Nov. 30, 1943. L. E. SIMMONS 2,335,318

TRANSMISSION MECHANISM

Filed June 10, 1941 4 Sheets-Sheet 1

Fig. 1.

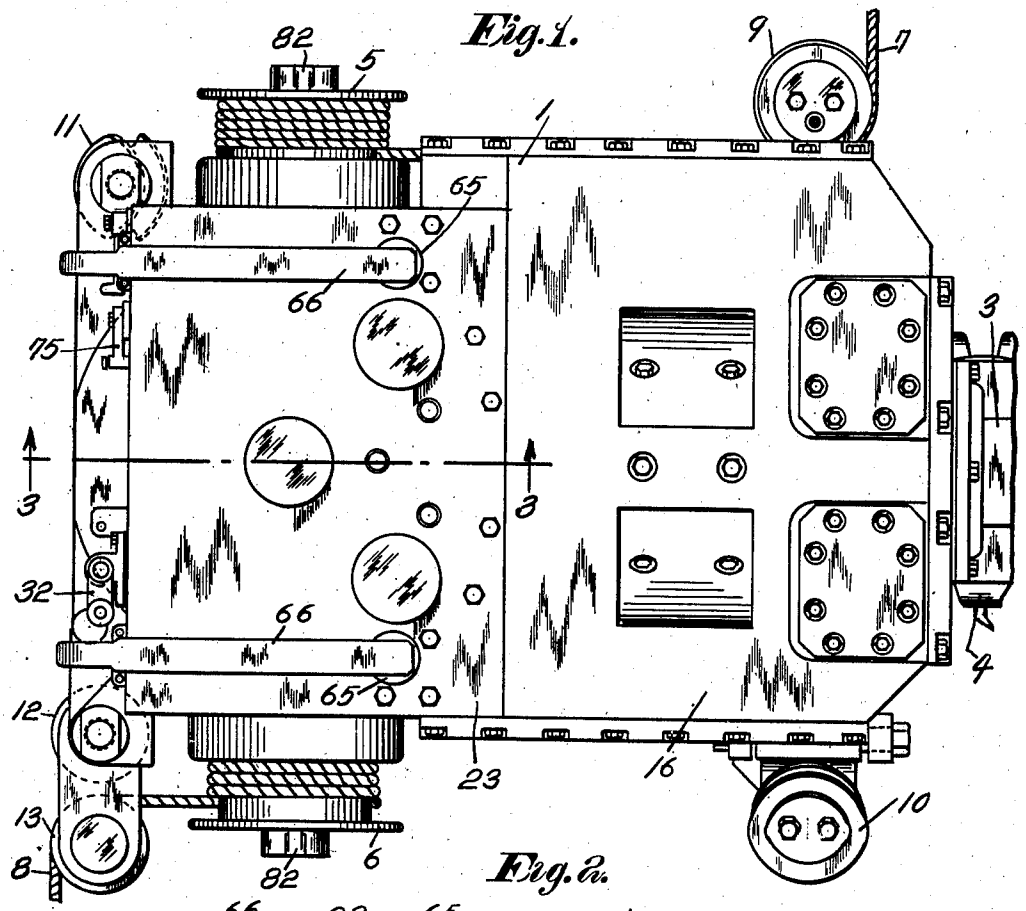
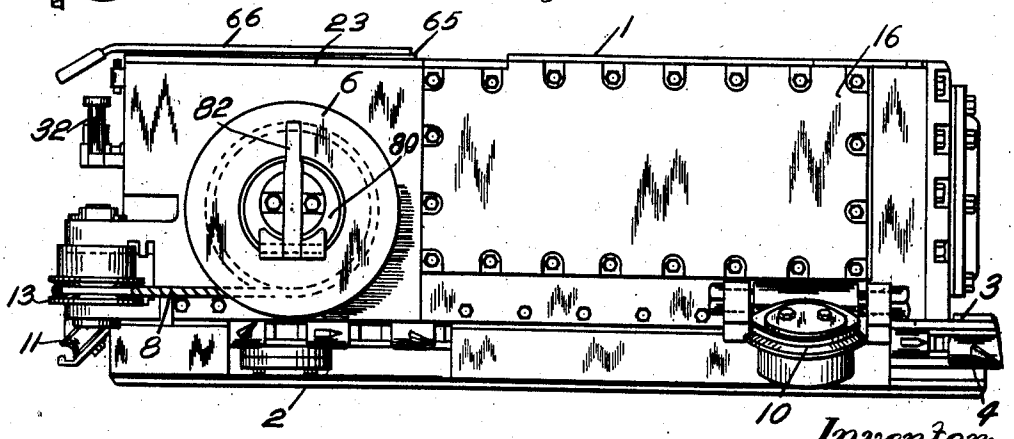


Fig. 2.



