May 7, 1946. C. E. TIBBALS 2,399,713

LONGWALL MINING MACHINE

Filed April 21, 1945 4 Sheets-Sheet 1

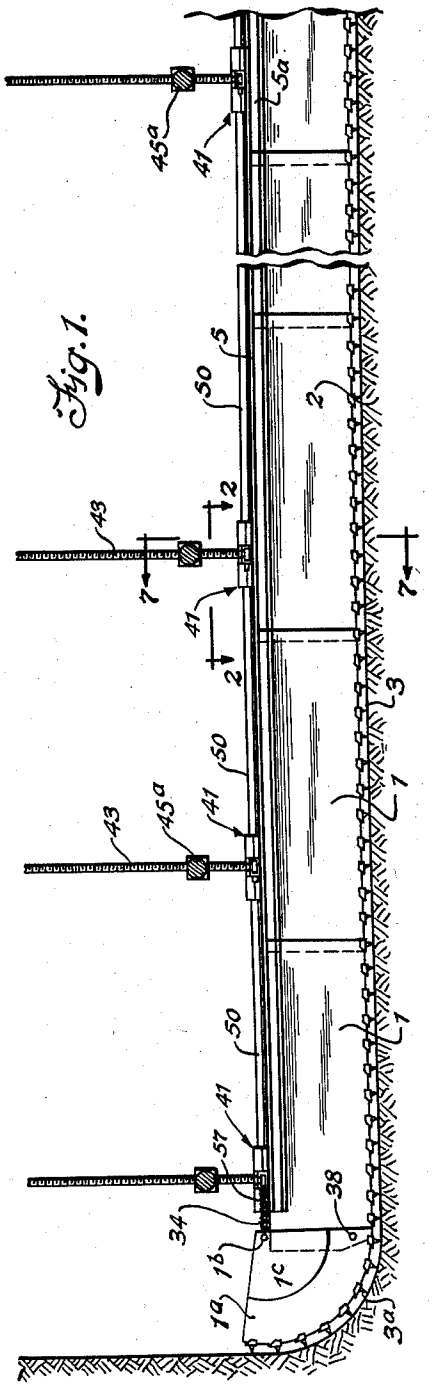


Fig. 1.

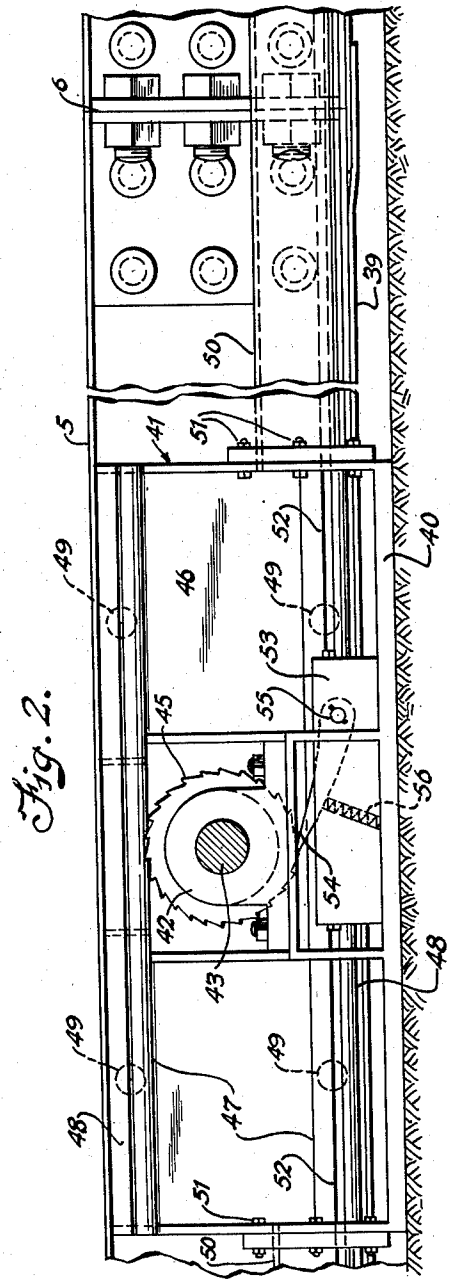


Fig. 2.

