and included substantially within the vertical limits thereof including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and fast and slow speed transmission means between said motor and feed operating member including worms rotatable on axes lying in the same vertical plane extending transversely of the machine and coaxially arranged worm gears meshing respectively with said worms, and means for only alternatively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter at fast and slow speeds.

33. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and fast and slow speed transmission means between said motor and feed operating member including coaxially arranged worm gears selectively operable to drive said member in opposite directions and rotatable about a vertical axis and a coaxial spur gear interposed between and selectively driven by said worm gears and a gear projecting between said worm gears and meshing with said coaxial spur gear.

34. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and fast and slow speed transmission means between said motor and feed operating member to effect rotation of the latter in a direction to effect feed of the machine including coaxially arranged worm gears selectively operable to drive said member in opposite directions and disposed on an axis parallel with the axis of said feed operating member and gearing driven by said worm gears and including a gear projecting between said worm gears, said worm gears and said gear rotating in parallel horizontal planes.

35. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and fast and slow speed transmission means between said motor and feed operating member including coaxially arranged worm gears rotatable about a vertical axis, and means for only alternatively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter in a direction to effect feed of the machine at fast and slow speeds.

36. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and fast and slow speed transmission means between said motor and feed operating member including coaxially arranged worm gears disposed on an axis parallel with the axis of said feed operating member, and means for only alternatively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter in a direction to effect feed of the machine at fast and slow speeds.

37. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and fast and slow speed transmission means between said motor and feed operating member including parallel worms rotatable on horizontal axes extending transversely of the machine and lying in vertical planes perpendicular to the central longitudinal vertical plane of the machine and selectively operative to drive said feed operating member at fast and slow speeds.

38. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and fast and slow speed transmission means between said motor and feed operating member including parallel worms rotatable on horizontal axes extending transversely of the machine and lying in vertical planes perpendicular to the central longitudinal vertical plane of the machine, and coaxially arranged worm gears meshing with said worms respectively and selectively operative to drive said feed operating member at fast and slow speeds.

39. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and fast and slow speed transmission means between said motor and feed operating member including parallel worms rotatable on horizontal axes extending transversely of the machine and lying in vertical planes perpendicular to the central longitudinal vertical plane of the machine, coaxially arranged worm gears meshing with said worms respectively, and means for alternatively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter at fast and slow speeds.

40. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and fast and slow speed transmission means between said motor and feed operating member including parallel worms rotatable on horizontal axes extend-

ing transversely of the machine and lying in vertical planes perpendicular to the central longitudinal vertical plane of the machine and selectively operative to drive said feed operating member at fast and slow speeds.

41. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and fast and slow speed transmission means between said motor and feed operating member including parallel worms rotatable on horizontal axes extending transversely of the machine and lying in vertical planes perpendicular to the central longitudinal vertical plane of the machine, and coaxially arranged worm gears meshing with said worms respectively and selectively operable to drive said feed operating member at fast and slow speeds.

42. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and fast and slow speed transmission means between said motor and feed operating member including parallel worms rotatable on horizontal axes extending transversely of the machine and lying in vertical planes perpendicular to the central longitudinal vertical plane of the machine, coaxially arranged worm gears meshing with said worms respectively, and means for alternatively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter at fast and slow speeds.

43. In a mining machine, a motor, and machine feeding mechanism driven thereby including a feed operating member adapted to cooperate with flexible feeding means, and plural speed transmission means between said motor and feed operating member including coaxial fast and slow speed terminal gears rotatable about a vertical axis, and friction clutches coaxial with said gears, one individual to each gear, for selectively connecting the same in driving relation with said feed operating member to effect rotation of the latter in a direction to effect feed of the machine at a plurality of speeds.

44. In a mining machine, a motor, and machine feeding mechanism driven thereby including a feed operating member rotatable about a vertical axis and adapted to cooperate with flexible feeding means, and plural speed transmission means between said motor and feed operating member including coaxial fast and slow speed terminal gears rotatable about a vertical axis, and friction clutches coaxial with said gears, one individual to each gear, for selectively connecting the same in driving relation with said feed operating member to effect rotation of the latter in a direction to effect feed of the machine at a plurality of speeds.

