May 9, 1933. G. BODIN 1,907,719

MINING MACHINE

Original Filed June 11, 1928 3 Sheets-Sheet 1

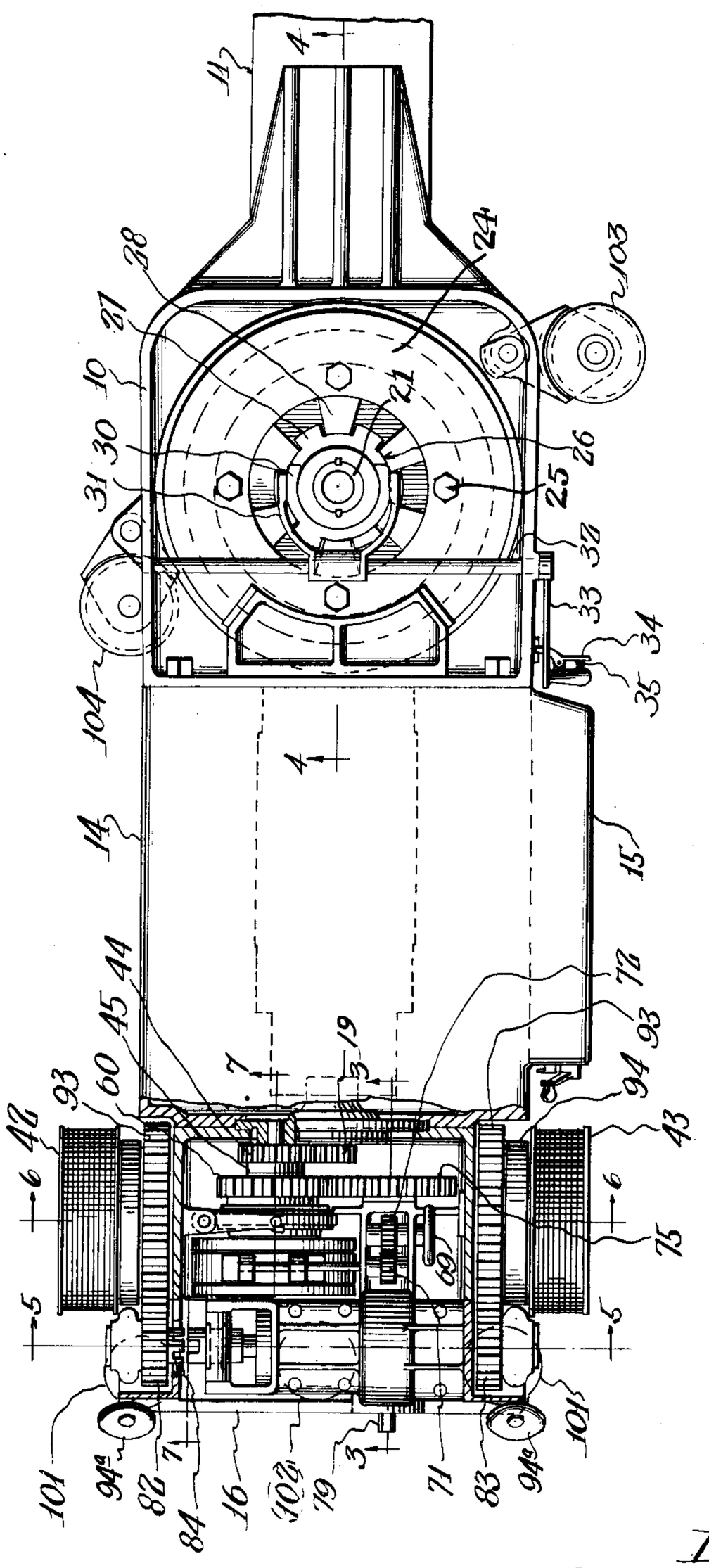

Fig. 1

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MINING MACHINE

Original Filed June 11, 1928 3 Sheets-Sheet 2

Fig. 2

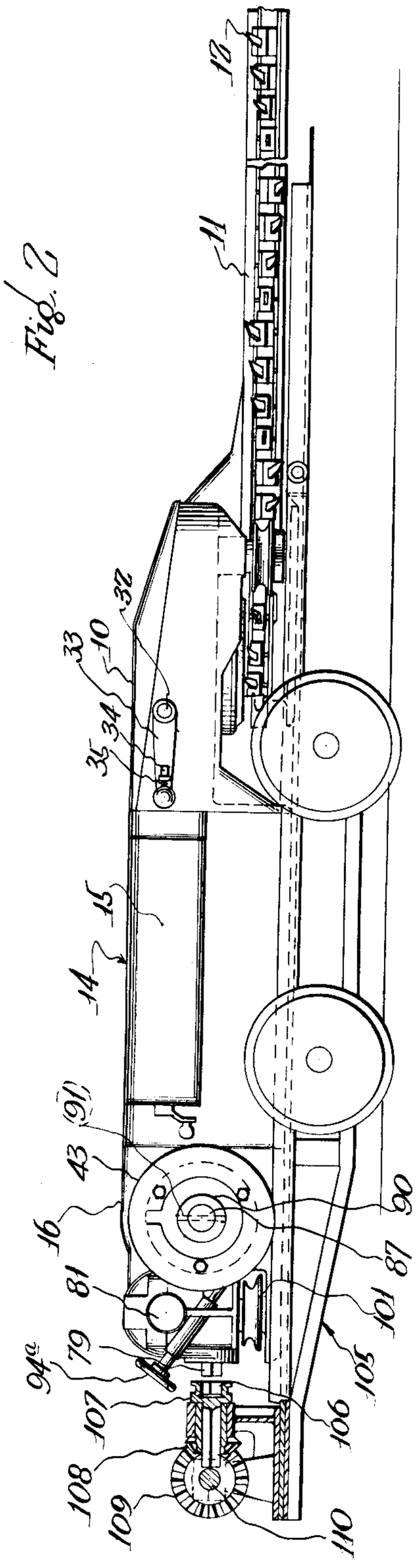

Fig. 4

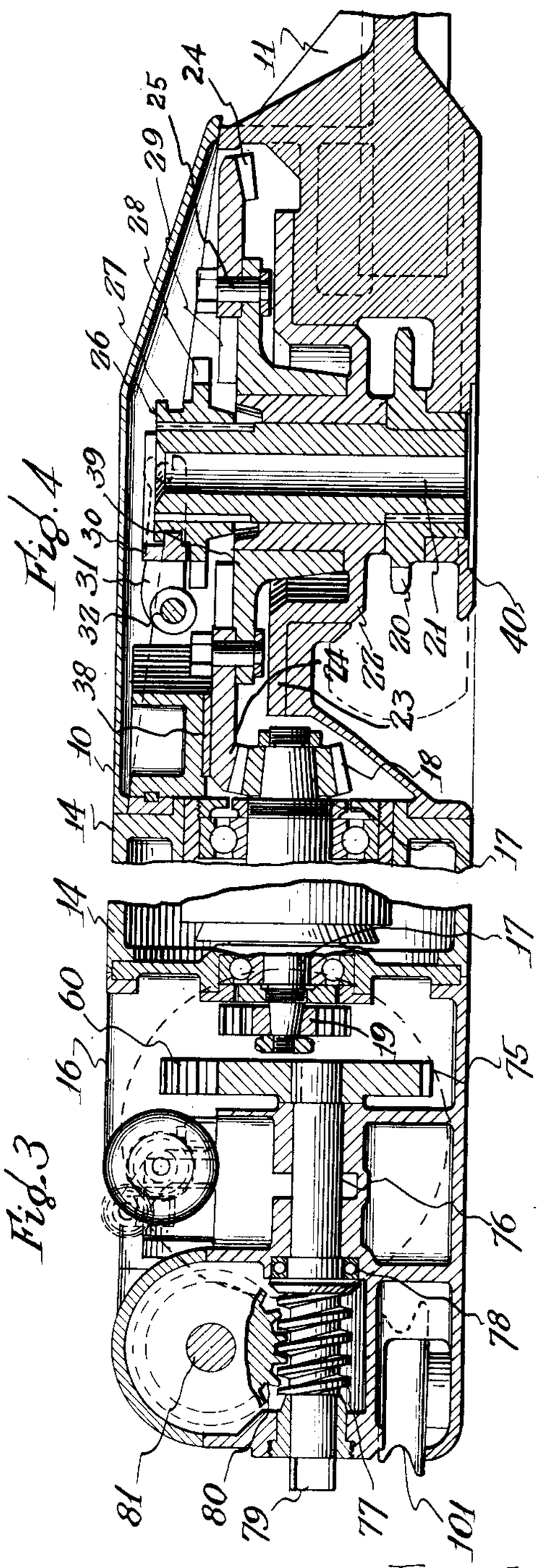

Fig. 3

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Original Filed June 11, 1928 3 Sheets-Sheet 3