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LONGWALL MINING MACHINE

Filed April 21, 1945 4 Sheets-Sheet 2

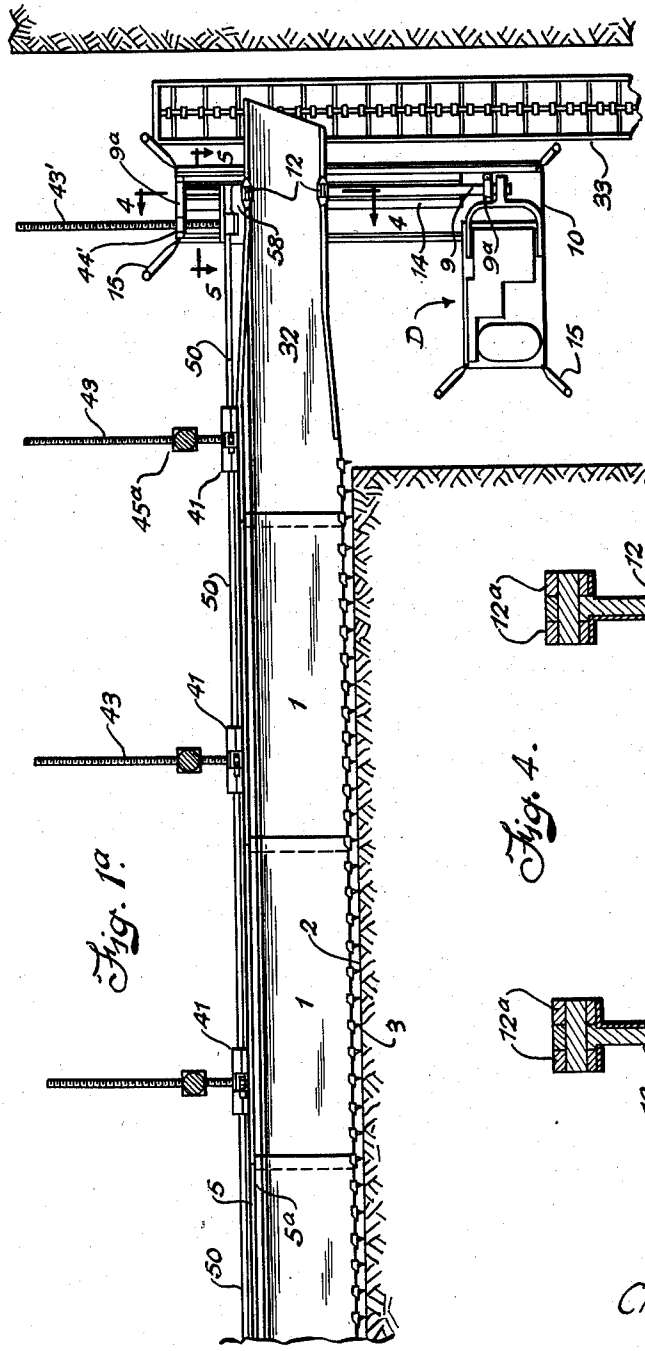


Fig. 1a.

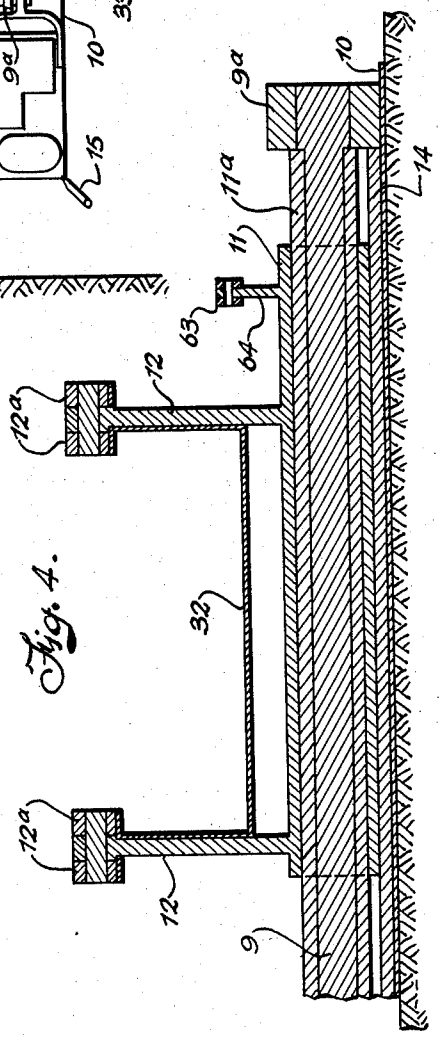


Fig. 4.

