Aug. 23, 1938. C. O. WOOD 2,128,064

KERF CUTTING MACHINE

Original Filed March 28, 1936 2 Sheets-Sheet 1

Fig. 1

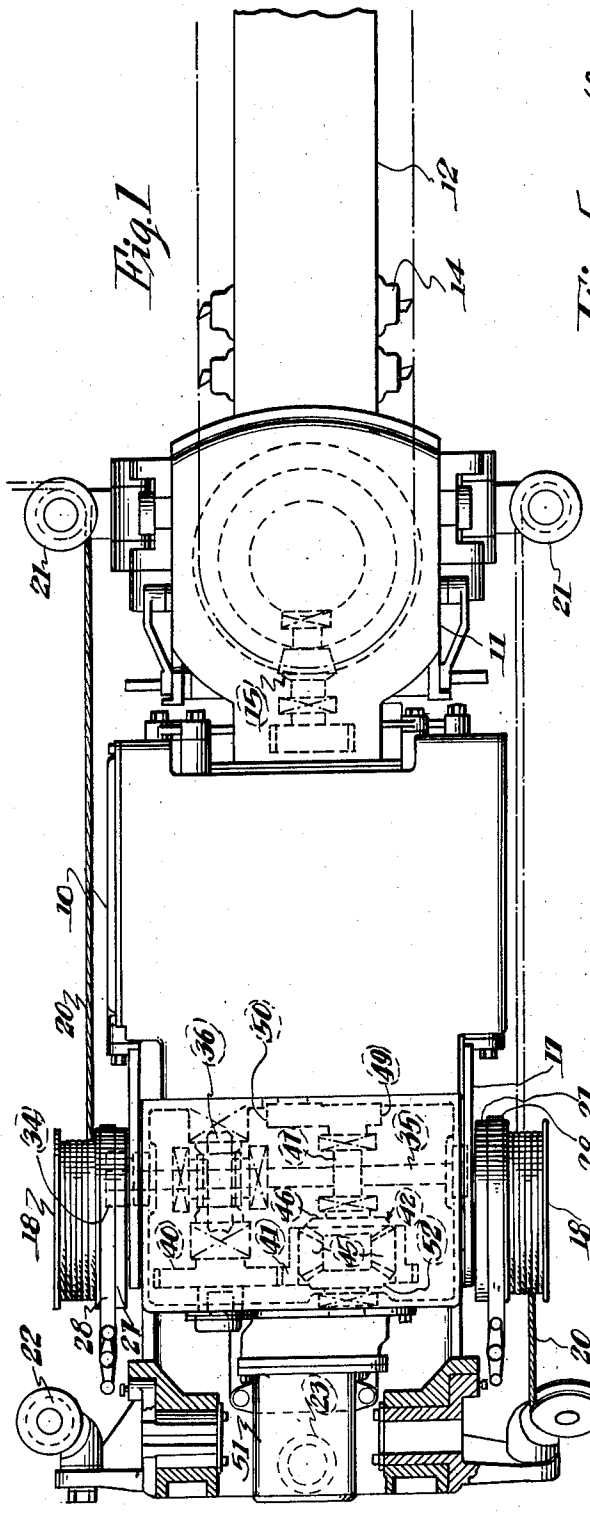


Fig. 5

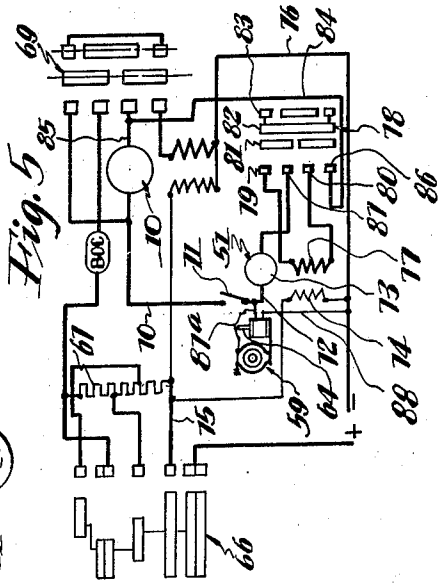
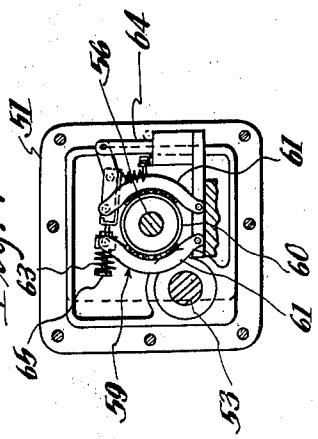