Fig. 5

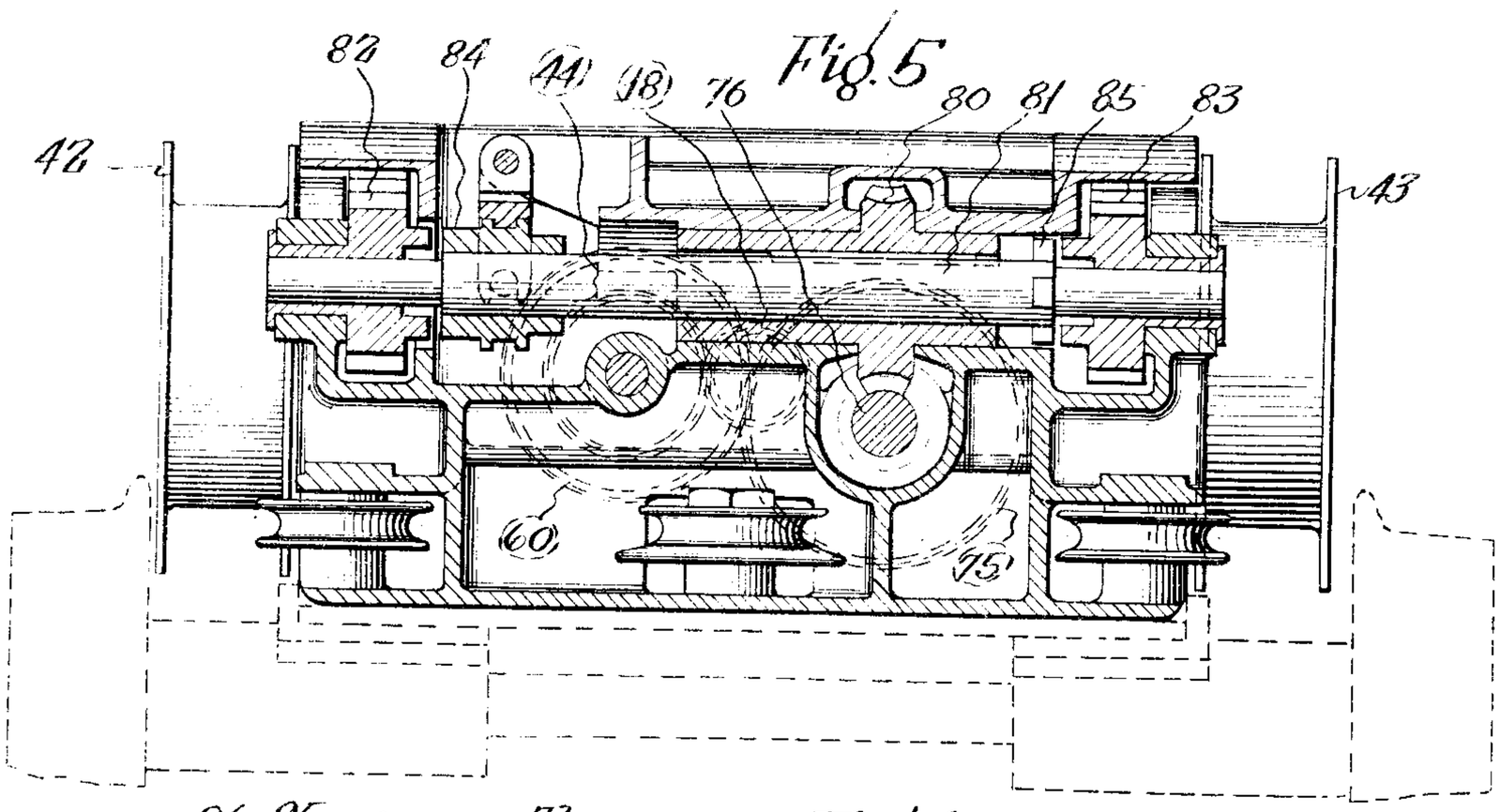


Fig. 6