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LONGWALL MINING MACHINE

Filed April 21, 1945 4 Sheets-Sheet 3

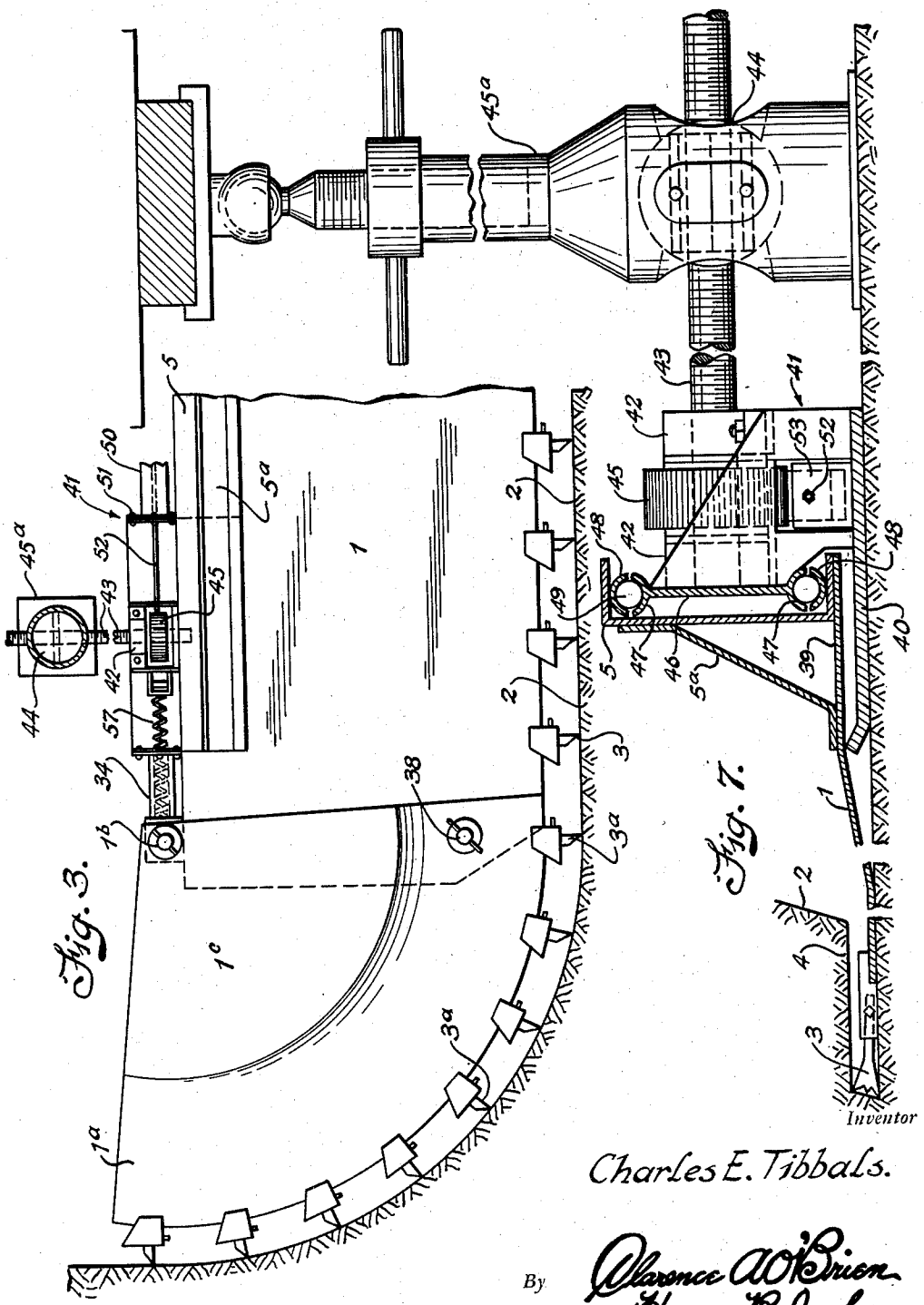


Fig. 3.

Fig. 7.