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TRANSMISSION MECHANISM

Filed June 10, 1941 4 Sheets-Sheet 2

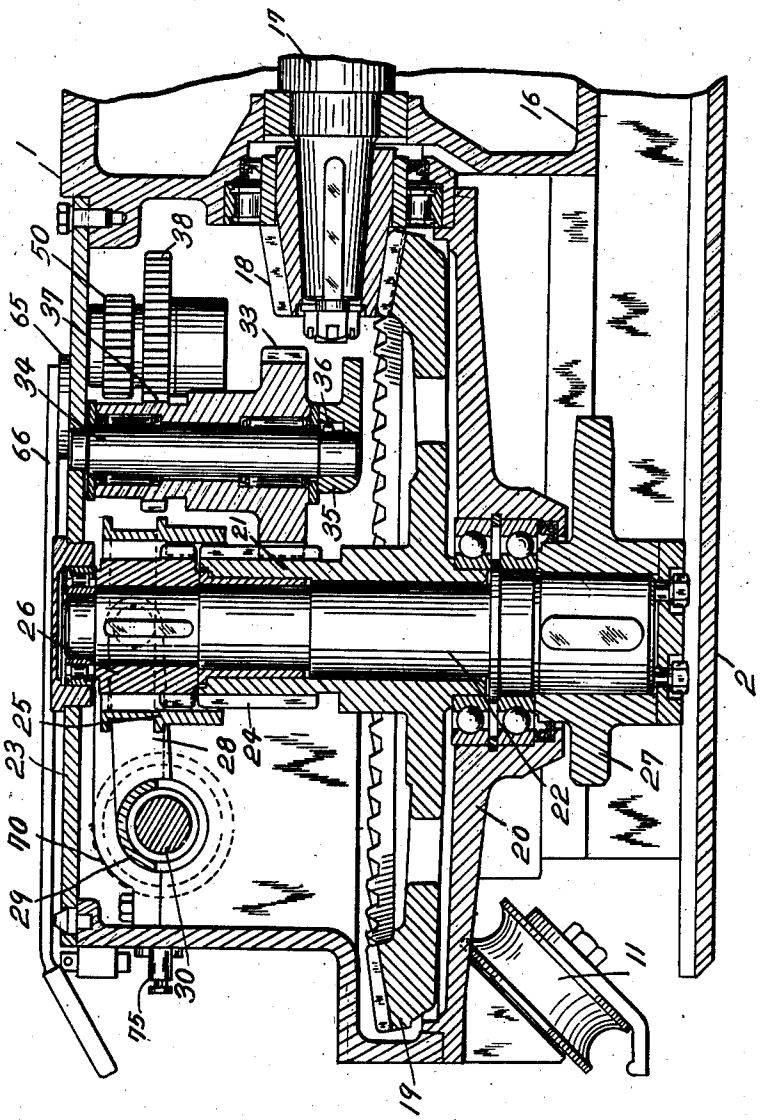


Fig. 3.