Fig. 4



Inventor
Claude O. Wood
Clarence F. Poole
Attorney

Aug. 23, 1938. C. O. WOOD 2,128,064

KERF CUTTING MACHINE

Original Filed March 28, 1936 2 Sheets-Sheet 2

Fig. 2

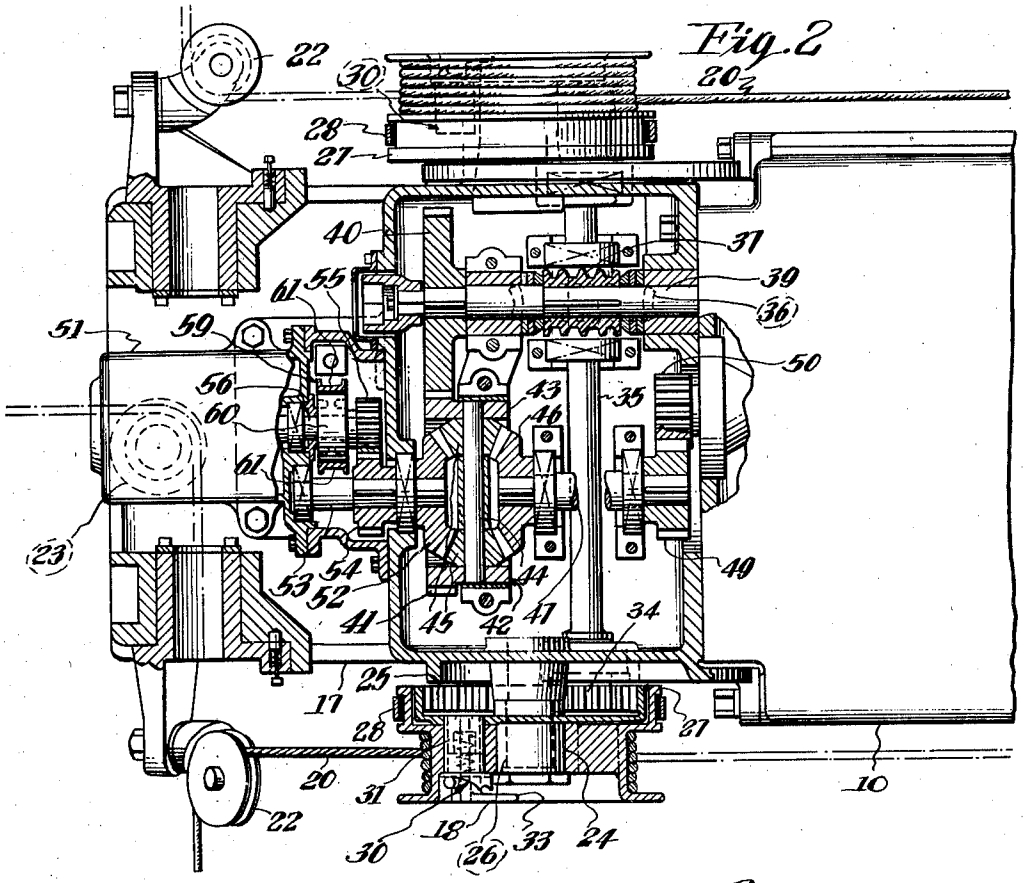
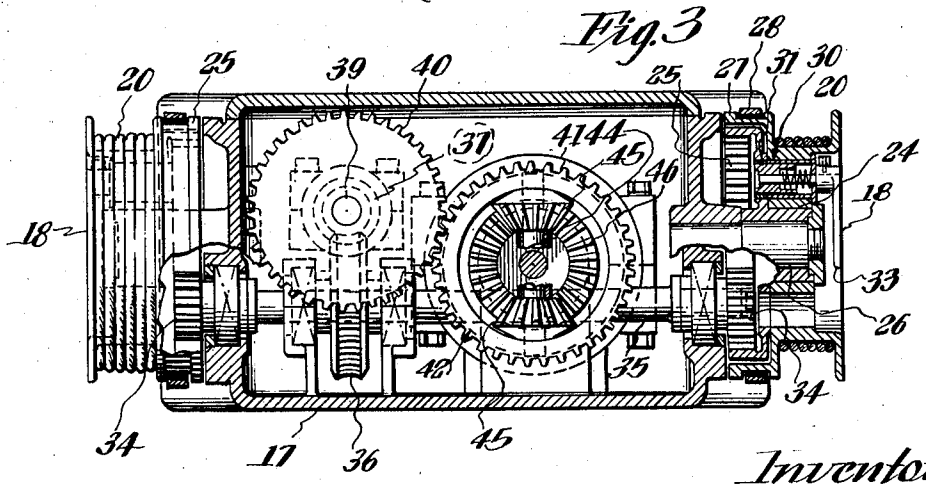