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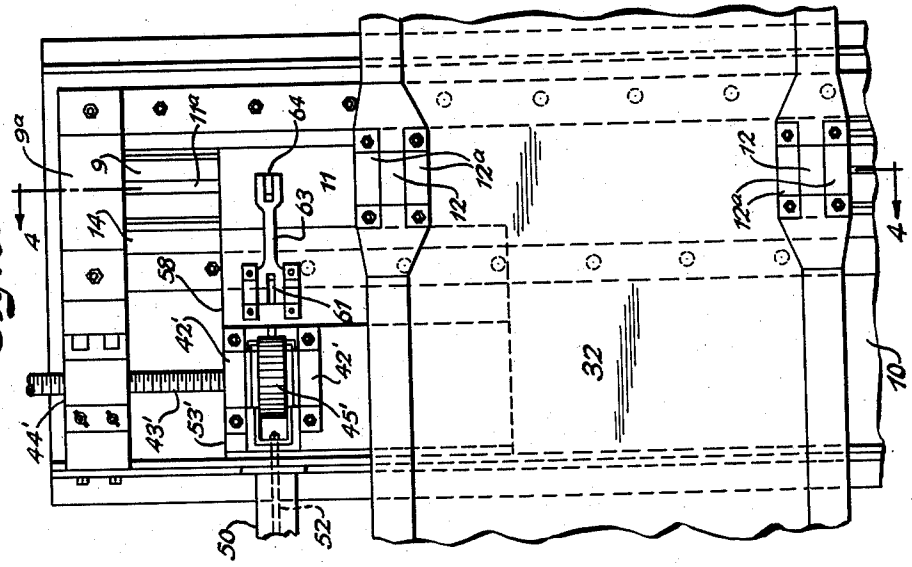
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May 7, 1946. C. E. TIBBALS 2,399,713

LONGWALL MINING MACHINE

Filed April 21, 1945 4 Sheets-Sheet 4

Fig. 6.



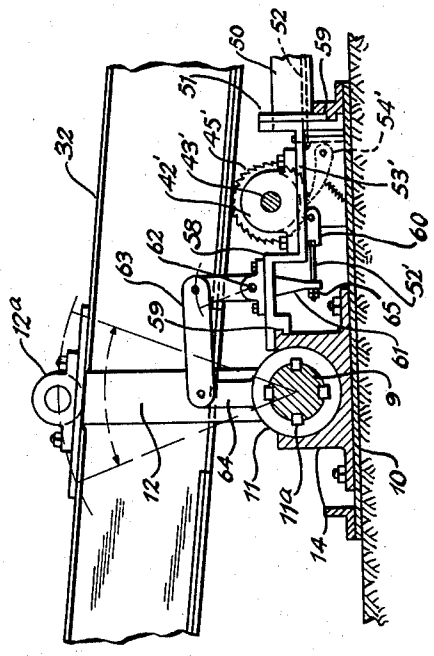


Fig. 5.

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Patented May 7, 1946 2,399,713

UNITED STATES PATENT OFFICE

2,399,713

LONGWALL MINING MACHINE

Charles E. Tibbals, Bluefield, W. Va.

Application April 21, 1945, Serial No. 589,483

11 Claims. (Cl. 262—1)

This invention relates to certain new and useful improvements in the type of longwall mining machine disclosed in my copending U. S. application for Letters Patent, Serial No. 548,014, filed August 4, 1944.

An important object of the present invention is to provide anti-friction means to support part of the load on the shaking conveyor and undercutter so as to reduce the drag of the latter upon the mine floor and to thereby promote ease of movement of the same.

A further object of the invention is to provide the anti-friction means so that the conveyor and undercutter is allowed to move relative to the feed units forming part of means to feed the conveyor and undercutter laterally toward the pillar being mined, whereby objectionable horizontal oscillation of the feed screws of said units is eliminated.

A still further object of the invention is to provide the back end of the conveyor and undercutter with an oscillating section having an arcuate edge provided with cutting bits, whereby a pillar may be mined in an entry which is open only at one end without preliminary development work to extend the entry.

Still another object of the invention is to provide improved means for actuating the ratchet wheels of the feed units forming part of the means for feeding the conveyor and undercutter laterally toward the pillar being mined.

More specific objects and features of the invention will become apparent from the following description when considered in connection with the accompanying drawings, and the invention consists in the novel form, combination and arrangement of parts hereinafter more fully described, shown in the drawings and claimed.

In the drawings, wherein like reference characters indicate corresponding parts throughout the several views:

Figure 1 is a plan view showing substantially one-half of a mining machine constructed in accordance with the present invention.

Figure 1—*a* is a view similar to Figure 1 showing the remainder of the machine, this view, together with Figure 1, showing the complete machine.

Figure 2 is an enlarged fragmentary section taken on line 2—2 of Figure 1.

Figure 3 is an enlarged fragmentary plan view showing the back end of the conveyor and undercutter.

Figure 4 is an enlarged section through the discharge pan and the drive unit, taken on line 4—4 of Figure 1—*a*.

Figure 5 is an enlarged section taken on line 5—5 of Figure 1—*a*.

Figure 6 is an enlarged fragmentary plan view of the portion of the machine at the discharge pan and drive unit.

Figure 7 is an enlarged transverse section taken on line 7—7 of Figure 1.