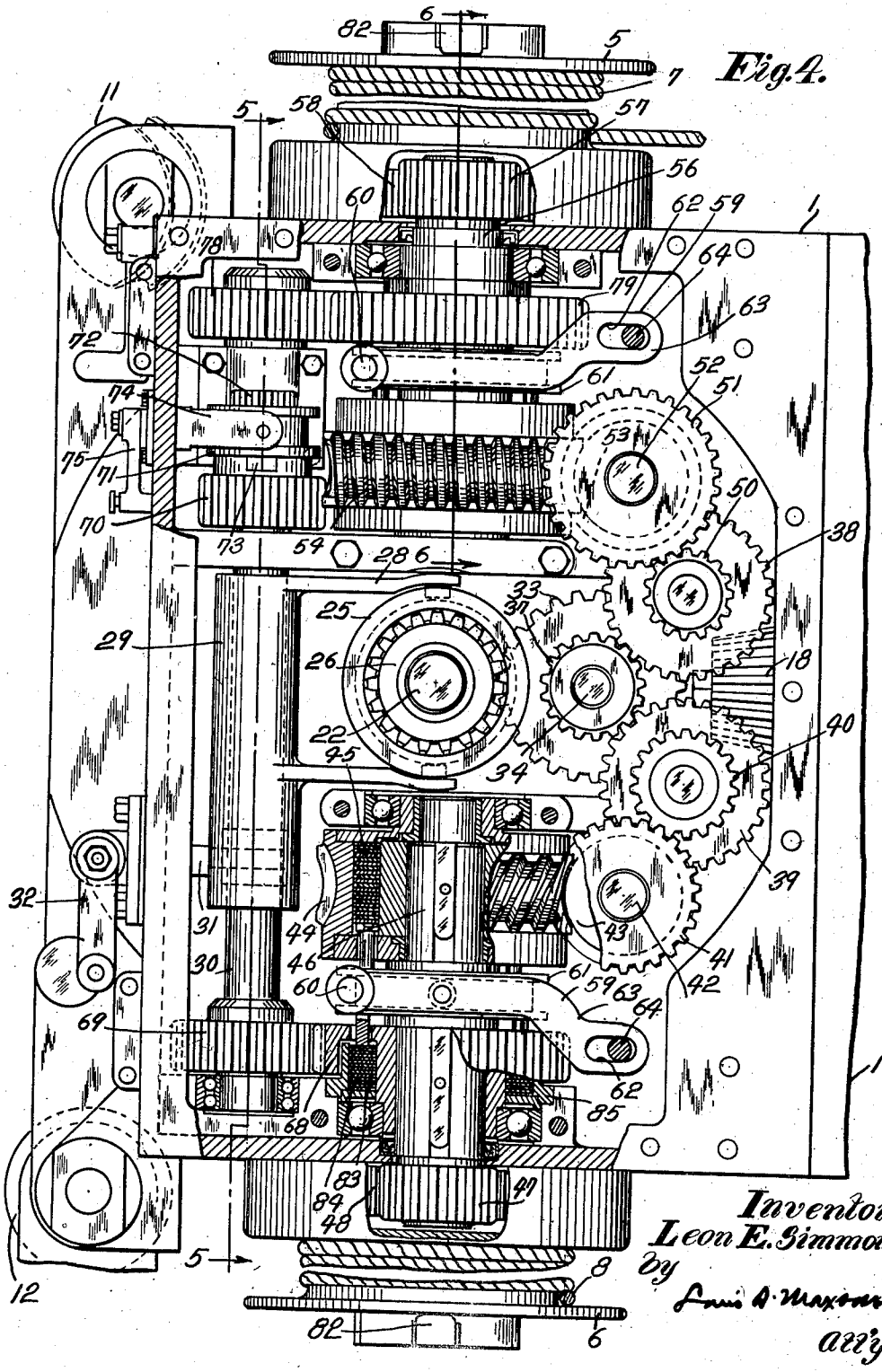
Inventor:
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TRANSMISSION MECHANISM

Filed June 10, 1941 4 Sheets-Sheet 3

Fig. 4.



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Nov. 30, 1943. L. E. SIMMONS 2,335,318

