April 23, 1946. C. E. TIBBALS 2,399,073

LONGWALL MINING MACHINE

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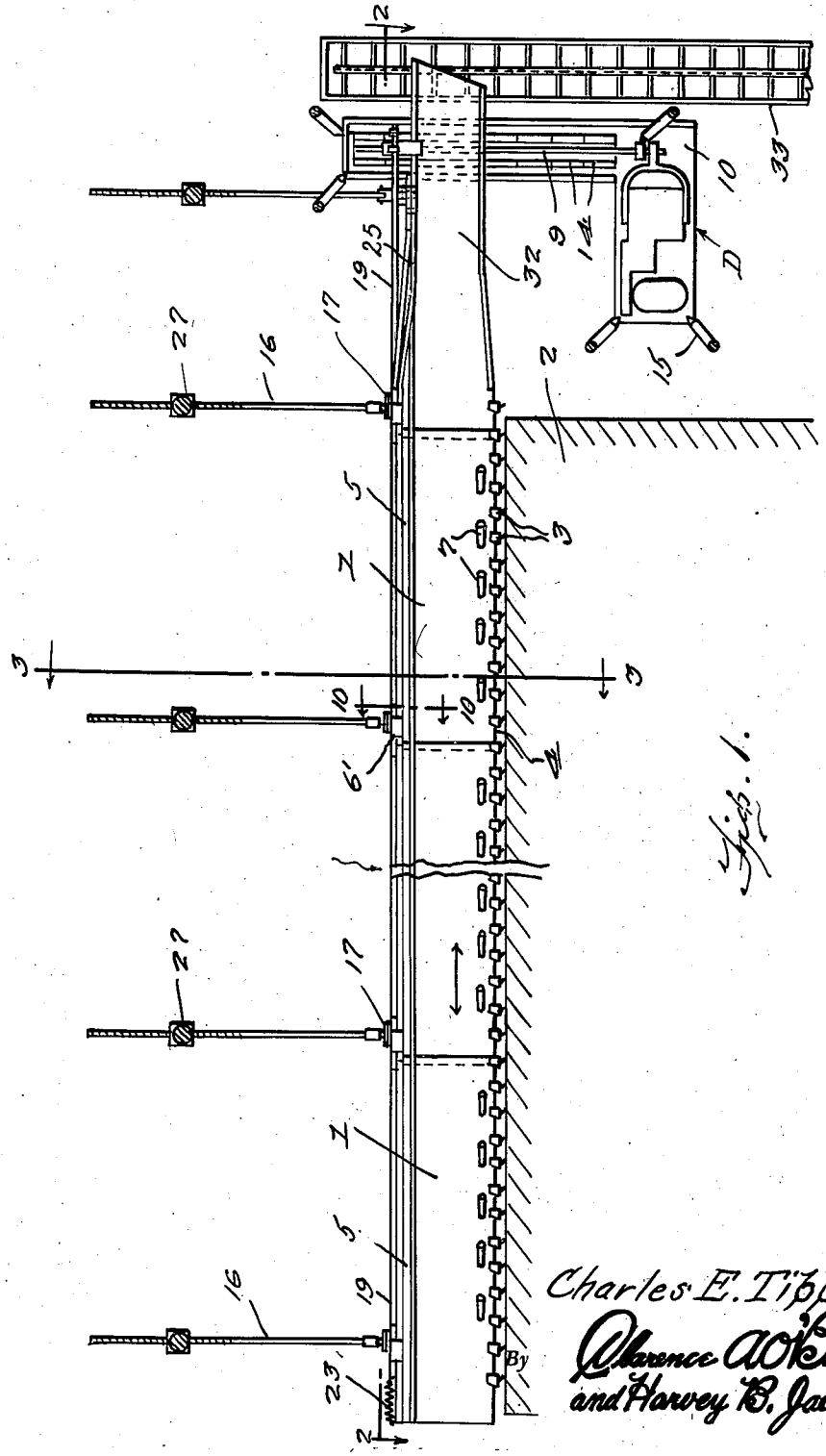


Fig. 1.

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Fig. 2.