Referring in detail to the drawings, the present invention consists of a combined shaking conveyor and undercutter including a series of overlapping metallic plates 1 etxending along the face of the coal pillar 2 and resting at the portions adjacent the pillar upon the mine floor. The edges of the plates next to the coal are fitted with replaceable steel bits 3 to form a cutting edge. The conveyor and undercutter is reciprocated by a driving unit D in a manner similar to a common shaking conveyor, and it is fed automatically toward the coal to form an undercut 4 by means later described. As usual, the conveyor and undercutter is reciprocated with a rapid rearward and a slow forward movement to effect the forward travel of the coal.

An upstanding side member 5, consisting of channel iron sections, is fastened upon the edges of the plates 1 remote from the coal face to stiffen and connect the plates 1 and to form a wall for retaining the coal on said plates. Bolted connections are provided at 6 between the sections of the side member 5, as shown in Figure 2, and a bracing strip 5*a* of angular form connects each section of member 5 with the associated plate 1 to brace the plates in proper angular relation to the side member 5 at the outer edge portions of said plates. The bracing strips 5*a* correspond to the length of the plates 1 and may have their adjacent ends overlapped in the same manner as the plates. This construction provides a conveyor and undercutter having limited lateral flexibility, as is desirable.

The end of the conveyor and undercutter next to the driving unit D is fitted with a discharge pan 32 which is inclined upwardly and outwardly to discharge the coal into a standard conveyor 33 located in the main entry beside the driving unit. The drive unit D is a standard shaking conveyor drive unit fitted with a drive shaft 9 which is journaled in bearings 9*a* of a base plate 10. A sleeve 11 is slidably keyed at 11*a* on the shaft 9 and carries upstanding drive arms 12 whose upper ends are journaled in bearings 12*a* secured on the upper flanges of the side members of discharge pan 32. The arms 12 are oscillated to

reciprocate the conveyor and undercutter, and the sliding movement of sleeve 11 on shaft 9 permits the pan 32 to move laterally toward the coal. A channel-shaped guide 14 is secured on the base plate 10 and slidably snugly receives the sleeve 11 to transmit the lateral shaft stresses to the base plate 10. Heavy screw jacks 15 are set against the mine roof to hold the drive unit rigidly in position.

At the back end of the machine, the conveyor and undercutter has a segmental plate 1a which is pivoted at 1b, to a stationary structural member 34 of the machine adjacent the rear end and at the outer edge of the rearmost plate 1, for horizontal oscillation. The segmental plate 1a has an arcuate edge concentric with the pivot 1b and equipped with detachable cutter bits 3a. Also, the edge of plate 1a adjacent the rearmost plate 1 is overlapped upon the latter, as shown in Figure 3, and an eccentric pin connection 38 is provided between the plate 1a and the adjacent plate 1 where they overlap. The arrangement is such that when the plates 1 are longitudinally reciprocated, the plate 1a is caused to oscillate about the pivot 1b so as to undercut the coal in an arcuate path at the closed end of the entry and so that preliminary development work is eliminated at this point. The outer portion 1c of the plate 1a is preferably offset upwardly to keep the coal on the marginal portion of plate 1a adjacent the cutting bits and thereby insure movement of the coal onto the adjacent plate 1.

The outer edge portion of each plate 1 is offset upwardly, as shown at 39 in Figure 7, and located beneath this edge portion of each plate 1 is a shoe 40 adapted to rest upon the mine floor. A frame 41 is rigid with and rises from each shoe 40 and has spaced bearings 42 in which is journaled the end portion of a feed screw 43. Each feed screw 43 has threaded engagement in a nut member mounted at 44 in the base of a jack 45a disposed at the outer side of the conveyor and undercutter and held stationary by engagement with the roof and floor of the mine. A ratchet wheel 45 is secured on the feed screw 43 between the bearings 42, for a purpose which will presently become apparent. Each frame 41 has a rigid plate member 46 disposed within and arranged parallel with the adjacent section of side member 5, and this plate member 46 is provided at the top and bottom with channel tracks 47. Coacting and parallel with the tracks 47 are further tracks 48 respectively secured to the under side of the upper flange and to the upper side of the lower flange of the adjacent section of side member 5. Interposed between each pair of coacting tracks 47 and 48 are bearing balls 49. Anti-friction bearings are thus provided for promoting ease of movement of the conveyor and undercutter relative to the shoes 40, and for supporting the load of the conveyor and undercutter along the outer edge portion of the latter.