TRANSMISSION MECHANISM

Filed June 10, 1941 4 Sheets-Sheet 4

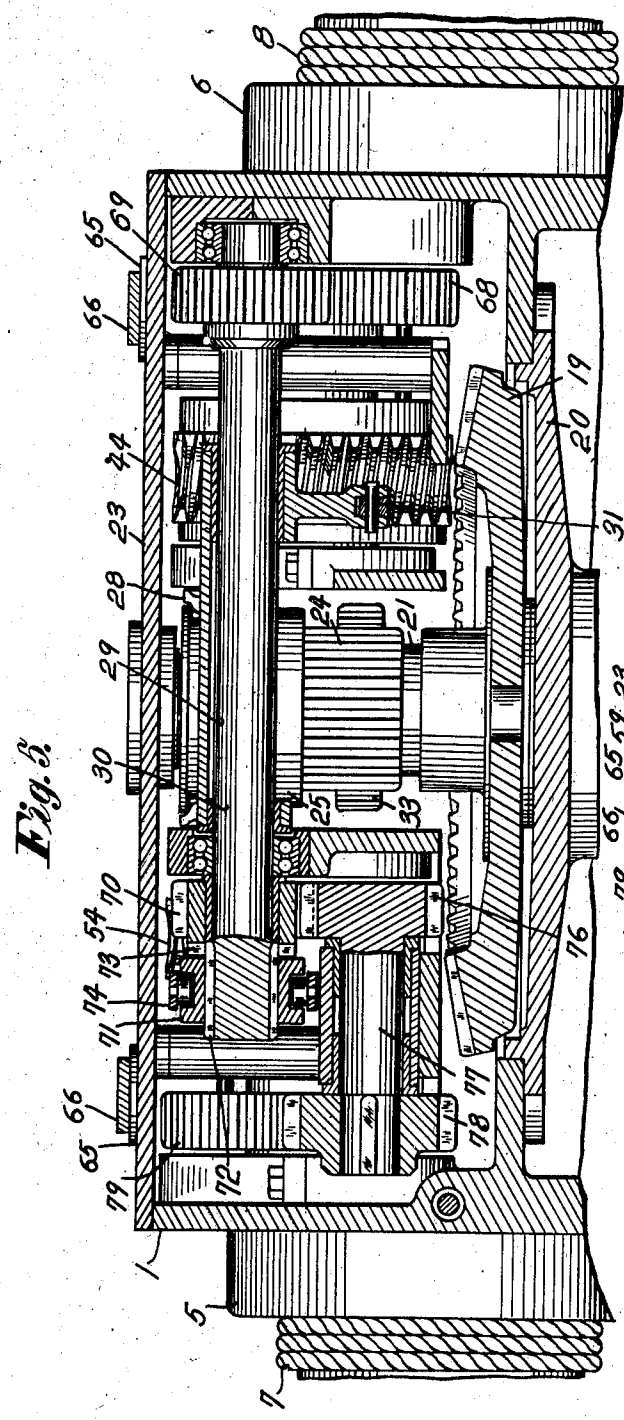


Fig. 5.

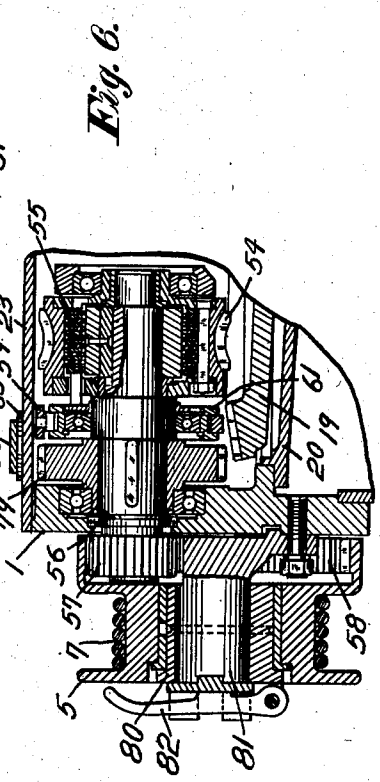


Fig. 6.

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Patented Nov. 30, 1943

2,335,318

UNITED STATES PATENT OFFICE

2,335,318

TRANSMISSION MECHANISM

Leon E. Simmons, Claremont, N. H., assignor to Sullivan Machinery Company, a corporation of Massachusetts

Application June 10, 1941, Serial No. 397,499

14 Claims. (Cl. 74—359)

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

An object of the present invention is to provide an improved mining machine transmission mechanism. Another object is to provide an improved feeding mechanism for a coal mining machine. A further object is to provide an improved flexible feeding mechanism wherein relatively rotatable cable winding drums are employed to effect feeding and guiding of the machine and having improved plural speed transmission means for driving the drums at different speeds. A still further object is to provide an improved plural speed transmission mechanism which is extremely simple in construction due to a novel arrangement of the transmission elements. Yet another object is to provide an improved plural speed transmission mechanism for effecting drive of the cable winding drums at relatively low and relatively high speeds. Still another object is to provide improved high and low speed gearings for driving the cable winding drums and each gearing including gear elements common to the drive of both drums. A still further object is to provide an improved flexible feeding means for a coal mining machine having improved means for driving the feeding and controlling drums at a plurality of speeds in a direction to wind in the feeding and controlling cables whereby the machine may be fed and guided in an improved manner. Another object is to provide an improved plural speed transmission mechanism embodying high and low speed gearings and clutch-controlled means whereby either gearing may effect drive of either of the cable winding drums whereby the latter may be driven separately at a plurality of speeds or concurrently at relatively different speeds. A still further object is to provide an improved mining machine feeding mechanism having novel arrangements and combinations of parts. Other objects and advantages of the invention will, however, hereinafter more fully appear in the ensuing description.

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

In these drawings:

Fig. 1 is a plan view of a coal mining machine in which an illustrative embodiment of the invention is incorporated.

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

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

Fig. 4 is a top plan view of the mechanism shown in Fig. 3, with the cover plate removed and parts shown in horizontal section to illustrate structural details.

Fig. 5 is a cross sectional view taken substantially on line 5—5 of Fig. 4.

Fig. 6 is a detail vertical sectional view taken substantially on line 6—6 of Fig. 4, on a reduced scale.

In this illustrative embodiment of the invention, the improved transmission mechanism is shown incorporated in the feeding mechanism of a coal mining machine of the flexibly fed, room and pillar type, although it will be evident that various features of the invention, without departing from its spirit, may be employed in mining machines of various other types.