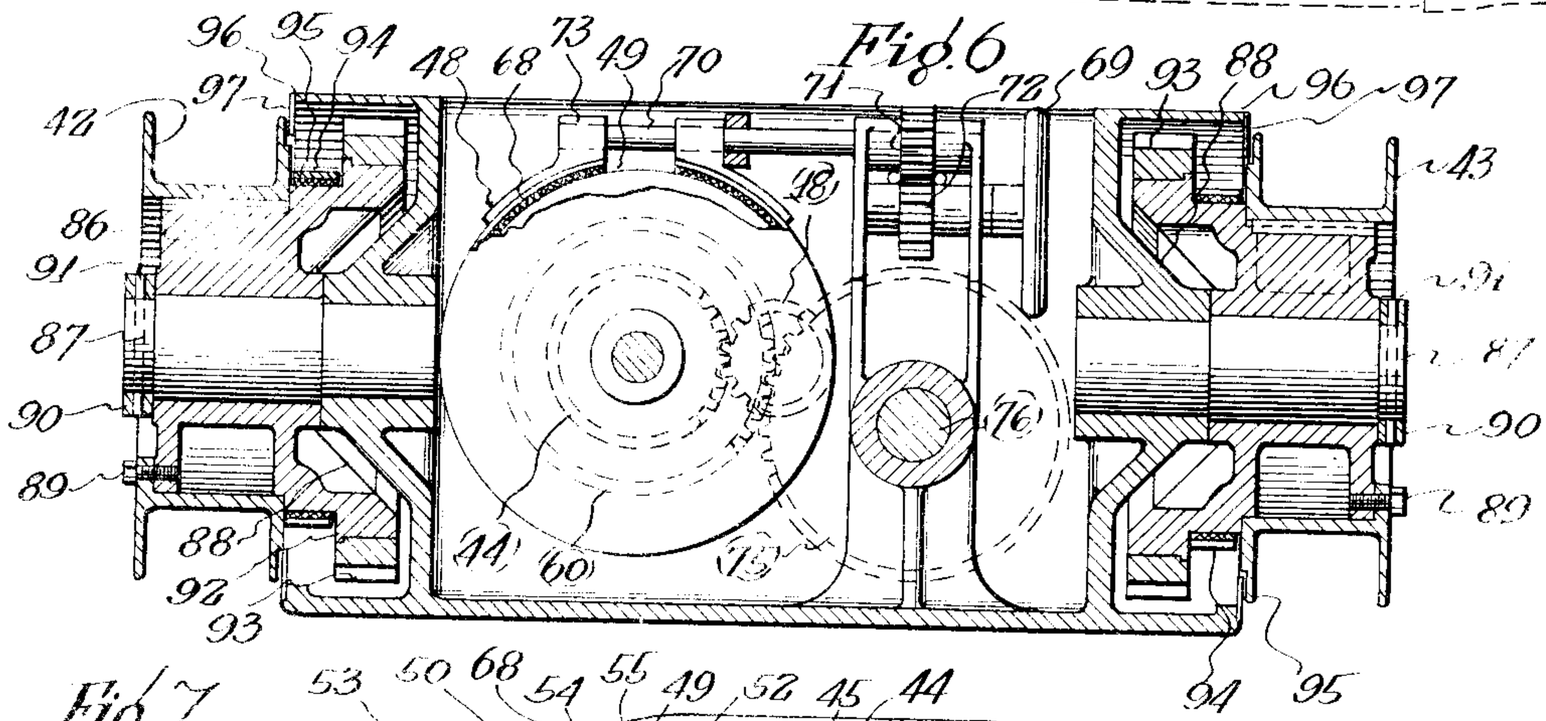
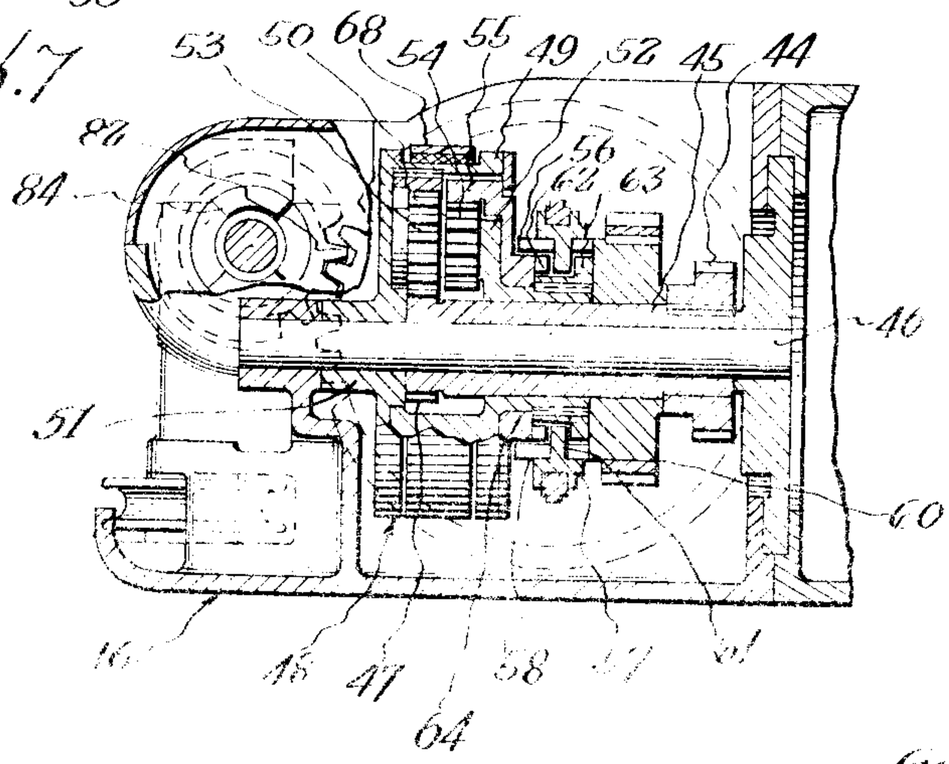