Fig. 3



Inventor
Claude O Wood
Clarence F. Poole
Attorney

Patented Aug. 23, 1938

2,128,064

UNITED STATES PATENT OFFICE

2,128,064

KERF-CUTTING MACHINE

Claude O. Wood, Chicago, Ill., assignor to Goodman Manufacturing Company, Chicago, Ill., a corporation of Illinois

Application March 28, 1936, Serial No. 71,371
Renewed January 13, 1938

15 Claims. (Cl. 262—30)

This invention relates to improvements in kerf-cutting machines and more particularly to a variable speed drive mechanism arranged to control the feeding speed of a mining machine dependent upon the load on the cutting mechanism.

Among the objects of my invention are to provide a new and improved variable speed drive to the feeding mechanism of a mining machine which is so arranged that the speed of the feeding mechanism will be automatically reduced as the load on the cutting mechanism increases.

In carrying out my invention, I drive the feeding mechanism through epicyclic gearing of the differential type, and control the driving speed of the drive gearing by means of a controlling motor separate from the driving motor, which is operatively connected with a reaction member of the drive gearing.

Other objects of my invention will appear from time to time as the accompanying specification proceeds.

My invention may be more clearly understood with reference to the accompanying drawings wherein:

Figure 1 is a top plan view of a mining machine of the room and pillar type illustrating one form in which my invention may be embodied;

Figure 2 is a view of the rear end of the mining machine shown in Figure 1, with the gear cover removed and with certain parts broken away and shown in horizontal section in order to more clearly illustrate certain details of my invention;

Figure 3 is a transverse fragmentary sectional view taken substantially along line 3—3 of Figure 2;

Figure 4 is a detail front end view of the controlling motor illustrating certain details of the braking mechanism therefor; and

Figure 5 is a wiring diagram of the motor circuit.

In the embodiment of my invention illustrated in the drawings, my improved form of feed controlling mechanism is shown as being incorporated in a mining machine of the room and pillar type. Said mining machine is of an ordinary construction well known to those skilled in the art so will only herein be described insofar as is necessary to make my present invention clearly understandable.

The main elements of the mining machine illustrated include a motor 10 having cutting mechanism disposed forwardly thereof which includes a cutter bar support frame 11 which forms a support for a projecting cutter bar 12 having a cutter chain 14 movable thereabout in a closed orbital path. Said cutter chain is driven from the forward end of said motor by means of a suitable gear train, generally indicated by reference character 15 and best shown in Figure 1.

Feed operating and controlling mechanism is disposed rearwardly of said motor and includes a frame member 17 which has a pair of winding drums 18, 18 mounted at opposite sides thereof for rotation about a transversely extending axis. Each of said winding drums is of a similar construction and has a flexible cable 20 wound thereon which may be trained forwardly therefrom around a sheave 21 to a fixed abutment remote from the machine for moving the machine along a coal face in a usual manner, or which may be trained rearwardly therefrom around a sheave 22 to a fixed abutment remote from the machine for controlling feeding movement thereof, or inwardly from said sheave to a sheave 23 for moving the machine onto its propelling truck.