The mining machine disclosed comprises a main frame 1 mounted on a bottom skid plate 2 for sliding movement over the mine floor. Projecting forwardly lengthwise of the main frame 1 and supported within the latter is a horizontal plane cutter bar 3 having an endless cutter chain 4 guided for circulation in an orbital path about its margin. Arranged at the opposite sides of the rearward portion of the main frame are relatively rotatable feeding and controlling, cable winding drums 5 and 6 on which feeding and controlling cables 7 and 8 are respectively wound. Arranged at the opposite sides of the front end of the main frame 1 are swing-arm-mounted guide sheaves 9 and 10, while arranged at the rear end of the main frame are guide sheaves 11, 12 and 13, and the feeding and controlling cables 7 and 8 may be extended from their respective drums around these guide sheaves in various directions from the machine during the feeding and guiding of the machine, in the manner well understood by those skilled in the art. Arranged within the forward portion of the main frame 1, above the cutter bar, is a motor 16 having its power shaft 17 horizontally disposed and extending longitudinally of the machine with its axis of rotation lying in the central longitudinal vertical plane of the latter. This motor drives the cutter chain 4 and the feeding and controlling drums 5 and 6, as will later be described.

The cutter chain driving means comprises a bevel pinion 18 keyed to the rear end of the motor power shaft 17 (Fig. 3) and meshing with a large

horizontal bevel gear 19 rotatable on a vertical axis lying in the same vertical plane as the motor power shaft axis. The hub of the bevel gear 19 is journaled in a ball bearing supported within the bearing-supporting-hub of a detachable bearing support 20 secured to the main frame. The bevel gear hub has an internal hollow vertical shaft 21 surrounding a vertical shaft 22, and the hollow shaft 21 is journaled at its upper end on a bearing supported by the shaft 22, in the manner shown. The shaft 22 is journaled in a roller bearing supported within a detachable top cover plate 23 and is journaled near its lower end within a ball bearing supported within the bearing-support-hub of the bearing support 20. Formed on the upper portion of the hollow shaft 21 is an elongated spur gear 24, and the teeth of a sliding clutch member 25 are movable into sliding interlocking engagement with the upper portions of the spur gear teeth and with the teeth of a clutch member 26 keyed to the upper end of the shaft 22 to connect the latter in driven relation with the hollow shaft 21. Keyed to the lower end of the shaft 22 is a chain sprocket 27 which engages and drives the endless cutter chain 4. The operating means for the sliding clutch member 25 comprises a shipper yoke 28 having a sleevelike hub 29 journaled on bearing sleeves supported by a transverse shaft 30 (Fig. 5). The shipper yoke 28 may be actuated through operating connections 31 including an operating handle 32 conveniently arranged at the rear end of the machine. It is accordingly evident that when the sliding-clutch-member is moved into the position shown in Fig. 3 to interlock the upper portions of the teeth of the spur gear 24 with the teeth of the clutch member 26, the cutter chain may be driven from the motor through the bevel gearing 18, 19, hollow vertical shaft 21, vertical shaft 22 and the chain sprocket 27, and when the sliding-clutch-member is moved upwardly into its released position the cutter chain may remain idle during running of the motor.

Now referring to the improved plural speed transmission mechanism for effecting drive of the feeding and controlling drums 5 and 6, it will be noted that meshing with the lower portions of the teeth of the spur gear 24 is a spur gear 33 journaled on roller bearings supported by a vertical shaft 34. This shaft is arranged forwardly of the vertical shaft 22 and is supported at its upper end within the top cover plate 23 and at its lower end within a bracket 35, and the shaft is held against rotation with respect to the bracket by means of a key pin 36 received within a vertical key slot in the bracket. Formed on the hub of the spur gear 33 is a spur gear 37 meshing with spur gears 38 and 39. The axes of rotation of the spur gears 38 and 39 are spaced equi-distantly from the central longitudinal vertical plane of the machine and lie in a common vertical plane extending transversely of the machine (see Fig. 4). Secured to and driven by the spur gear 39 is a spur gear 40 meshing with a spur gear 41 secured to a vertical shaft 42 suitably journaled within the main frame. Secured to and driven by the vertical shaft 42 is a fast speed worm 43 meshing with a fast speed worm wheel 44, the latter being connectible by a conventional multiple disc clutch 45 to a horizontal shaft 46. The shaft 46 extends transversely of the machine and is suitably journaled within bearings supported within the main frame, and has secured thereto and drives a spur gear 47 meshing with an internal gear 48 secured to the controlling drum 6. Secured to and driven by the spur gear 38 is a spur gear 50 having a somewhat less number of teeth than the spur gear 40 and meshing with a spur gear 51 having a somewhat greater number of teeth than the spur gear 41. The gear 51 is secured to a vertical shaft 52 suitably journaled within the main frame. Secured to and driven by the vertical shaft 52 is a low speed worm 53 meshing with a low speed worm wheel 54, the latter being connectible by a conventional multiple disc clutch 55 (see also Fig. 6) to a horizontal shaft 56, similar to the shaft 46 of the fast speed transmission mechanism. The horizontal shaft 56 extends transversely of the machine and is suitably journaled within bearings supported within the main frame. Secured to and driven by the shaft 56 is a spur gear 57 meshing with an internal gear 58 secured to the feeding drum 5. The operating means for the disc clutches 45 and 55 are identical in design and each comprises a shipper yoke 59 pivotally mounted at 60 within the main frame and engaging a shipper ring 61, the latter having fingers projecting into engagement with the end pressure plate of the disc clutch operated thereby. Engaged in a slot 62 in an arm 63 integral with the shipper yoke is a crank pin 64 secured to a vertical operating shaft 65 having an operating lever 66. These clutch operating levers extend rearwardly over the top of the main frame and have grasping portions conveniently located at the rear end of the machine. It will thus be seen that when the disc clutch 45 is applied, the controlling drum 6 may be driven in cable winding direction at a relatively high speed from the machine motor through bevel gearing 18, 19, spur gearing 24, 33, 37, 39, 40, 41, the fast speed worm gearing 43, 44, shaft 46 and the spur gear 47 meshing with the internal gear 48 secured to the drum. The feeding drum 5 may be driven in cable winding direction at a relatively low speed from the machine motor through bevel gearing 18, 19, spur gearing 24, 33, 37, 38, 50, 51, the low speed worm gearing 53, 54, shaft 56 and the spur gear 57 meshing with the internal gear 58 secured to the drum.