45. In a mining machine, a motor having its axis extending longitudinally of the machine, cutting mechanism driven from one end of said motor, and feeding mechanism driven from the opposite end of said motor including a feed operating member adapted to cooperate with flexible feeding means, and plural speed transmission means between said motor and feed operating member including coaxial fast and slow speed terminal gears rotatable about a vertical axis, and friction clutches coaxial with said gears, one individual to each gear, for selectively connecting the same in driving relation with said feed operating member to effect rotation of the latter in a direction to effect feed of the machine at a plurality of speeds.

46. In a mining machine, a motor, and feeding means driven thereby including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, and fast and slow speed transmission means between said motor and feed operating member including coaxially arranged oppositely rotatable worm gears rotatable about a vertical axis and selectively operable to drive said feed operating member in opposite directions, said feed operating member being rotatable in one direction to draw in said flexible feeding means at a relatively slow speed and in the opposite direction to draw in said flexible feeding means at a relatively fast speed without changing the relation to said flexible feeding means relative thereto.

47. In a mining machine, a machine frame slidable on its bottom on the mine bottom, a motor carried thereby and having its power shaft extending longitudinally of the machine, cutting mechanism driven from one end of said motor, and feeding mechanism including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said feed operating member and the opposite end of said motor to effect rotation of said member in a direction to feed the machine at a relatively slow cutting speed and at a relatively high machine moving speed and including coaxial fast and slow speed worm wheels continuously rotatable on a vertical axis during the feeding operation and selectively operable to drive said feed operating member at fast and slow predetermined speeds, one of said worm wheels being disconnected from said feed operating member while the other worm wheel is connected in operative driving relation therewith during driving of said member at either speed.

48. In a mining machine, a machine frame slidable on its bottom on the mine bottom, a

motor carried thereby and having its power shaft extending longitudinally of the machine, cutting mechanism driven from one end of said motor, and feeding mechanism including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said feed operating member and the opposite end of said motor to effect rotation of said member in a direction to feed the machine at a relatively slow cutting speed and at a relatively high machine moving speed and including coaxial fast and slow speed worm wheels continuously rotatable on a vertical axis during the feeding operation and selectively operable to drive said feed operating member at fast and slow predetermined speeds, and worms rotating on parallel axes and meshing with said worm wheels respectively, one of said worm wheels being disconnected from said feed operating member while the other worm wheel is connected in operative driving relation therewith during driving of said member at either speed.

49. In a mining machine, a machine frame slidable on its bottom on the mine bottom, a motor carried thereby and having its power shaft extending longitudinally of the machine, cutting mechanism driven from one end of said motor, and feeding mechanism including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said feed operating member and the opposite end of said motor including coaxial fast and slow speed worm wheels rotatable on a vertical axis and selectively operable to drive said feed operating member at fast and slow speeds, and worms rotating on parallel axes lying in a vertical plane extending transversely of the machine and meshing with said worm wheels respectively and gearing connecting said worms together for simultaneous rotation.

50. In a mining machine, a machine frame slidable on its bottom on the mine bottom, a motor carried thereby and having its power shaft extending longitudinally of the machine, cutting mechanism driven from one end of said motor, and feeding mechanism including a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said feed operating member and the opposite end of said motor to effect rotation of said member in a direction to feed the machine at a relatively slow cutting speed and at a relatively high machine moving speed and including coaxial fast and slow speed worm wheels rotatable on a vertical axis and a plurality of friction clutches coaxial with said worm wheels, one individual to each of the same, for selectively connecting the same in driving relation with said feed operating member.

51. In a mining machine of the type slidable on its bottom on the mine bottom during cutting, feed operating mechanism including a feed operating member adapted to cooperate with flexible feeding means, a motor, cutting mechanism driven from one end of said motor, and plural speed driving connections between said feed operating member and the opposite end of said motor to effect rotation of said member in a direction to feed the machine at a relatively slow cutting speed and at a relatively high machine moving speed and including coaxial fast and slow speed worm wheels rotatable on a vertical axis, a driving element coaxial with said worm wheels, and a plurality of friction clutches coaxial with said driving element for selectively connecting said worm wheels in driving relation with said element.