Each winding drum 18 is freely mounted on a hub 24 of an internal gear 25, which internal gear is mounted on a stub shaft 26. Said stub shaft is mounted in a suitable boss extending laterally outwardly from the frame 17. Each of said winding drums is provided with an inwardly extending flange 27, the outer periphery of which is adapted to be engaged by a suitable holding device, such as a brake drum 28 for controlling rotation of said drum when disconnected from the motor 10 and enabling one drum and its associated flexible cable to act as a retarding member to hold the machine in the desired relationship with respect to the coal face while being moved thereacross by the opposite drum.

Said drums are adapted to be independently driven from the internal gears 25, 25 at similar rates of speeds and each of said internal gears may be selectively connected to its associated drum by means of a suitable pin clutch 30 in a well-known manner. Said pin clutches each consist of a pin 31 adapted to be selectively engaged with suitable apertures formed in the web of said internal gear by means of a suitable operating handle 33 (see Figure 3).

The internal gears 25, 25 are meshed with and driven by pinions 34, 34 on the outer ends of a transversely extending shaft 35. Said shaft is journaled in the frame member 17 in a suitable manner and has a worm gear 36 keyed thereto which is driven from a worm 37 keyed on a longitudinally extending shaft 39. Said last-named shaft is suitably journaled in the frame member 17 and is disposed to one side of the center

of the motor 10 and has a spur gear 40 keyed thereto which meshes with and is driven from a spur ring gear 41.

The spur ring gear 41, as herein shown, is formed adjacent one end of the outer periphery of a cylindrical member 43 which is journaled in the frame member 17 in a suitable manner. Said cylindrical member has a shaft 44 mounted therein and extending transversely thereacross. Said shaft, as herein shown, has a pair of bevel pinions 45, 45 freely mounted thereon and disposed adjacent opposite sides of the inner periphery of said cylindrical member. Said bevel pinions are meshed with a bevel gear 46 keyed on the forward end of a longitudinal shaft 47 journaled in the frame member 17 in a suitable manner. A spur pinion 49 is keyed on the opposite end of said shaft and meshes with and is driven from an armature pinion 50 of the motor 10.

With reference now in particular to the novel means for driving the winding drums 18, 18, so that the speed thereof will be reduced as the load on the cutter bar 12 and cutter chain 14 increases, a control motor 51 is provided. Said control motor is normally rotatable at a slower rate of speed than the drive motor 10 and is operatively connected with the motor 10 for controlling the speed of rotation of the ring gear 41 by means of suitable epicyclic gearing, generally indicated by reference character 42. Said epicyclic gearing is herein shown as being of the differential type, although various other types of epicyclic gearing may be utilized which will effect the same result, and includes the ring gear 41, bevel pinions 45, 45 and bevel gear 46. Said gearing also includes a bevel gear 52 which meshes with the bevel pinions 45, 45 and forms a reaction member for said differential drive gearing. Said bevel gear is disposed oppositely from the bevel gear 46 and is keyed on the forward end of a shaft 53 coaxial with the bevel gear 46. The shaft 53 has a spur pinion 54 keyed thereto which meshes with and is driven from a spur pinion 55 on the forward end of a shaft 56 for the motor 51.

The control motor 51 is a relatively small motor compared to the drive motor 10 and serves only as a controlling means for the epicyclic gear system before mentioned and, accordingly, has no drive function. The shaft 53 is driven by said control motor in a direction opposite to the direction of rotation of the shaft 47 and when the speeds of rotation of the bevel gears 46 and 52 are the same, there will be no orbital movement of the bevel pinions 45, 45 and the spur ring gear 41 will perform no drive function. As the speed of the motor 51 decreases and the speed of the drive motor 10 increases, the speed of rotation of the pinions 45, 45 will decrease, but the orbital speed of said pinions will increase. This will result in an increase in the speed of rotation of the spur ring gear 41. A maximum speed of said spur ring gear will be reached when the bevel gear 52 is held from rotation.