Tubular structural members 50 are arranged between and rigidly connect adjacent frames 41, the ends of the members 50 being rigidly bolted to the frames 41 at 51. Extending through each structural member 50 is a rod section 52, and adjacent rod sections 52 are rigidly connected to the opposite ends of box-like slides 53 mounted on the shoes 40 and slidable in the frames 41. A pawl 54 is pivoted at 55 in each connector 53, and is spring-pressed upwardly at 56 into operative engagement with the adjacent ratchet wheel 45. At the back end of the conveyor and undercutter, the adjacent rod section 52 has its rear end attached to a helical tension spring 57 that extends through the structural member 34 and has its other end attached to the pivot 1b for the segmental section 1a. Structural member 34 is rigidly secured to the rear end of the adjacent frame 41, and it will be seen that spring 57 yieldingly resists movement of the rod sections 52 and the connectors 53 toward the front or discharge end of the machine. At the discharge end, the adjacent structural member 50 is bolted at 51 to a carriage 58, as shown in Figure 5, said carriage being slidably mounted on the base 10 and its guide 14 at 59 for movement parallel with shaft 9. A further connector 53' is slidable beneath the carriage 58 and has the adjacent rod section 52 bolted thereto. A short rod section 52' is connected with slide 53' by means of a pivoted clevis or yoke 60, and this rod section 52' slidably extends through the depending arm of a lever 61 pivoted intermediate its ends at 62 upon the carriage 58. The upper arm of lever 61 is connected by a link 63 with an upstanding arm 64 rigid with sleeve 11, and nuts 65 are adjustably mounted on the rod section 52' at the forward side of lever 61. The feed screw 43' at the discharge end of the machine is journaled in bearings 42' mounted on carriage 58, ratchet wheel 45' being secured on screw 43' between the bearings 42'. The screw 43' is associated with a nut member mounted at 44' on the base plate 10. Connector 53' also carries a pawl 54' that is spring-pressed into engagement with the ratchet wheel 45'.

In operation, the coal is undercut by the present machine and is then broken down onto the conveyor and undercutter by suitable means. As the conveyor and undercutter reciprocates, the broken down coal is moved forwardly and ultimately discharged from the pan 32 onto the conveyor 33 for discharge at a desired remote point. Driving unit D causes differential rocking movement of shaft 9 and oscillation of arms 12 so that the conveyor and undercutter is reciprocated with a fast rearward stroke and a slow forward stroke. As the conveyor and undercutter moves relative to the ratchet wheels and feed screws, the said feed screws are not oscillated. This eliminates a hazard presented by the construction disclosed in my above-mentioned copending application, and the ball bearing supports at the outer side of the conveyor and undercutter minimize the load on the drive unit. As the arms 12 are longer than the arm 64, the conveyor and undercutter moves backward for a greater distance than the rod sections 52 and 52' and the connectors 53 and 53'. During the latter part of the back stroke of the conveyor and undercutter, the lever 61 engages the nuts 65 so as to exert a forward pull on rod sections 52 and 52' and the connectors 53 and 53'. This causes pawls 54 and 54' to move forwardly relative to the ratchet wheels 45 and 45', thereby turning the latter so that the feed screws 43 and 43' are fed toward the face by the associated nut members at 44 and 44'. This causes the shoes 40 and the conveyor and undercutter to be fed toward the coal as the undercutting operation and conveying operation proceed. On the forward stroke of the conveyor and undercutter, lever 61 is moved away from nuts 65 and spring 57 causes the rod sections 52 and 52' and the connectors 53 and 53' to be moved rearwardly and back to their normal positions. It is well known that the maximum load on a shaking conveyor drive is during the quick back stroke. The

conveyor and undercutter of the present machine is fed laterally by the feed mechanism during the decelerating part of the back stroke or during approximately the latter one-third of the stroke, thus causing the cutting to be done on the slow forward stroke or during the low load part of each cycle. At the back of the machine, the oscillating section 1*a* is swung about the pivot 1*b* so as to undercut the coal at the closed end of the entry, without the necessity of previous development work at this point. As the conveyor and undercutter is fed toward the pillar during completion of each rearward stroke or movement thereof, the cutter bits are adjusted for the next cutting operation so as to deepen the undercut 4 each time the conveyor and undercutter moves forwardly or toward the conveyor 33.

From the foregoing description, it is believed that the construction, operation and advantages of the present invention will be readily understood and appreciated by those skilled in the art. Minor changes in details of construction illustrated and described are contemplated, such as fall within the spirit and scope of the invention as claimed.