52. In a mining apparatus, in combination, a machine frame slidable on its bottom on the mine bottom, cutting mechanism carried by said machine frame, feeding mechanism carried by said machine frame including a feed operating member rotatable on a vertical axis and adapted to cooperate directly with flexible feeding means and actuating means for said member to effect feeding of the apparatus at a relatively slow cutting speed and at a relatively high moving speed and including a plurality of coaxial worm wheels disposed on axes parallel to a line parallel to the axis of rotation of said feed operating member, means whereby said worm wheels may only alternatively drive said feed operating member, and means for effecting rotation of said worm wheels at relatively different speeds including worms engaging respectively therewith.

53. In a mining apparatus, in combination, a machine frame slidable on its bottom on the mine bottom, cutting mechanism carried by said machine frame, feeding mechanism carried by said machine frame including a feed operating member rotatable on a vertical axis and adapted to cooperate directly with flexible feeding means and actuating means for said member to effect feeding of the apparatus at a relatively slow cutting speed and at a relatively high moving speed and including a plurality of coaxial worm wheels disposed on axes parallel to a line parallel to the axis of rotation of said feed operating member, means whereby said worm wheels may only alternatively drive said feed operating member, and means for effecting rotation of said worm wheels at relatively different speeds including worms engaging respectively therewith and rotating on parallel axes.

54. In a mining apparatus, in combination, a machine frame slidable on its bottom on the mine bottom, cutting mechanism carried by said frame, feeding mechanism carried by said frame including a feed operating

member rotatable on a vertical axis and adapted to cooperate directly with flexible feeding means and actuating means for said feed operating member to effect feeding of the apparatus at a relatively slow cutting speed and at a relatively high moving speed and including a plurality of coaxial worm wheels rotating on axes parallel to a line parallel to the axis of rotation of said feed operating member, means for effecting rotation of said worm wheels at different speeds including worms engaging respectively therewith, and means whereby said feed operating member may be driven by either of said worm wheels including clutch means coaxial with said worm wheels selectively engageable to cause the latter to act selectively as driving elements for said feed operating member.

55. In a mining apparatus, in combination, a machine frame slidable on its bottom on the mine bottom, cutting mechanism carried by said frame, feeding mechanism carried by said frame including a feed operating member rotatable on a vertical axis and adapted to cooperate directly with flexible feeding means and actuating means for said feed operating member to effect feeding of the apparatus at a relatively slow cutting speed and at a relatively high moving speed and including a plurality of coaxial worm wheels rotating on axes parallel to a line parallel to the axis of rotation of said feed operating member, means for effecting rotation of said worm wheels at different speeds including worms engaging respectively therewith and rotating on parallel axes, and means whereby said feed operating member may be driven by either of said worm wheels including clutch means coaxial with said worm wheels selectively engageable to cause the latter to act selectively as driving elements for said feed operating member.

56. In a mining apparatus, in combination, a machine frame slidable on its bottom on the mine bottom, cutting mechanism carried by said frame, feeding mechanism carried by said frame including a feed operating member rotatable on a vertical axis and adapted to cooperate with flexible feeding means, actuating means for said feed operating member to effect feeding of the apparatus at a relatively slow cutting speed and at a relatively high moving speed and including a plurality of coaxial worm wheels rotatable on axes parallel to a line parallel to the axis of rotation of said feed operating member, means whereby said worm wheels may only alternatively drive said feed operating member, and means for effecting rotation of said worm wheels at different speeds including oppositely rotating worms engaging respectively therewith.

57. In a mining apparatus, in combination, a machine frame slidable on its bottom on the mine bottom, cutting mechanism carried by said frame, feeding mechanism carried by said frame including a feed operating member rotatable on a vertical axis and adapted to cooperate directly with flexible feeding means and actuating means for said feed operating member to effect feeding of the apparatus at a relatively slow cutting speed and at a relatively high moving speed and including a plurality of coaxial worm wheels rotatable on axes parallel to a line parallel to the axis of rotation of said feed operating member, means whereby said worm wheels may only alternatively drive said feed operating member, and means for effecting rotation of said worm wheels at different speeds including worms engaging respectively therewith and rotating in opposite directions on parallel axes.