Now referring to the improved clutch-controlled connections whereby the feeding drum 5 may be driven at a relatively high speed and the controlling drum 6 may be driven at a relatively low speed, it will be noted that arranged coaxially with the fast speed worm wheel 44 is a spur gear 68 having its hub keyed to the shaft 46, and this spur gear meshes with a spur gear 69 secured to the horizontal shaft 30. The shaft 30 extends transversely of the machine rearwardly of the vertical shaft 22 and is suitably journaled within bearings supported within the main frame. Journaled on a bearing sleeve supported by the shaft 30 is a spur gear 70, and this gear is connectible to the shaft 30 by a sliding-clutch member 71 splined at 72 to the shaft and having clutch teeth connectible to clutch teeth 73 on the gear 70. The clutch member 71 is operated by a shipper yoke 74 actuated through operating connections including an operating handle 75 conveniently arranged at the rear end of the machine. Meshing with and driven by the spur gear 70 is a spur gear 76 secured to a horizontal shaft 77, the latter being arranged parallel with and below the shaft 30 and likewise suitably journaled within bearings supported within the main frame. Keyed to and driven by the shaft 77 is a spur gear 78 meshing with a spur gear 79 herein

arranged coaxial with the low speed worm wheel 54 and keyed to the shaft 56.

The feeding and controlling drums 5 and 6 are mounted on eccentric bushings whereby the drum gears may be released from their driving gears to permit free drum rotation, in the manner fully described in Patent No. 2,131,178 in which I am coinventor. Since these drum mountings are similar in construction, a description of the drum mounting for the feeding drum 5 will suffice for both. As shown in Fig. 6, the drum is journaled on a bearing sleeve supported on an eccentric bushing 80 supported by a stub shaft 81 secured to the adjacent side of the main frame. Secured to the eccentric bushing 80 is an operating lever 82 whereby the bushing may be rotated relative to the stub shaft to effect release of the internal drum gear 58 for meshing engagement with the driving gear 57. As these eccentric drum drive release devices are fully described in the above mentioned patent and do not per se enter into the present invention, further detailed description thereof is unnecessary.

Associated with the controlling drum 6 is a friction brake whereby rotation of the controlling drum in cable unwinding direction may be frictionally resisted, and this brake comprises a series of friction discs 83 secured to the hub of the spur gear 68 (Fig. 4) and interleaved with a series of friction discs 84 secured to a sleevelike member 85, the latter being rigidly secured to the adjacent side of the main frame. This brake is operated through the same operating means as that which operates the disc clutch 45, and the shipper ring 61 has fingers which project into engagement with the end pressure plate of the brake, so that when the disc clutch 45 is released the brake may be applied.