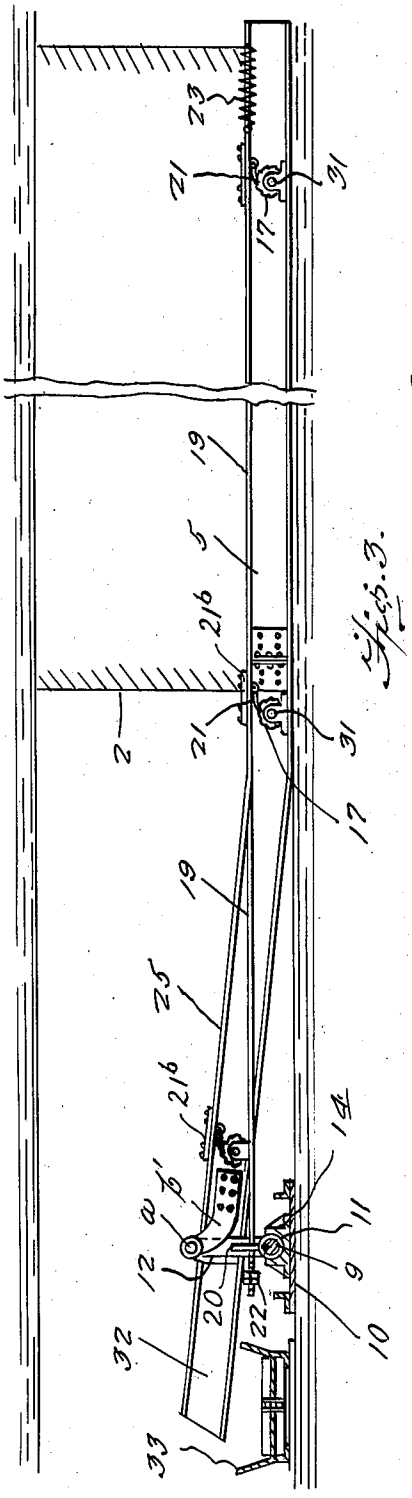
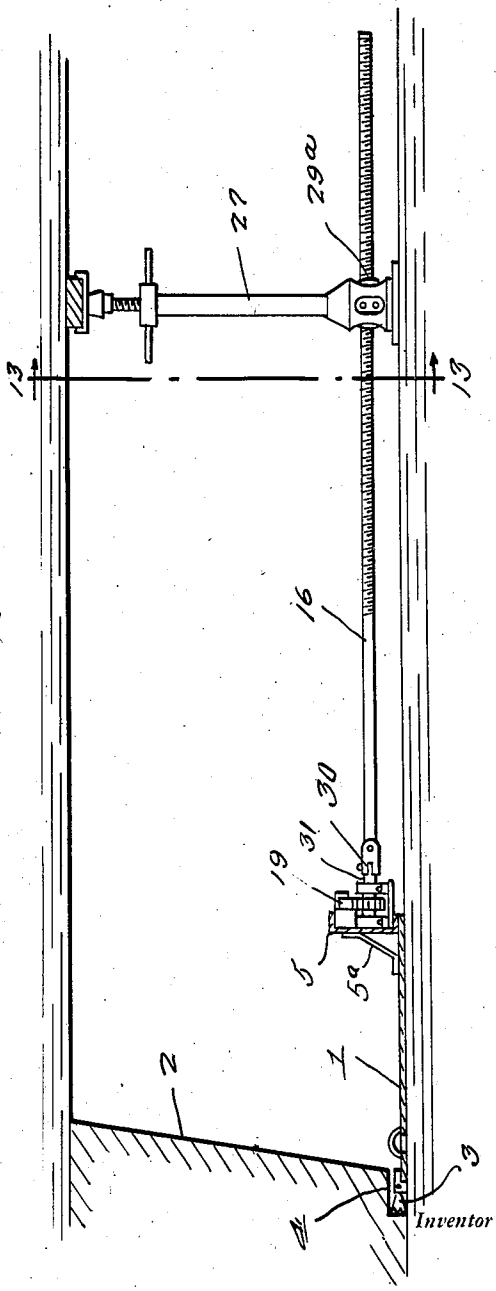


Fig. 3.



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Fig. 4.