58. In a mining apparatus, in combination, a machine frame slidable on its bottom on the mine bottom, feed operating means thereon at one end thereof including a feed operating member adapted to cooperate directly with flexible feeding means, a motor adjacent the opposite end of said frame and having its axis extending longitudinally of the apparatus, cutting mechanism driven from one end of said motor, and driving connections between said feed operating member and the opposite end of said motor for effecting rotation of said member to feed the apparatus at a relatively slow cutting speed and at a relatively high moving speed and including a plurality of worms and coaxial worm gears meshing respectively therewith and rotatable about a vertical axis, said worm gearing being disposed intermediate said motor and said feed operating member, and means whereby said worm gears may only alternatively drive said feed operating member to effect feed at aforesaid speeds.

59. In a mining apparatus, in combination, a machine frame slidable on its bottom on the mine bottom, feed operating means thereon at one end thereof including a feed operating member adapted to cooperate directly with flexible feeding means, a motor adjacent the opposite end of said frame, cutting mechanism driven from one end of said motor, and driving connections between said feed operating member and the opposite end of said motor for effecting rotation of said member to feed the apparatus at a relatively slow cutting speed and at a relatively high moving speed and including a plurality of worms rotating in opposite directions and coaxial worm gears meshing respectively therewith and rotatable on a vertical axis, said worm gearing being disposed intermediate said motor and said feed operating member and means whereby said worm gears may only alternatively drive said feed operating member to effect feed at aforesaid speeds.

60. In a mining apparatus, in combination, a machine frame slidable on its bottom on

the mine bottom, feed operating means thereon at one end thereof including a feed operating member adapted to cooperate directly with flexible feeding means, a motor adjacent the opposite end of said frame and having its axis extending longitudinally of the apparatus, cutting mechanism driven from one end of said motor, and driving connections between said feed operating member and the opposite end of said motor for effecting rotation of said member to feed the apparatus at a relatively slow cutting speed and at a relatively high moving speed and including a plurality of worms rotating at different speeds and coaxial worm gears meshing respectively therewith and rotatable on a vertical axis, said worm gearing being disposed intermediate said motor and said feed operating member and means whereby said worm gears may only alternately drive said feed operating member to effect feed at aforesaid speeds.

61. In a mining apparatus, in combination, a machine frame slidable on its bottom on the mine bottom, feed operating means thereon at one end thereof including a feed operating member adapted to cooperate directly with flexible feeding means, a motor adjacent the opposite end of said frame and having its axis extending longitudinally of the apparatus, cutting mechanism driven from one end of said motor, and driving connections between said feed operating member and the opposite end of said motor for effecting rotation of said member to feed the apparatus at a relatively slow cutting speed and at a relatively high moving speed and including a plurality of worms rotating in opposite directions and at different speeds and coaxial worm gears meshing respectively therewith and rotatable on a vertical axis, said worm gearing being disposed intermediate said motor and said feed operating member, and means whereby said worm gears may only alternatively drive said feed operating member to effect feed at aforesaid speeds.

62. In a mining machine, a motor, and feeding means driven thereby comprising a feed operating member adapted to cooperate with flexible feeding means, and plural speed driving connections between said motor and feed operating member including worms rotating on horizontal axes lying in vertical planes perpendicular to the central longitudinal vertical plane of the machine, and worm gears meshing respectively therewith and rotating on vertical axes, said worm gears only being operable to effect rotation of said feed operating member selectively at different speeds.

63. In a mining machine, a motor, and feeding means driven thereby including a feed operating member adapted to cooperate directly with flexible feeding means and driving means therefor comprising fast and slow speed gear trains selectively operable to effect rotation of said feed operating member at fast and slow predetermined speeds, each gear train including a worm gear individual thereto and rotatable on a vertical axis, and friction clutches one coaxial with each worm gear for selectively connecting said worm gears in driving relation with said feed operating member to effect rotation of the latter at aforesaid speeds.