Fig. 7



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UNITED STATES PATENT OFFICE

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MINING MACHINE

Application filed June 11, 1928, Serial No. 284,349. Renewed December 4, 1931.

This invention relates to imrovements in mining machines and more particularly to coal cutting machines of the Shortwall type slidable on their bottoms on the mine bottom while undercutting the coal.

The principal object of this invention is to provide a kerf cutting mining machine of the shortwall type suitable for use in thin seams of coal. A further object of the invention is to provide a machine which is simple and compact of construction, and still is of such rugged construction as to meet all reasonable requirements in cutting coal. A further object is to provide a mining machine of an improved construction including two power driven drums on said machine of substantially the same size and construction whereby the machine may be more easily manipulated about the mine.

Other objects of the invention will appear from time to time in the following description of the machine embodying the several features of my invention.

The invention consists in the combination, construction and arrangement of the parts as will hereinafter be described in connection with the accompanying drawings, in which:

Figure 1 is a top plan view of the machine embodying the several features of my invention with parts of the rear housing broken away to show the gearing therein;

Figure 2 is a side elevation of the machine on a power truck with parts of the truck drive shown in section;

Figure 3 is an enlarged sectional view of the rearward portion of the machine taken on line 3—3 of Figure 1;

Figure 4 is an enlarged sectional view of the forward portion of the machine taken on line 4—4 of Figure 1;

Figure 5 is an enlarged sectional view of the machine taken on line 5—5 of Figure 1;

Figure 6 is an enlarged sectional view of the machine taken on line 6—6 of Figure 1; and

Figure 7 is an enlarged fragmentary sectional view of the rearward portion of the machine showing the details of the planetary driven taken on line 7—7 of Figure 1.

Referring now to the details shown in the drawings, the machine comprises a main frame made up in three sections arranged in longitudinal alignment with each other. A front frame section 10 constitutes a support for the cutting mechanism comprising a cutter bar 11 having an orbitally moving cutter chain 12 thereon driven from a suitable motor which will hereinafter be described. A central section 14 comprises the motor which is herein shown as an electric motor having a suitable controller or starting mechanism 15 thereon, while a rearward frame section 16 constitutes a support and housing for the feed operating devices and gear reduction mechanism therefor.

These sections are all readily detachable from each other rendering accessibility to all mechanism and electrical parts and the motor 14 has its bottom adapted to rest on the mine floor when the machine is performing its cutting operation and its height determines the height of the machine.