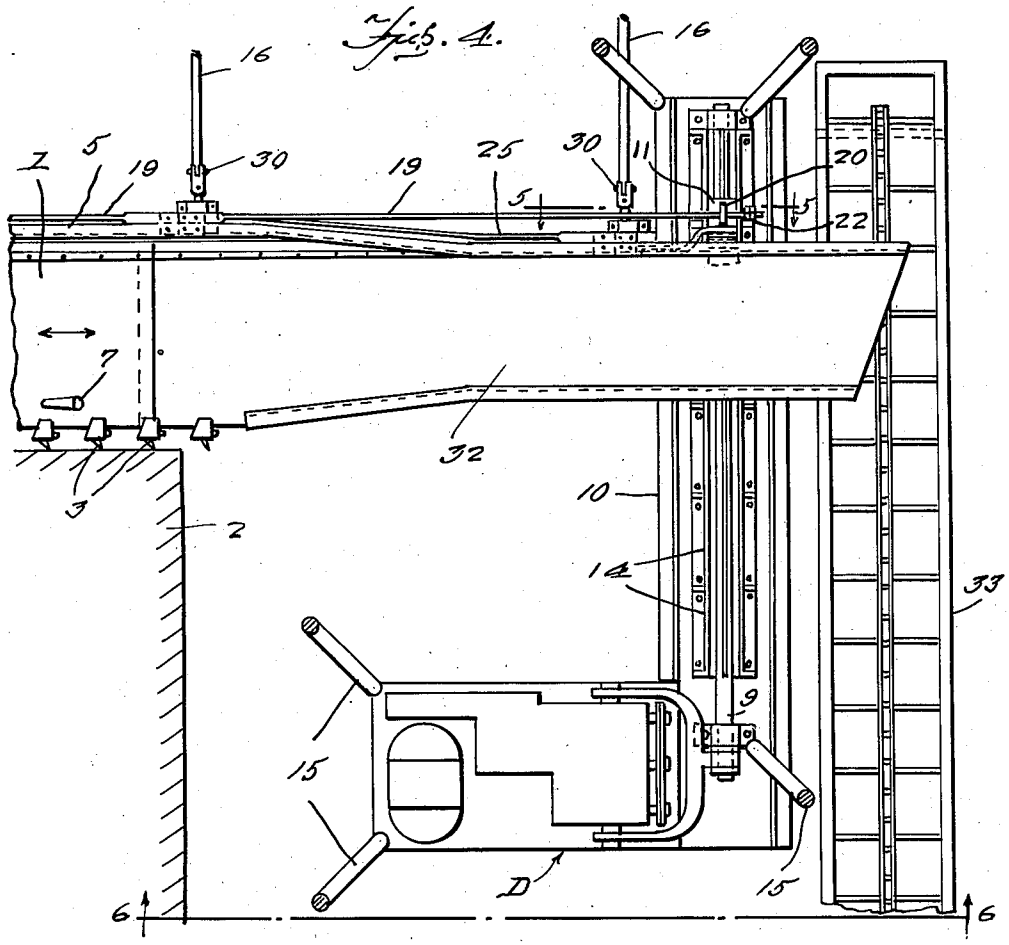


Fig. 8.

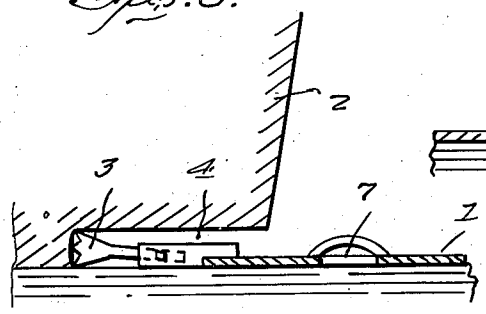
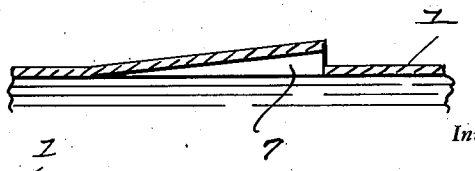


Fig. 9.



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Fig. 5.