It will be apparent from the foregoing that the bevel gear 52 driven by the control motor 51 serves as a reaction member for the differential gearing 42 and that the feeding speed of the machine depends upon the speed of rotation of said reaction member.

When there is a heavy torque load on the feeding mechanism, and both motors are connected to the source of power supply, the drive motor 10 tends to drive the control motor 51 as a generator through said differential gearing. Thus, as the load on the feeding mechanism increases from a no load condition, the speed of said drive motor will tend to decrease, while the speed of said control motor will tend to approach the speed of said drive motor. This will decrease the feeding speed of the machine. As the load on the feeding mechanism decreases, the speed of said drive motor will increase while the speed of said control motor will tend to decrease. This will increase the feeding speed of the machine.

When the control motor 51 is disconnected from the source of current supply and there is a heavy torque load on the feeding mechanism, the motor 10 will tend to drive said motor at the same rate of speed as the speed of said driven motor, in which case the spur ring gear 41 will remain stationary.

Means are provided to hold the controlling motor 51 from rotation when disconnected from the source of power supply to permit the feeding mechanism to be driven at a relatively high rate of speed, which as herein shown, comprises a magnetic brake 59 (see Figures 2 and 4). Said brake is of a usual construction well known to those skilled in the art, so will only herein be described insofar as is necessary to make my present invention clearly understandable, and includes a brake drum 60 keyed on the shaft 56. Said drum is adapted to be engaged by opposing brake shoes 61, 61 by means of a spring 63 and a suitable system of levers in a usual manner (see Figure 4). Said brake shoes are disengaged from said brake drum by means of a solenoid 64 which is operatively connected with said shoes through a suitable system of levers in a manner well known to those skilled in the art, so will not herein be described in detail. Said solenoid is connected in the electrical system in such a manner that said brake shoes will engage the brake drum 60 whenever said controlling motor is disconnected from the system and will be disengaged therefrom when said controlling motor is connected in the system. Thus, when it is desired to drive the feed drums 18, 18 at a relatively high rate of speed, said controlling motor is disconnected from the system and a direct drive is provided to said drums from the drive motor 10.

Means are provided to permit said magnetic brake to be released upon a predetermined load on the brake drum 60 and provide an overload release in the drive system when feeding or moving at a high rate of speed. Said means, as herein shown, includes the compression spring 63 which effects engagement of said brake shoes with said brake drum, the tension of which spring may be varied to suit varying conditions by means of an adjusting screw 65.

Referring now in particular to the electrical connections between the motors 10 and 51, said motors, as herein shown, are of the shunt wound type having relatively weak series controlling fields and are herein shown as being connected in parallel. A control drum, generally indicated by reference character 66, is provided for progressively cutting a resistance 67 from the motor 10 in a usual manner when starting said motor. A reverse drum 69 is provided for reversing the direction of rotation of said motor when desired. The circuit to said motor is of a usual type, so will not herein be described in detail.

The control motor 51 is connected in the circuit by means of a conductor 70 which extends from the armature circuit of the motor 10 to a

suitable switch 71, and a conductor 72 extending from said switch to an armature 73 of said control motor.

A shunt field 74 of said motor is connected between a conductor 75 leading from the controller 66 and a conductor 76 leading from the series and shunt fields of the motor 10 to ground.

A series field 77 for the motor 51 is connected in the motor circuit by means of a speed control drum 78 and contact fingers 79 and 80.

The speed control drum 78, as herein shown, is provided with three sets of contacts indicated generally by reference characters 81, 82 and 83, respectively. Said contacts are arranged to connect the series field 77 into the circuit in a normal manner or short said series field out of the circuit, or reverse the direction of the flow of current therethrough.

Thus, when the series field 77 is connected with the set of contacts, indicated by reference character 81, current will flow therethrough in a normal direction and the motor 51 will rotate at a relatively slow speed. When said series field is connected with the set of contacts, indicated by reference character 82, said series field will be shorted from the motor circuit and the speed of rotation of said motor will increase, and when said series field is connected with the set of contacts, indicated by reference character 83, the direction of the flow of current through said series field will be reversed and the speed of rotation of said control motor will be at a maximum.