The motor 14 may be of any type but is herein shown as an electric motor having a longitudinally disposed armature secured to an armature shaft 17. The armature shaft 17 has a bevel driving pinion 18 at its forward end, and another driving pinion 19 at its rearward end.

The arrangement and construction of the cutter chain driving mechanism is illustrated in Figure 4 in detail. The cutter bar 11 is rigidly supported on the front frame section 10 and is relatively close to the ground in order that the cutter chain may cut a kerf at the mine bottom. The cutter chain 12 rides in suitable guides in the cutter bar 11 and is threaded around, and driven by a sprocket 20 on a hollow shaft 21. The hollow shaft 21 is journaled in a member 22 on the front frame section 10 near its central portion and the sprocket 20 is journaled on its hub in the bottom portion of the front frame section 10. It may here be observed that the inner surface of the member 22 serves as a bearing support for the hollow shaft 21 while its outer surface serves as a bearing support for a hub portion 39 of a bevel gear 24. A dished in portion of the member 22 surrounds the lower portion

of the hub 39 and a flange 23 projects outwardly therefrom for supporting the member 22 in the front frame section 10. The hollow shaft 21 is driven by the bevel gear 24 through a suitable clutch mechanism generally indicated at 26. The bevel gear 24 in turn is driven by the bevel driving pinion 18 on the armature shaft 17. The clutch indicated at 26 is a jaw clutch of the ordinary type and comprises a member 27 feathered to the hollow shaft 21 having jaws 28 thereon engageable with jaws 29 on the bevel gear 24.

A yoke 30 rides in a suitable groove in the member 27 and has a fork 31 pivoted thereto. The fork 31 is fixed to a rod 32. The rod 32 in turn has a crank handle 33 at one end thereof so that movement of the handle 33 one way or the other moves the member 27 vertically to engage or disengage the jaws 28 with the jaws 29. A locking means which may be of any suitable type is provided to hold the jaws 28 in disengagement from the jaws 29. The locking means herein shown comprises a lever 34 pivoted to the handle 33 which fits in a suitable aperture in the side of the machine frame. A spring 35 is provided to hold the lever 34 in engagement with said aperture.

The bevel gear 24 abuts a bearing member 38 at its top portion to take the thrust imparted to said bevel gear through the bevel pinion 18. The bevel gear 24 is made in the form of a ring which is bolted to the hub portion 39 by means of nuts and bolts indicated at 25 in a usual manner and is mounted for rotation on the outer surface of the supporting member 22. The purpose of so constructing said bevel gear is to facilitate removal of said bevel gear, and make it easier to disassemble the cutting end of the machine in general.

In the form herein shown it will be observed that when the machine is dismounted from the truck and resting in cutting position that a bottom portion 40 of the front frame section 10 serves as a support for the forward section of the mining machine and that a recess is open to both sides of the frame and to the ground directly rearward of the cutter chain sprocket 20 so that the cuttings may readily be discharged from the cutter chain 12 and will not tend to accumulate directly rearward of the cutter chain so as to be drawn back into the kerf by said cutter chain.

Referring now to the construction and arrangement of the feed operating mechanism it will be seen that I provide a novel construction and arrangement of parts disposed mainly at the rear end of the motor requiring a minimum amount of vertical height and including a pair of winding drums 42 and 43 independently driven from the motor 14 through a frictionally controlled geared speed reduction device. The driving pinion 19 at the rear of the armature shaft 17 is meshed with a gear 44 on a sleeve 45 which is loosely mounted on a longitudinal shaft 46. The sleeve 45 carries a pinion 47 thereon which constitutes the driving or sun gear of a planetary gear mechanism generally indicated at 48.

The planetary gear mechanism 48 may be of any suitable type heretofore utilized in mining machine transmissions. In the form shown herein said planetary includes an outer casing 49 which carries an internal gear 50 on its inner periphery, and has a hub 51 loosely mounted on the shaft 46. A cage 52 is provided for rotation within the casing 49 and carries thereon one or more pairs of planetary pinions 53 and 54, each pair of said pinions being mounted side by side and rotating together on the same axis but having a different number of teeth so as to produce a speed differential in the usual manner. One of the planetary pinions 53 is meshed with the sun gear 47 and the internal gear 50 carried in the outer casing 49. The other planetary pinion 54 is meshed with an internal gear 55 carried by a member 56 which is herein shown as a low speed member. A sliding clutch member 57 slides in guides in members 58 integral with a driving gear 60 and has a plurality of clutch jaws 61 thereon adapted to be moved in one direction to engage clutch jaws 62 of the low speed member 56 and to drive the gear 60 at a predetermined low speed, or in an opposite direction to engage clutch jaws 63 carried on a hub 64 of the cage 52 so as to provide a high speed connection for the gear 60. Under normal operating conditions the casing 49 is restrained from rotation by means of a friction band 68.

When the machine is put under excessive load conditions at either speed however, the arrangement is such that the casing 49 may be permitted to slip in the friction band 68 thereby protecting the driving parts from damage or breakage when unusual cutting conditions are met with. Furthermore, the friction band 68 may be also utilized to afford variations in speed either through the high or low speed connections in the usual manner. Pressure of the friction band 68 on the casing 49 is varied by means of a hand wheel 69 which has driving connection with a threaded rod 70 through gears 71 and 72. The rod 70 is fixed to the gear 72 at one end and is threaded in a lug 73 by the friction band 68 at its other end so that rotation of the hand wheel 69 causes rotation of the threaded rod 70 to tighten or loosen the friction band 68 on the casing 49 to vary the point at which said casing will slip in said band.