What I claim is:

1. A longwall mining machine comprising an elongated shaking conveyor and undercutter including a plate assembly adapted to be reciprocated with the inner longitudinal edge portion thereof disposed upon the mine floor and having detachable undercutting bits along the inner edge thereof and a channel-shaped coal-retaining wall along the outer longitudinal edge portion of the same, said coal-retaining wall having outwardly projecting upper and lower flanges, a driving unit connected to the discharge end of the assembly for imparting longitudinal reciprocating movement thereto with a quick rearward stroke and a slow forward stroke, stationary floor-engaging shoes horizontally disposed in spaced relation and projecting beneath the outer longitudinal edge portion of the assembly, frames rigid with and rising from said shoes, and projecting between said flanges of the coal-retaining wall and anti-friction bearings between said frames and said flanges of the coal-retaining wall.

2. A longwall mining machine comprising an elongated shaking conveyor and undercutter including a plate assembly adapted to be reciprocated with the inner longitudinal edge portion thereof disposed upon the mine floor and having detachable under-cutting bits along the inner edge thereof and a channel-shaped coal-retaining wall along the outer longitudinal edge portion of the same, said coal-retaining wall having outwardly projecting upper and lower flanges, a driving unit connected to the discharge end of the assembly for imparting longitudinal reciprocating movement thereto with a quick rearward stroke and a slow forward stroke, stationary floor-engaging shoes horizontally disposed in spaced relation and projecting beneath the outer longitudinal edge portion of the assembly, frames rigid with and rising from said shoes, and projecting between said flanges of the coal retaining wall and anti-friction bearings between said frames and said flanges of the coal-retaining wall, and horizontal structural members rigidly connecting said frames.

3. A longwall mining machine comprising an elongated shaking conveyor and undercutter including a plate assembly adapted to be reciprocated with the inner longitudinal edge portion thereof disposed upon the mine floor and having detachable undercutting bits along the inner edge thereof and a coal-retaining wall along the outer longitudinal edge portion of the same, a driving unit connected to the discharge end of the assembly for imparting longitudinal reciprocating movement thereto with a quick rearward stroke and a slow forward stroke, stationary floor-engaging shoes horizontally disposed in spaced relation and projecting beneath the outer longitudinal edge portion of the assembly, frames rigid with and rising from said shoes, and anti-friction bearings between said frames and said coal-retaining wall, and horizontal structural members rigidly connecting said frames, transversely arranged feed screws disposed at spaced points along the outer edge of the assembly and having their inner ends journaled in said frames, ratchet wheels secured on the inner ends of said feed screws, an actuating element for said ratchet wheels including rod sections slidable through said structural members, and connectors for said rod sections slidable in said frames and carrying pawls spring-pressed into engagement with the ratchet wheels, stationary feed nuts for said feed screws, and means operatively connecting said actuating element to the driving unit for moving said actuating element longitudinally relative to the assembly so as to cause the pawls to turn the ratchet wheels and feed screws for feeding the assembly laterally toward the coal.

4. A longwall mining machine comprising an elongated shaking conveyor and undercutter including a plate assembly adapted to be reciprocated with the inner longitudinal edge portion thereof disposed upon the mine floor and having detachable undercutting bits along the inner edge thereof and a coal-retaining wall along the outer longitudinal edge portion of the same, a driving unit connected to the discharge end of the assembly for imparting longitudinal reciprocating movement thereto with a quick rearward stroke and a slow forward stroke, stationary floor-engaging shoes horizontally disposed in spaced relation and projecting beneath the outer longitudinal edge portion of the assembly, frames rigid with and rising from said shoes, and anti-friction bearings between said frames and said coal-retaining wall, and horizontal structural members rigidly connecting said frames, transversely arranged feed screws disposed at spaced points along the outer edge of the assembly and having their inner ends journaled in said frames, ratchet wheels secured on the inner ends of said feed screws, an actuating element for said ratchet wheels including rod sections slidably through said structural members, and connectors for said rod sections slidable in said frames and carrying pawls spring-pressed into engagement with the ratchet wheels, stationary feed nuts for said feed screws, and means operatively connecting said actuating element to the driving unit for moving said actuating element longitudinally relative to the assembly so as to cause the pawls to turn the ratchet wheels and feed screws for feeding the assembly laterally toward the coal during the latter part of the rearward stroke of the assembly.

5. The construction defined in claim 3, wherein the driving unit includes a base plate having a guideway extending transversely beneath the conveyor and undercutter, a driven rock shaft, a sleeve slidably fitted in said guideway and slidably keyed on said rock shaft, and upstanding arms rigid with said sleeve and pivoted to the conveyor and undercutter, in combination with a carriage slidable on said base plate parallel

with the rock shaft, and a structural member rigidly connecting the next adjacent frame with said carriage, one of said feed screws being journaled on said carriage.