The control motor 51 is connected with the reverse drum 69, so it will be reversed upon reversal of the direction of rotation of the motor 10, by means of the conductor 70 and a conductor 84 connected between a conductor 85 leading from the motor 10 to the reverse drum 69, and contact fingers 86 and 87 adapted to engage the control drum 78, for conducting current to the armature of said control motor.

The magnetic brake 59 is connected in the system by means of a conductor 87a connected to the conductor 72 and a conductor 88 connected to the conductor 76 which leads to ground. Thus, when the switch 71 is disconnected from the circuit, the solenoid 64 will be deenergized and the brake shoes 61, 61 will be engaged with the brake drum 60 by means of the spring 63 for holding the control motor 51 from rotation. When said switch is closed and the motor 10 is energized, said solenoid will be energized which will disengage said brake shoes from said brake drum.

It will be seen from the foregoing that a novel means has been provided for controlling the speed of rotation of the feed drums 18, 18 which is dependent upon the load imparted to the drive motor 10 by the cutter chain 14 while cutting across the coal face. Thus, when an obstruction is encountered by the cutter chain during the cutting operation, the speed of the motor 10 will decrease, due to the load thereon, while the speed of the controlling motor 51 will increase. This will reduce the speed of rotation of the spur ring gear 41 and correspondingly reduce the speed of the winding drums 18, 18, and when the load on said motor is relieved, the speed of rotation of said drums will correspondingly increase.

It will also be seen that the speed of the control motor 51 may be increased or decreased, independently of load on the motor 10 by changing the direction of the flow of current through the series field 77 for varying the feeding speed of the winding drums independently of the drive motor 10 when desired.

While I have herein shown and described one form of my invention, I do not wish to be limited to the precise details of construction or arrangement of parts herein shown and described, excepting as specifically limited in the appended claims.

I claim as my invention:

1. In a speed controlling mechanism, a drive motor, a driven member, a drive connection from said drive motor to said driven member including epicyclic gearing, a control motor for controlling the driving speed of said epicyclic gearing, an electrical connection to said control motor connected in the electrical circuit to said drive motor, and braking means for holding said control motor from rotation when said electrical connection is disconnected from the electrical circuit to the drive motor.

2. In a speed controlling mechanism, a drive motor, a driven member, a drive connection from said drive motor to said driven member including epicyclic gearing, a control motor for controlling the driving speed of said epicyclic gearing, an electrical connection to said control motor connected in the electrical circuit to said drive motor, braking means for holding said control motor from rotation when said electrical connection is disconnected from the electrical circuit to the drive motor, and means to permit said braking means to be automatically released from said control motor upon a predetermined load on said drive motor.

3. In a speed controlling mechanism, a drive motor, a driven member, a drive connection from said drive motor to said driven member including epicyclic gearing, a control motor for controlling the driving speed of said epicyclic gearing, an electrical connection to said control motor connected in the electrical circuit to said drive motor, braking means for holding said control motor from rotation when said electrical connection is disconnected from the electrical circuit to the drive motor comprising a magnetic brake connected in said circuit and adapted to be operative when disconnected therefrom, said brake being adapted to release upon a predetermined load thereon.

4. In a speed controlling mechanism, a drive motor, a driven member, a drive connection from said drive motor to said driven member including a gear and epicyclic gearing driven thereby, a reaction member for said epicyclic gearing, and means for controlling the driving speed of said epicyclic gearing comprising a control motor normally adapted to rotate at a slower speed than said driving motor, an electric circuit connecting said control motor with said driving motor, a drive connection from said controlling motor to said reaction member, means for connecting said controlling motor into or out of said electrical circuit, and braking means for holding said controlling motor from rotation when disconnected from said electrical circuit.