64. In a mining machine, a machine frame slidable on its bottom directly on the mine bottom during the cutting operation, a horizontal motor carried thereby having its axis horizontally disposed and extending longitudinally of the machine, said motor having a low compact casing resting directly on the mine bottom, the vertical dimension of said motor substantially determining the height of the machine, cutting mechanism driven from one end of said motor including a projecting cutter bar, and feeding means driven from the opposite end of said motor comprising a rotatable feed operating member adapted to cooperate with flexible feeding means, and driving connections between said motor and said feed operating member for effecting rotation of the latter at fast and slow predetermined speeds comprising separate fast and slow speed gear trains whose elements all rotate on relatively fixed axes and through which said feed operating member is selectively driven, each gear train including intermeshing worm reduction gearing.

65. In a mining machine, a machine frame slidable on its bottom directly on the mine bottom during the cutting operation, a horizontal motor carried thereby having its axis horizontally disposed and extending longitudinally of the machine, said motor having a low compact casing resting directly on the mine bottom, the vertical dimension of said motor substantially determining the height of the machine, cutting mechanism driven from one end of said motor including a projecting cutter bar, and feeding means driven from the opposite end of said motor comprising a rotatable feed operating member adapted to cooperate with flexible feeding means, and driving connections between said motor and said feed operating member for effecting rotation of the latter at fast and slow predetermined speeds comprising separate fast and slow speed gear trains, each gear train including intermeshing worm reduction gearing and clutch means for connecting said gear trains only alternatively in driving relation with said feed operating member.

66. In a mining machine, a machine frame slidable on its bottom directly on the mine bottom during the cutting operation, a horizontal motor carried thereby having its axis horizontally disposed and extending longitudinally of the machine, said motor having a low compact casing resting directly on the

mine bottom, the vertical dimension of said motor substantially determining the height of the machine, cutting mechanism driven from one end of said motor including a projecting cutter bar, and feeding means driven from the opposite end of said motor comprising a rotatable feed operating member rotatable about a vertical axis at the end of the machine remote from said cutter bar and adapted to cooperate with flexible feeding means, and driving connections between said motor and said feed operating member for effecting rotation of the latter at fast and slow predetermined speeds comprising separate fast and slow speed gear trains whose elements all rotate on relatively fixed axes and through which said feed operating member is selectively driven, each gear train including intermeshing worm reduction gearing.

67. In a mining machine, a machine frame slidable on its bottom directly on the mine bottom during the cutting operation, a horizontal motor carried thereby having its axis horizontally disposed and extending longitudinally of the machine, said motor having a low compact casing resting directly on the mine bottom, the vertical dimension of said motor substantially determining the height of the machine, cutting mechanism driven from one end of said motor including a projecting cutter bar, and feeding means driven from the opposite end of said motor comprising a rotatable feed operating member rotatable about a vertical axis at the end of the machine remote from said cutter bar and adapted to cooperate with flexible feeding means, and driving connections between said motor and said feed operating member for effecting rotation of the latter at fast and slow predetermined speeds comprising separate fast and slow speed gear trains, each gear train including intermeshing worm reduction gearing, and clutch means for connecting said gear trains only alternatively in driving relation with said feed operating member.

68. In a mining machine, a machine frame adapted to rest upon and slide in any direction over the mine bottom, a motor carried by said frame, cutting mechanism driven by said motor including a kerf cutter projecting from said frame, and feeding means driven by said motor including a feed operating member disposed on an axis lying in a vertical plane extending transversely of the machine and adapted to cooperate directly with flexible feeding means, and plural predetermined speed driving connections between said motor and said feed operating member including fast and slow speed worm gear trains each including a worm wheel rotatable on an axis parallel with the axis of said feed operating member, and means for only alternatively connecting said worm wheels in driving relation with said feed operating member to effect rotation of the latter in a direction to effect feed of the machine at either a fast or a slow speed.

69. In a mining machine, a machine frame adapted to rest upon and slide in any direction over the mine bottom, a horizontal motor carried by said frame and having a low compact casing resting directly on the mine bottom, the vertical dimension of said motor substantially determining the height of the machine, cutting mechanism driven by said motor including a kerf cutter projecting from said frame, and feeding means driven by said motor and included substantially within the vertical limits thereof including a feed operating member disposed on an axis lying in a vertical plane extending transversely of the machine and adapted to cooperate directly with flexible feeding means, and plural predetermined speed driving connections between said motor and said feed operating member including fast and slow speed worm gear trains each including a worm wheel, said worm wheels being coaxially arranged, and means for only alternatively connecting said worm wheels in driving relation with said feed operating member to effect rotation of the latter in a direction to effect feed of the machine at either a fast or a slow speed.