The driving gear 60 is meshed with a gear 75 keyed to a shaft 76 parallel with and to one side of the shaft 46. A worm 77 is carried on the shaft 76 and a suitable thrust bearing 78 is provided on the shaft 76 forward of said worm to compensate for the end thrust on said worm. The rearward end of the shaft

76 projects beyond the rearward boundaries of the machine and has a squared end 79 thereon for receiving a socket for driving the truck mechanism which will hereinafter be described.

The worm 77 meshes with and drives a worm wheel 80 on a transverse shaft 81 rearwardly of the planetary transmission device 48 and above the shaft 76. A pair of pinions 82 and 83 are freely mounted on each end of the shaft 81 and have driving connection therewith through a pair of sliding clutches 84 and 85 to afford selective driving connections to the winding drums 42 and 43.

It will be observed that the worm 77 and worm gear 80 are thus interposed between the planetary gear 48 and the driven feed drums 42 and 43, so that excessive loads or shocks imposed on the feed operating gearing through either of the rope drums will be borne largely by said worm and worm gear, thus giving further protection to the planetary gearing from unnecessary wear and damage.

Since the feed drum on the left side of the machine performs the same function as the feed drum on the right side of the machine and since the construction of both drums is the same, the drum 42 only will be herein described and the same part numerals will be applied to both drums.

Each drum is keyed to a hub 86 having a bearing surface on a stub shaft 87 carried in a boss 88 formed integrally with the rearward frame section 16. A plurality of cap screws 89 are provided to hold the drum 42 in place on the hub 86. The hub 86 is held in place on the stub shaft 87 by means of a collar 90 having a pin 91 passing therethrough. A wheel 92 is formed integral with the hub 86 on the inner side thereof and has a ring gear 93 keyed thereto. The ring gear 93 serves as a driving gear for the drum 42 and meshes with the pinion 82. A friction band 94 is interposed between the drum 42 and the ring gear 93 and is adapted to engage a friction surface 95 on the hub 86 to retard rotation of the drum 42. This braking device is used particularly for controlling paying out of one of the draft ropes during the maneuvering of the machine on the mine floor. The friction bands 94 for the drums 42 and 43 are controlled by hand wheels 94ª through any suitable controlling device of the usual form heretofore employed for the same purpose.

A portion 96 of the frame 16 surrounds the ring gear 93 and friction band 94. An end piece 97 is attachable to the end of the portion 96 and abuts the rearward portion of the drum 42 to form an enclosure for the friction band 94 and ring gear 93 to prevent particles of coal from collecting in said ring gear and friction band.

To adjust the friction band 94 it is necessary to remove the cap screw 89 from the drum 42 and slip said drum from the hub 86. Said friction band is then easily accessible for repair or adjustment. The hub 86 may be removed from the stub shaft 87 by removing the drum 42 from the hub 86, removing the end piece 97 from the portion 96 and removing the collar 90 from said stub shaft. The hub 86 may then be slipped off the stub shaft 87 to repair or renew the gear 93.

From the above description it will be seen that a feed drum is provided on each side of the rearward portion of the machine, that said drums are independently operable at a plurality of frictionally controlled speeds and that said drums are so constructed and arranged that the driving and retarding mechanism for said drums is fully enclosed, but that said driving and retarding mechanism is readily accessible for repairs or adjustment.

A plurality of guide devices are disposed at several points on the rear end and sides of the machine to permit the feed ropes to be arranged in varying positions with respect to the machine. As shown herein, these guide devices may include two guide sheaves 101, 101, each disposed on a vertical axis at the rear corner of the frame, a centrally disposed sheave 102 at the center of the rear end of the frame, a sheave 103 at the forward right hand corner of the machine and a sleeve 104 on the left hand side of the machine near the central portion of the front frame section 10.

A self-propelling truck generally indicated at 105 is provided to transport the machine from cutting place to cutting place and may be of any general type heretofore utilized and is no part of my present invention so will not be described in detail except to mention the fact that a socket 106 on a coupling pin 107 engages the squared end 79 of the shaft 76 and rotates a bevel pinion 108 which drives a bevel gear 109 to drive a shaft 110 which in turn drives the truck 105 through any suitable driving mechanism of a type well known to those familiar with the art which is not herein shown since it is no part of the present invention.

It may now be seen that I have provided a mining machine of the shortwall type having a new and novel arrangement of feed operating and cutting mechanism so that said machine will be of a minimum height and still be of such a length as to be readily transportable about the mine and not interfere with props or roof supports while cutting. While my machine is of a low height, the mechanical and electrical parts of my machine are of such size and strength that said machine may safely and efficiently meet all requirements in cutting coal due to the compact and novel arrangement of said parts

whereby said parts are readily accessible for repair or adjustment.