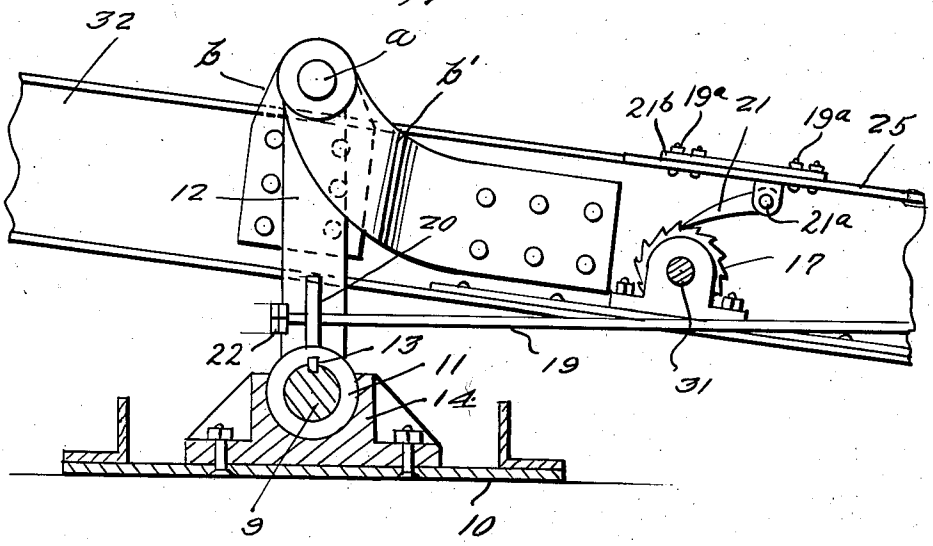
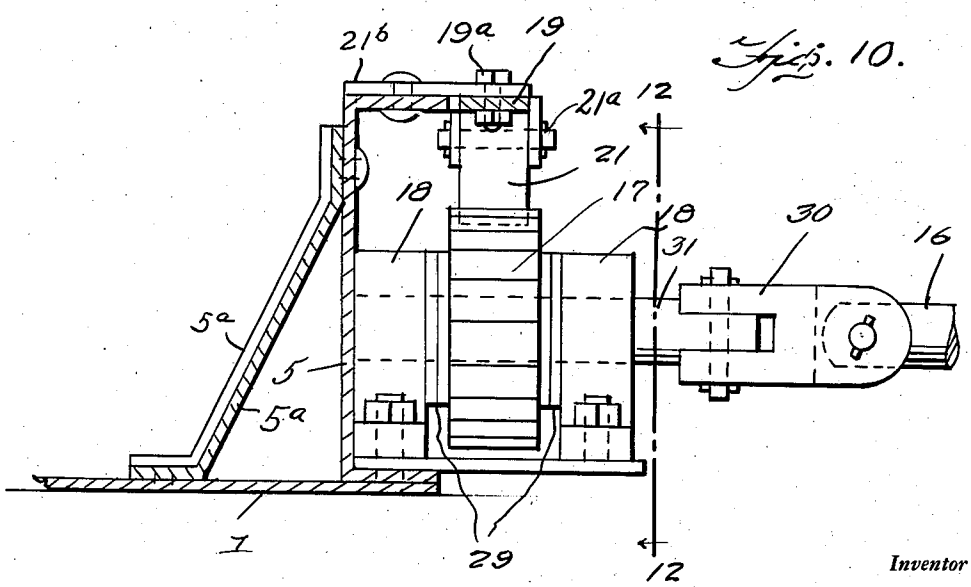


Fig. 10.



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Fig. 6.