From the foregoing it will be evident that when the disc clutch 45 is applied and the clutch member 71 is connected, the feeding drum 5 may be driven in cable winding direction at a relatively high speed through the high speed worm gearing 43, 44, shaft 46, spur gears 68, 69, shaft 30, spur gears 70, 76, shaft 77, spur gears 78, 79, shaft 56 and the gear 57 meshing with the internal gear 58 secured to the drum. It will also be evident that when the disc clutch 55 is applied and the clutch member 71 is connected, the controlling drum 6 may be driven in cable winding direction at a relatively low speed through the worm gearing 53, 54, shaft 56, spur gearing 79, 78, shaft 77, spur gears 76, 70, shaft 30, spur gears 69, 68, shaft 46 and the gear 47 meshing with the internal gear 48 secured to the drum. During drive of the feeding drum 5 at a relatively low speed and drive of the controlling drum 6 at a relatively high speed, the clutch member 71 is released. Also, during drive of either drum at either speed the other drum may remain idle simply by operating the eccentric bushing to throw out the drum gear from meshing engagement with its driving gear. It will thus be seen that the drums may be separately driven in cable winding direction at a relatively high speed and at a relatively low speed and the feed drum may be driven at a slow speed while the controlling drum is concurrently driven at a fast speed. Also, when the disc clutch 45 is released, rotation of the controlling drum 6 in cable unwinding direction may be frictionally resisted by the brake 83, 84.

The mode of operation of a coal mining machine of the room and pillar type disclosed is well known to those skilled in the art, and, therefore, a detailed description of the mode of operation of the machine is unnecessary. As is usual in coal mining machines of the type disclosed, the feeding and controlling cables 7 and 8 may have their free ends attached to appropriately located anchor jacks, and the feeding drum 5 may be employed to wind in the feeding cable to effect sumping of the cutter bar into the coal adjacent the right hand rib, and thereafter to feed the cutter bar transversely across the coal face. During the transverse cutting operation, the controlling drum 6 may wind in the controlling cable at either low or high speeds to effect guiding of the machine, and when the machine approaches the left hand rib the controlling cable may also be employed to effect angling of the machine with respect to the left hand rib. Thereafter the feeding cable is properly set up and then wound in by its drum to effect retraction of the machine to withdraw the cutter bar from the coal. The feeding cable may be extended around the various guide sheaves along either side of the machine, and preferably the feeding cable is extended along the right hand side of the machine to an anchor jack located near the right hand rib during the sumping operation.

As a result of this invention it will be noted that an improved mining machine transmission mechanism is provided whereby the cable winding drums may be rotated in cable winding direction at relatively high and relatively low speeds. It will further be evident that by the provision of the improved clutch-controlled connections between the low and high speed gearings, either drum may be driven at either high or low speeds through either gearing and the feed drum may be driven at a slow speed while the controlling drum is concurrently driven at a fast speed. It will also be evident that by the provision of the novel transmission connections a plural speed transmission mechanism is provided which is extremely simple in construction. Other uses and advantages of the improved mining machine will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. A mining machine transmission mechanism comprising, in combination, relatively rotatable members to be driven, a high speed transmission including a high speed controlling clutch through which one of said members may be driven at a relatively high speed, a low speed transmission including a low speed controlling clutch through which said other member may be driven at a relatively low speed, and transmission connections driven by an element of said low speed transmission and controlled by said low speed controlling clutch for effecting drive of said high speed driven member at a relatively low speed.

2. A mining machine transmission mechanism comprising, in combination, relatively rotatable members to be driven, a high speed transmission including a high speed controlling clutch through which one of said members may be driven at a relatively high speed, a low speed transmission including a low speed controlling clutch through which said other member may be driven at a relatively low speed, and transmission connections

driven by an element of said high speed transmission and controlled by said high speed controlling clutch for driving said low speed driven member at a relatively high speed.

3. A mining machine transmission mechanism comprising, in combination, relatively rotatable members to be driven, a high speed transmission including a high speed controlling clutch through which one of said members may be driven at a relatively high speed, a low speed transmission including a low speed controlling clutch through which said other member may be driven at a relatively low speed, transmission connections driven by an element of said low speed transmission and controlled by said low speed controlling clutch for effecting drive of said high speed driven member at a relatively low speed, a brake for frictionally resisting rotation of one of said members when the same is disconnected from its drive, and clutch means for interrupting the drive through said transmission connections during braking of said member.

4. A mining machine transmission mechanism comprising, in combination, relatively rotatable members to be driven, a high speed transmission including a high speed controlling clutch through which one of said members may be driven at a relatively high speed, a low speed transmission including a low speed controlling clutch through which said other member may be driven at a relatively low speed, transmission connections driven by an element of said low speed transmission and controlled by said low speed controlling clutch for effecting drive of said high speed driven member at a relatively low speed, a brake for frictionally resisting the rotation of one of said members when the same is disconnected from its drive, and means for interrupting the drive through said transmission connections during braking of said member including a releasable clutch for disconnecting elements of said transmission connections.