70. In a mining machine, a machine frame adapted to rest upon and slide in any direction over the mine bottom, a motor carried by said frame, cutting mechanism driven by said motor including a kerf cutter projecting from said frame, and feeding means driven by said motor including a feed operating member disposed on an axis lying in a vertical plane extending transversely of the machine and adapted to cooperate with flexible feeding means, and plural predetermined speed driving connections between said motor and said feed operating member including fast and slow speed worm gear trains each including a worm wheel rotatable on an axis parallel with the axis of said feed operating member, and friction clutches coaxial with said worm wheels, one individual to each worm wheel, for selectively connecting said worm wheels in driving relation with said feed operating member to effect rotation of the latter in a direction to effect feed of the machine at either a fast or a slow speed.

71. In a mining machine, a machine frame adapted to rest upon and slide in any direction over the mine bottom, a motor carried by said frame, cutting mechanism driven by said motor including a kerf cutter projecting from said frame, and feeding means driven by said motor including a feed operating member disposed on an axis lying in a vertical plane extending transversely of the machine and adapted to cooperate directly with flexible feeding means, and plural predetermined

speed driving connections between said motor and said feed operating member including fast and slow speed worm gear trains each including a worm wheel rotatable on an axis parallel with the axis of said feed operating member and a worm, said worms rotating on parallel axes at different speeds and meshing with said worm wheels respectively, and means for only alternatively connecting said worm wheels in driving relation with said feed operating member to effect rotation of the latter in a direction to effect feed of the machine at either a fast or a slow speed.

72. In a mining machine, a machine frame adapted to rest upon and slide in any direction over the mine bottom, a horizontal motor carried by said frame, and having a low compact casing resting directly on the mine bottom, the vertical dimension of said motor substantially determining the height of the machine, cutting mechanism driven by said motor including a kerf cutter projecting from said frame, and feeding means driven by said motor and included substantially within the vertical limits thereof including a feed operating member disposed on an axis lying in a vertical plane extending transversely of the machine and adapted to cooperate directly with flexible feeding means, and plural predetermined speed driving connections between said motor and said feed operating member including fast and slow speed worm gear trains each including a worm wheel and a worm, said worms rotating on parallel axes at different speeds and meshing with said worm wheels respectively, said worm wheels being coaxially arranged, and means for only alternatively connecting said worm wheels in driving relation with said feed operating member to effect rotation of the latter in a direction to effect feed of the machine at either a fast or a slow speed.

73. In a mining machine, a machine frame adapted to rest upon and slide in any direction over the mine bottom, a motor carried by said frame, cutting mechanism driven by said motor including a kerf cutter projecting from said frame, and feeding means driven by said motor including a feed operating member disposed on an axis lying in a vertical plane extending transversely of the machine and adapted to cooperate with flexible feeding means, and plural predetermined speed driving connections between said motor and said feed operating member including fast and slow speed worm gear trains each including a worm wheel rotatable on an axis parallel with the axis of said feed operating member and a worm, and worms rotating on parallel axes at different speeds and meshing with said worm wheels respectively, and friction clutches coaxial with said worm wheels, one individual to each worm wheel, for selectively connecting said worm wheels in driving relation with said feed operating member to effect rotation of the latter in a direction to effect feed of the machine at either a fast or a slow speed.

In testimony whereof I affix my signature.

MORRIS P. HOLMES.

CERTIFICATE OF CORRECTION.

Patent No. 1,815,872. Granted July 21, 1931, to

MORRIS P. HOLMES.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, line 77, for the misspelled word "therby" read thereby; page 6, line 99, claim 7, for "speds" read speeds; claim 8, line 119, strike out the words "gears for selectively connecting said worm"; page 9, line 115, claim 30, after "axis" strike out the comma; page 16, line 59, claim 73, for the word "and" second occurrence read said; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of November, A. D. 1931.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)