The arrangement of the feed gearing and controlling clutches 84 and 85 selectively connecting the gearing to the two feed drums mentioned is such as to permit either of the drums to be driven independently of each other and when either of the drums are disconnected the rope may be paid off under the control of the friction band or brake 94. The machine may then be sumped with either rope and a cross cut may be made with one of the ropes while the other rope may be utilized for retarding movement of the rear end of the machine. Retardation of either rope may be controlled either by the brake band 94, or if desired, the associated clutch 85 may be positively connected with the transverse driving shaft 81, so that the rope on the drum 43 will be paid out at the same rate the rope on the drum 42 is wound in. It will thus be seen that the machine is capable of being fed in either direction; that is, from right to left or from left to right, and retardation of the rear end of the frame may be controlled either manually through the friction device or automatically by connecting the drum with the drive gearing. It will be further understood that the drums may be selectively driven at variable speeds through the planetary gear 48, and that the direction of rotation of the gearing and drums may be reversed by reversing the motor in the usual manner.

Although I have herein shown and described one embodiment of my invention, it will be understood that the construction and arrangement of the various parts may be altered without departing from the spirit and scope thereof. Furthermore, I do not wish to be construed as limiting myself to the specific form illustrated, excepting as it may be specifically limited in the appended claims.

I claim as my invention:

1. In a mining machine of the class described, a motor slidable on its bottom on a mine bottom, cutting mechanism on one end of said motor, and feeding mechanism independent of said cutting mechanism including a feed operating drum on each side thereof adjacent the rearward portion of said motor and a gear reduction for operatively connecting said feed drums with the rearward end of said motor including a transverse shaft connectible with each of said feed operating drums, and a planetary geared reduction device interposed between said shaft and said motor having its axis beneath the axis of said shaft.

2. In a mining machine of the class described, a motor, cutting mechanism forwardly of said motor, feeding mechanism rearwardly of said motor including a feed operating drum on each side thereof adjacent the rearward portion of said motor, and a gear reduction for operatively connecting said feed drums with the rearward portion of said motor including a transverse shaft connectible with said drums at opposite ends thereof, a plural speed frictionally controlled planetary gear reduction device on an axis parallel with the axis of rotation of said motor and having driving connection therewith, a second shaft perpendicular to said transverse shaft having driving connection with said tranverse shaft and driven by said planetary gear reduction device, the axes of said shaft being beneath the axis of said transverse shaft, said feeding mechanism and said cutting mechanism being substantially within the vertical limits of said motor.

3. In a mining machine of the class described, a motor, a motor shaft on said motor, feeding mechanism rearwardly of said motor, cutting mechanism forwardly of said motor, said cutting mechanism including a cutter bar projecting forwardly therefrom having a cutter chain circulating thereabout, said feeding mechanism including a feed operating drum on each side of said motor adjacent the rearward portion of said motor and a gear reduction for operatively connecting said feed drums with the rearward end of said motor through a transverse shaft selectively connectible with said drums at opposite ends thereof, a plural speed frictionally controlled planetary gear reduction device on a longitudinal shaft on one side of said motor shaft and below the axis of said motor shaft, a second longitudinal shaft on the opposite side of said motor shaft from said first mentioned shaft below the axis of said motor shaft and driven by said planetary gear reduction device, and a worm and worm gear drive between said transverse shaft and said second mentioned longitudinal shaft.

4. In a mining machine of the class described, a motor slidable on its bottom on a mine bottom, a motor shaft on said motor, feeding mechanism rearwardly of said motor, cutting mechanism forwardly of said motor. said cutting mechanism including a cutter bar projecting forwardly therefrom having a cutter chain circulating thereabout, and said feeding mechanism including a feed operating drum on each side of said motor adjacent the rearward portion of said motor for operatively connecting said feed drums with the rearward end of said motor, a speed reduction device including a transverse shaft selectively connectible with said drums at opposite ends thereof, a plural speed frictionally controlled planetary gear reduction device on a longitudinal shaft and below the axis of said motor shaft, a second longitudinal shaft on the opposite side of said motor shaft from said first mentioned shaft below the axis of said motor and driven by said planetary gear reduction device, and a worm and worm gear drive between said transverse

shaft and said second mentioned shaft, said feeding mechanism and said cutting mechanism being substantially within the vertical limits of said motor.

5. In a mining machine of the class described, a motor slidable on its bottom on a mine bottom, feeding mechanism rearwardly of said motor, cutting mechanism forwardly of said motor including a forwardly projecting cutter bar having a cutter chain circulating thereabout, driving means for said cutter chain including a cutter chain sprocket and a bevel gear reduction for selectively connecting said cutter chain sprocket with the forward end of said motor, and a bearing shoe engaging the mine bottom for rigidly supporting said cutter bar with respect to said mining machine, and extending rearwardly from the forward portion of said machine and terminating at a point substantially adjacent the rearwardmost extremities of said cutter chain sprocket.

6. In a mining machine of the class described, a motor slidable on its bottom on a mine bottom, feeding mechanism rearwardly of said motor, cutting mechanism forwardly of said motor, said feeding mechanism and said cutting mechanism being within the vertical limits of said motor and said cutting mechanism including a forwardly projecting cutter bar having a cutter chain circulating thereabout, driving means for said cutter chain including a cutter chain sprocket and a single bevel gear reduction for selectively connecting said cutter chain sprocket with the forward end of said motor, a bearing shoe engaging the mine bottom for rigidly supporting said cutter bar with respect to said mining machine extending rearwardly from the forward portion of said machine and terminating at a point substantially adjacent the rearwardmost extremities of said cutter chain sprocket, and bearing means for said cutter chain sprocket within said bearing shoe.