5. In a speed controlling mechanism, a drive motor, a driven member, a drive connection from said drive motor to said driven member including a gear and epicyclic gearing driven thereby, a reaction member for said epicyclic gearing, and means for controlling the driving speed of said epicyclic gearing comprising a control motor normally adapted to rotate at a slower speed than said driving motor, an electric circuit connecting said control motor with said driving motor, a drive connection from said control motor to said

reaction member, means for connecting said control motor into or out of said electrical circuit, means for holding said control motor from rotation when disconnected from said circuit, and means to permit said holding means to be automatically released from said control motor upon a predetermined load on said drive motor.

6. In a speed controlling mechanism, a drive motor, a driven member, a drive connection from said drive motor to said driven member including a gear and epicyclic gearing driven thereby, said epicyclic gearing including a reaction member, and means for controlling the driving speed of said epicyclic gearing comprising a control motor normally adapted to rotate at a slower speed than said driving motor, an electric circuit connecting said control motor with said driving motor, a drive connection from said control motor to said reaction member, means for connecting said control motor into or out of said electric circuit, and means for holding said control motor from rotation when disconnected from said circuit comprising a magnetic brake connected in said circuit and adapted to be operative when disconnected therefrom, said brake being arranged to release upon a predetermined load thereon.

7. A mining machine including a motor, cutting mechanism driven by said motor, feeding mechanism therefor and a drive connection from said motor to said feeding mechanism, a control motor for controlling the speed of rotation of said feeding mechanism dependent upon the load on said cutting mechanism, said drive connection from said drive motor to said feeding mechanism including differential gearing including a pair of bevel pinions and a bevel gear meshing therewith and driven by said motor, and another bevel gear meshing with said bevel pinions and driven by said control motor, means for connecting or disconnecting said control motor from the source of current supply at will, and braking means for holding said control motor from rotation when disconnected from the source of current supply.

8. A mining machine including a motor, cutting mechanism driven by said motor, feeding mechanism therefor, and a drive connection from said motor to said feeding mechanism, a control motor for controlling the speed of rotation of said feeding mechanism dependent upon the load on said cutting mechanism, said drive connection from said drive motor to said feeding mechanism including differential gearing including a pair of bevel pinions and a bevel gear meshing therewith and driven by said motor, another bevel gear meshing with said bevel pinions and driven by said control motor, a switch for connecting or disconnecting said control motor from the source of current supply, and braking means operable upon opening of said switch for holding said control motor from rotation.

9. A mining machine including a motor, cutting mechanism driven by said motor, feeding mechanism therefor and a drive connection from said motor to said feeding mechanism, a control motor for controlling the speed of rotation of said feeding mechanism dependent upon the load on said cutting mechanism, said drive connection from said drive motor to said feeding mechanism including differential gearing including a pair of bevel pinions and a bevel gear meshing therewith and driven by said motor, another bevel gear meshing with said bevel pinions and driven by said control motor, a switch for connecting or disconnecting said control motor from the source of current supply, and an electrically controlled brake engageable with said control motor upon opening of said switch and disengageable from said control motor upon closing of said switch.

10. A mining machine including a motor, cutting mechanism driven by said motor, feeding mechanism therefor and a drive connection from said motor to said feeding mechanism, a control motor for controlling the speed of rotation of said feeding mechanism dependent upon the load on said cutting mechanism, said drive connection from said drive motor to said feeding mechanism including differential gearing including a pair of bevel pinions and a bevel gear meshing therewith and driven by said motor, another bevel gear meshing with said bevel pinions and driven by said control motor, a switch for connecting or disconnecting said control motor from the source of current supply, an electrically controlled brake engageable with said control motor upon opening of said switch and disengageable from said control motor upon closing of said switch, and means to permit said brake to be automatically released upon a predetermined load on said differential gearing.

11. In a mining machine, a motor, feeding mechanism for said mining machine including a winding drum having a flexible cable wound thereon, a projecting cutter bar having a cutter chain movable thereabout, a drive connection from said motor to said cutter chain and a drive connection from said motor to said feeding mechanism comprising differential drive gearing including a gear driven by said motor and a plurality of differential pinions meshing therewith and mounted for orbital movement with respect thereto, a control motor electrically connected with said drive motor so as to rotate at speeds proportionate to the load on said cutter chain, a reaction gear driven by said control motor and meshing with said differential pinions, a gear rotatably driven by said pinions upon orbital movement thereof, and a geared drive connection from said gear to said winding drum whereby the speed of rotation of said winding drum may vary upon variation in load on said cutter chain.