6. The construction defined in claim 3, wherein the driving unit includes a base plate having a guideway extending transversely beneath the conveyor and undercutter, a driven rock shaft, a sleeve slidably fitted in said guideway and slidably keyed on said rock shaft, and upstanding arms rigid with said sleeve and pivoted to the conveyor and undercutter, in combination with a carriage slidable on said base plate parallel with the rock shaft, and a structural member rigidly connecting the next adjacent frame with said carriage, one of said feed screws being journaled on said carriage, the feed nut of said one feed screw being mounted on said base plate.

7. The construction defined in claim 3, wherein the driving unit includes a base plate having a guideway extending transversely beneath the conveyor and undercutter, a driven rock shaft, a sleeve slidably fitted in said guideway and slidably keyed on said rock shaft, and upstanding arms rigid with said sleeve and pivoted to the conveyor and undercutter, in combination with a carriage slidable on said base plate parallel with the rock shaft, and a structural member rigidly connecting the next adjacent frame with said carriage, one of said feed screws being journaled on said carriage, the means for operatively connecting the actuating element to the driving unit including a further connector slidable beneath the carriage and having an actuating pawl for said one feed screw, a relatively short arm rigid with said sleeve, and link and lever connections between said shorter arm and said further connector.

8. A longwall mining machine comprising an elongated shaking conveyor and undercutter including a plate assembly adapted to be reciprocated with the inner longitudinal edge portion thereof disposed upon the mine floor and having undercutting bits along the inner edge thereof and a coal-retaining wall along the outer longitudinal edge portion of the same, a driving unit connected to the discharge end of the assembly for imparting longitudinal reciprocating movement thereto with a quick rearward stroke and a slow forward stroke, a stationary structural member adjacent the rear outer corner of the assembly, and a horizontally oscillating segmental plate pivoted to said structural member and having an arcuate inner edge concentric with its pivot and provided with cutter bits, said segmental plate having an edge portion overlapped upon and pivotally connected to the rear end of the plate assembly at a point near the inner edge of the segmental plate.

9. A longwall mining machine comprising an elongated shaking conveyor and undercutter including a plate assembly adapted to be reciprocated with the inner longitudinal edge portion thereof disposed upon the mine floor and having undercutting bits along the inner edge thereof and a coal-retaining wall along the outer longitudinal edge portion of the same, a driving unit connected to the discharge end of the assembly for imparting longitudinal reciprocating movement thereto with a quick rearward stroke and a slow forward stroke, a horizontally oscillating segmental undercutting and conveying plate pivoted at and overlapped upon the rear end of the plate assembly, and means operatively connecting said segmental plate to the plate assembly for actuation by the latter.

10. A longwall mining machine comprising an elongated shaking conveyor and undercutter including a plate assembly adapted to be reciprocated with the inner longitudinal edge portion thereof disposed upon the mine floor and having detachable undercutting bits along the inner edge thereof and a coal-retaining wall along the outer longitudinal edge portion of the same, a driving unit connected to the discharge end of the assembly for imparting longitudinal reciprocating movement thereto with a quick rearward stroke and a slow forward stroke, stationary floor-engaging shoes horizontally disposed in spaced relation and projecting beneath the outer longitudinal edge portion of the assembly, frames rigid with and rising from said shoes, and anti-friction bearings between said frames and said coal-retaining wall, said coal-retaining wall being of channel form and having outwardly projecting top and bottom flanges, said frames having vertical walls parallel with said retaining wall, said bearings including pairs of coacting tracks fixed to the flanges of the retaining wall and the vertical walls of the frames, and bearing balls between the pairs of tracks.

11. A longwall mining machine comprising an elongated combined shaking conveyor and undercutter including a plate assembly adapted to be longitudinally reciprocated upon the mine floor, undercutting bits mounted along one longitudinal edge of said assembly, a coal-retaining wall mounted along the other longitudinal edge of said assembly, a driving unit for imparting longitudinal reciprocating movement to said assembly with quick rearward and slow forward strokes, said bits being arranged to undercut on the forward stroke, means to automatically feed the assembly laterally toward the coal upon each rearward stroke of the assembly, a horizontally oscillating segmental undercutting and conveying plate pivoted at and overlapped upon the rear end of the plate assembly, and means operatively connecting said segmental plate to the plate assembly for actuation by the latter, said segmental plate having a raised outer portion.

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