5. A mining machine transmission mechanism comprising, in combination, relatively rotatable members to be driven, and means for driving said members one at a relatively high speed and the other at a relatively low speed including high and low speed transmissions respectively having high and low speed controlling clutches, and means operatively connected to an element of said low speed transmission and controlled by said low speed controlling clutch for driving said high speed driven member at a relatively low speed.

6. A mining machine transmission mechanism comprising, in combination, relatively rotatable members to be driven, and means for driving said members one at a relatively high speed and the other at a relatively low speed including high and low speed transmissions respectively having high and low speed controlling clutches, and means operatively connected to an element of said low speed transmission and controlled by said low speed controlling clutch for driving said high speed driven member at a relatively low speed, said last mentioned means including transmission shafting extending between said high and low speed transmissions and distinct from the latter.

7. A mining machine transmission mechanism comprising, in combination, relatively rotatable members to be driven, a high speed transmission including a high speed controlling clutch for driving one of said members at a relatively high speed, a low speed transmission including a low speed controlling clutch for driving said other member at a relatively low speed, and driving connections distinct from said transmissions and operatively connected to and driven by an element of said low speed transmission and controlled by said low speed controlling clutch for driving said high speed driven member at a relatively low speed.

8. A mining machine transmission mechanism comprising, in combination, relatively rotatable members to be driven, a high speed transmission including a high speed controlling clutch for driving one of said members at a relatively high speed, a low speed transmission including a low speed controlling clutch for driving said other member at a relatively low speed, and driving connections distinct from said transmissions and connected to and driven by an element of said high speed transmission and controlled by said high speed controlling clutch for driving said low speed driven member at a relatively high speed.

9. A mining machine transmission mechanism comprising, in combination, relatively rotatable members to be driven, a high speed transmission including a high speed controlling clutch for driving one of said members at a relatively high speed, a low speed transmission including a low speed controlling clutch for driving said other member at a relatively low speed, and driving connections operatively connected to and driven by an element of said low speed transmission and controlled by said low speed controlling clutch for driving said high speed driven member at a relatively low speed, said driving connections including transmission shafting arranged in parallelism with the elements of said high and low speed transmissions.

10. A mining machine transmission mechanism comprising, in combination, relatively rotatable members to be driven, a high speed transmission including a high speed controlling clutch for driving one of said members at a relatively high speed, a low speed transmission including a low speed controlling clutch for driving said other member at a relatively low speed, driving connections operatively connected to and driven by an element of said low speed transmission and controlled by said low speed controlling clutch for driving said high speed driven member at a relatively low speed, and a brake for frictionally resisting rotation of said high speed driven member when the latter is disconnected from its drive, said driving connections including a clutch for interrupting the drive therethrough during braking of said member.

11. A mining machine transmission mechanism comprising, in combination, relatively rotatable members to be driven, a high speed transmission including a high speed controlling clutch for driving one of said members at a relatively high speed, a low speed transmission including a low speed controlling clutch for driving said other member at a relatively low speed, and means for driving said high speed driven member at a relatively low speed including a transmission element rotatable with an element of said low speed transmission and controlled by said low speed controlling clutch, and transmission connections between said transmission element and said high speed driven member.

12. A mining machine transmission mechanism comprising, in combination, relatively rotatable members to be driven, a high speed transmission including a high speed controlling clutch for driving one of said members at a relatively high speed, a low speed transmission including a low speed controlling clutch for driving said other

member at a relatively low speed, and means for driving said low speed driven member at a relatively high speed including a transmission element rotatable with an element of said high speed transmission and controlled by said high speed controlling clutch, and transmission connections between said transmission element and said low speed driven member.

13. A mining machine transmission mechanism comprising, in combination, relatively rotatable members to be driven, a low speed transmission including a low speed controlling clutch for driving one of said members at a relatively low speed, a high speed transmission for driving said other member at a relatively high speed, and supplemental driving connections driven through an element of said low speed transmission and controlled by said low speed controlling clutch for driving said high speed driven member at a low speed.

14. A mining machine transmission mechanism comprising, in combination, relatively rotatable members to be driven, a low speed transmission including a low speed controlling clutch for driving one of said members at a relatively low speed, a high speed transmission for driving said other member at a relatively high speed, supplemental driving connections driven through an element of said low speed transmission and controlled by said low speed controlling clutch for driving said high speed driven member at a relatively low speed, a brake for frictionally resisting rotation of said high speed driven member when the latter is disconnected from its drive, and clutch means for interrupting the drive through said supplemental driving connections during braking of said member.

LEON E. SIMMONS.

CERTIFICATE OF CORRECTION.

Patent No. 2,335,318. November 30, 1943.

LEON E. SIMMONS

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, line 18, for "gear 58 for" read --gear 58 from--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 8th day of February, A. D. 1944.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)