12. In a mining machine, a motor, feeding mechanism for said mining machine including a winding drum having a flexible cable wound thereon, a projecting cutter bar having a cutter chain movable thereabout, a drive connection from said motor to said cutter chain, and a drive connection from said motor to said feeding mechanism adapted to vary upon variation in load on said cutter chain comprising differential drive gearing including a gear driven by said motor and a plurality of differential pinions meshing therewith and mounted for orbital movement with respect thereto, a control motor electrically connected with said drive motor so as to rotate at speeds proportionate to the load on said cutter chain, a reaction gear driven by said control motor and meshing with said differential pinions, a gear rotatably driven by said pinions upon orbital movement thereof, and a geared drive connection from said last named gear to said winding drum, means for connecting said control motor into or disconnecting it from the electrical circuit, and braking means for holding said control motor from rotation when disconnected from the electrical circuit.

13. In a mining machine, a motor, feeding

mechanism for said mining machine including a winding drum having a flexible cable wound thereon, a projecting cutter bar having a cutter chain movable thereabout, a drive connection from said motor to said cutter chain, and a drive connection from said motor to said feeding mechanism adapted to vary upon variation in load on said cutter chain comprising differential drive gearing including a gear driven by said motor and a plurality of differential pinions meshing therewith and mounted for orbital movement with respect thereto, a control motor electrically connected with said drive motor so as to rotate at speeds proportionate to the load on said cutter chain, a reaction gear driven by said control motor and meshing with said differential pinions, a gear rotatably driven by said pinions upon orbital movement thereof, and a geared drive connection from said gear to said winding drum, means for connecting said control motor into or disconnecting it from the electrical circuit for said drive motor, braking means for holding said control motor from rotation when disconnected from said electrical circuit, and means to permit said holding means to be automatically released from said control motor upon a predetermined load on said drive motor.

14. In a mining machine, a motor, feeding mechanism for said mining machine including a winding drum having a flexible cable wound thereon, a projecting cutter bar having a cutter chain movable thereabout, a drive connection from said motor to said cutter chain and a drive connection from said motor to said feeding mechanism adapted to vary upon variation in load of said cutter chain comprising differential drive gearing including a gear driven by said motor and a plurality of differential pinions meshing therewith and mounted for orbital movement with respect thereto, a control motor electrically connected with said drive motor so as to rotate at speeds proportionate to the load on said cutter chain, a gear driven by said control motor and meshing with said differential pinions, a gear rotatably driven by said pinions upon orbital movement thereof, and a geared drive connection from said gear to said winding drum, means for connecting said control motor into or disconnecting it from the electrical circuit for said drive motor, and braking means for holding said control motor from rotation when disconnected from said electrical circuit comprising a magnetic brake connected in said circuit and adapted to be operative when disconnected therefrom.

15. In a mining machine, a motor, feeding mechanism for said mining machine including a winding drum having a flexible cable wound thereon and a projecting cutter bar having a cutter chain movable thereabout, a drive connection from said motor to said cutter chain and a drive connection from said motor to said feeding mechanism adapted to vary upon variation in load on said cutter chain comprising differential drive gearing including a gear driven by said motor and a plurality of differential pinions meshing therewith and mounted for orbital movement with respect thereto, a control motor electrically connected with said drive motor so as to rotate at speeds proportionate to the load on said cutter chain, a gear driven by said control motor and meshing with said differential pinions, a gear driven by said pinions upon orbital movement thereof, and a geared drive connection from said gear to said winding drum, means for connecting said control motor into or disconnecting it from the electrical circuit for said drive motor and braking means for holding said control motor from rotation when disconnected from said electrical circuit comprising a magnetic brake connected in said circuit and adapted to be operative when disconnected therefrom, said brake being so arranged as to release upon a predetermined load on said differential gearing.

CLAUDE O. WOOD.