7. In a mining machine of the class described, a motor, feeding mechanism for moving said mining machine on its bottom on the mine bottom, cutting mechanism projecting forwardly of said motor, said cutting mechanism including a forwardly projecting cutter bar having a cutter chain circulating thereabout, a vertical shaft, a bearing and supporting member detachably mounted in said mining machine for supporting said shaft, a bevel gear coaxial with said shaft and journaled on the outer portion of said bearing and supporting member, and clutch means for operatively connecting said bevel gear with said vertical shaft.

8. In a mining machine of the class described, a motor, feeding mechanism for moving said mining machine on its bottom on the mine bottom, cutting mechanism projecting forwardly of said motor, said cutting mechanism including a forwardly projecting cutter bar having a cutter chain circulating thereabout, a vertical shaft, a bearing and supporting member detachably mounted in said mining machine for supporting said shaft, a hub coaxial with said shaft and journaled on the outer portion of said bearing and supporting member, a bevel gear detachably connected to said hub, and clutch means for operatively connecting said bevel gear with said vertical shaft.

9. In a mining machine of the class described, a motor, feeding mechanism for moving said mining machine on its bottom on the mine bottom, cutting mechanism projecting forwardly of said motor, said cutting mechanism including a forwardly projecting cutter bar having a cutter chain circulating thereabout, a vertical shaft, a bearing and supporting member detachably mounted in said mining machine for supporting said shaft, a hub coaxial with said shaft and journaled on the outer portion of said bearing and supporting member, a bevel gear detachably connected to said hub, and clutch means for selectively connecting said bevel gear with said vertical shaft, a bevel pinion driven by said motor for driving said bevel gear, and a thrust member above said bevel pinion and having bearing engagement with said bevel gear.

10. In a mining machine, a motor slidable on its bottom on the mine bottom having its axis extending longitudinally of the machine, the height of said motor determining the height of the machine, cutting mechanism on one end of said motor including a forwardly projecting cutter bar having a cutter chain circulating thereabout, means for driving said cutter chain from said motor including a cutter chain drive sprocket and a single bevel gear reduction interposed between said motor and said cutter chain drive sprocket, and feeding mechanism driven from the opposite end of said motor including a plurality of feed drums arranged on horizontal axes on opposite sides of said mining machine selectively connectible with said motor, each of said feed drums being adapted to cooperate with a flexible feeding member for independently winding in said flexible feeding members or allowing said flexible feeding members to pay out under friction control and means for driving said feed drums from said motor including a frictionally controlled planetary gear reduction device, and a worm and worm gear interposed between said feed drums and said planetary gear reduction device.

11. In a mining machine, a motor slidable on its bottom on the mine bottom having its axis extending longitudinally of the machine, the height of said motor determining the height of the machine, cutting mechanism on one end of said motor including a for-

wardly projecting cutter bar having a cutter chain circulating thereabout, means for driving said cutter chain from said motor including a cutter chain drive sprocket and a single bevel gear reduction interposed between said motor and said cutter chain drive sprocket, and feeding mechanism driven from the opposite end of said motor including a plurality of feed drums arranged on horizontal axes on opposite sides of said mining machine selectively connectible with said motor, each of said feed drums being adapted to cooperate with a flexible feeding member for independently winding in said flexible feeding members or allowing said flexible feeding members to pay out under friction control and means for driving said feed drums from said motor including a frictionally controlled plural speed gear reduction device, a worm driven thereby, and a worm gear driven by said worm and having selective connection with said feed drums.

12. In a mining machine, a motor slidable on its bottom on the mine bottom having its axis extending longitudinally of the machine, the height of said motor determining the height of the machine, cutting mechanism on one end of said motor including a forwardly projecting cutter bar having a cutter chain circulating thereabout, means driven by one end of said motor for driving said cutter chain about said cutter bar and feeding mechanism driven from the opposite end of said motor including a plurality of feed drums arranged on horizontal axes on opposite sides of said mining machine on the opposite end of said motor from said cutting mechanism, each of said feed drums being adapted to cooperate with a flexible feeding member for independently winding in said flexible feeding members or permitting said flexible feeding members to pay out under friction control, and means for driving said feed drums from said motor including a frictionally controlled plural speed gear reduction device, a worm driven thereby, and a worm gear driven by said worm and selectively connectible with said feed drums.

13. In a mining machine, a motor slidable on its bottom on the mine bottom having its axis extending longitudinally of the machine, the height of said motor determining the height of the machine, cutting mechanism on one end of said motor including a forwardly projecting cutter bar having a cutter chain circulating thereabout, means driven by one end of said motor for driving said cutter chain about said cutter bar and feeding mechanism driven from the opposite end of said motor including a plurality of feed drums arranged on horizontal axes on opposite sides of said mining machine on the opposite end of said motor from said cutting mechanism, each of said feed drums being adapted to cooperate with a flexible feeding member for independently winding in said flexible feeding members or permitting said flexible feeding members to pay out under friction control, and means for driving said feed drums from said motor including a frictionally controlled planetary gear reduction device, a worm driven thereby, and a worm gear driven by said worm and selectively connectible with said feed drums.

Signed at Chicago, in the county of Cook and State of Illinois, this 6th day of June, A. D. 1928.

GEORGE BODIN.