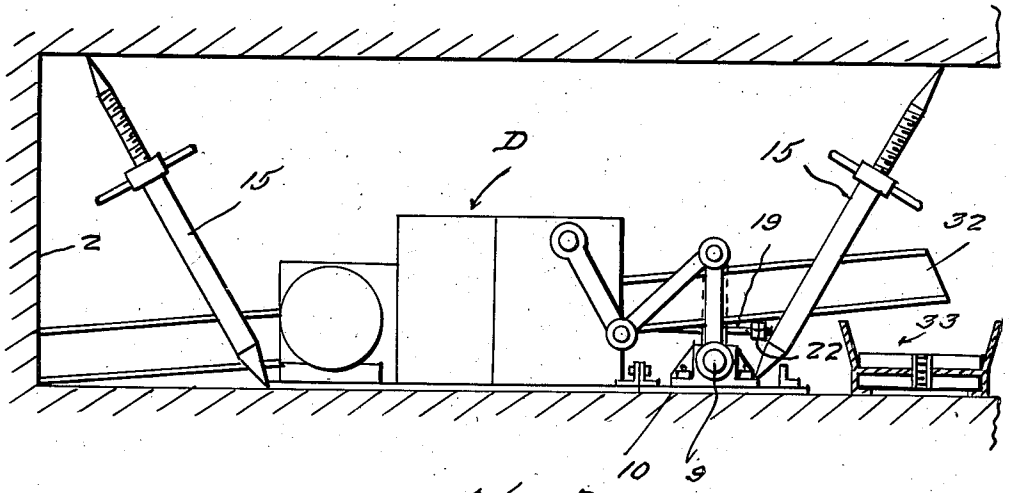
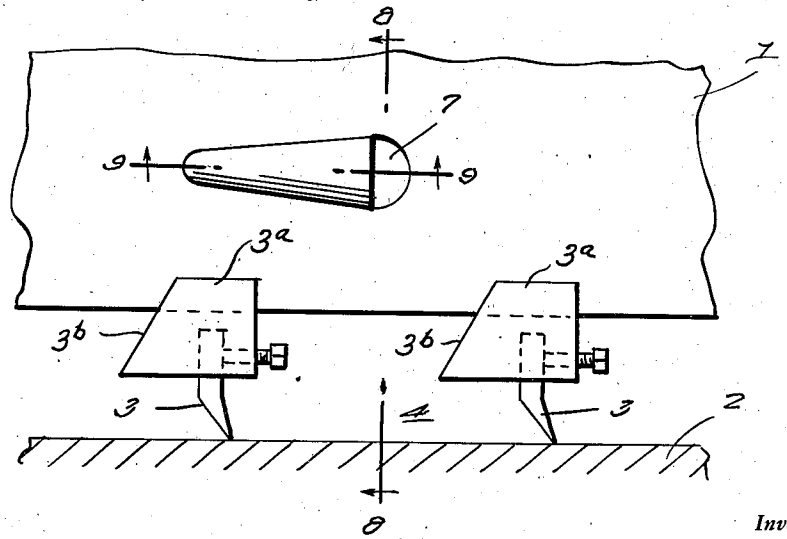


Fig. 7.



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Fig. 11.

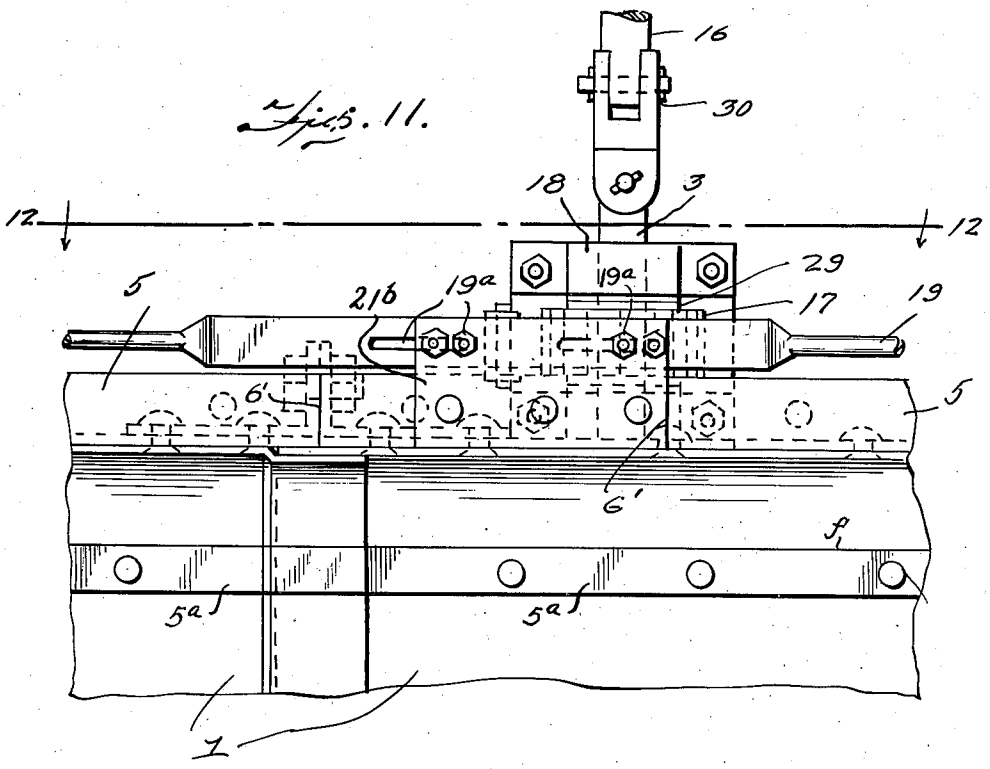
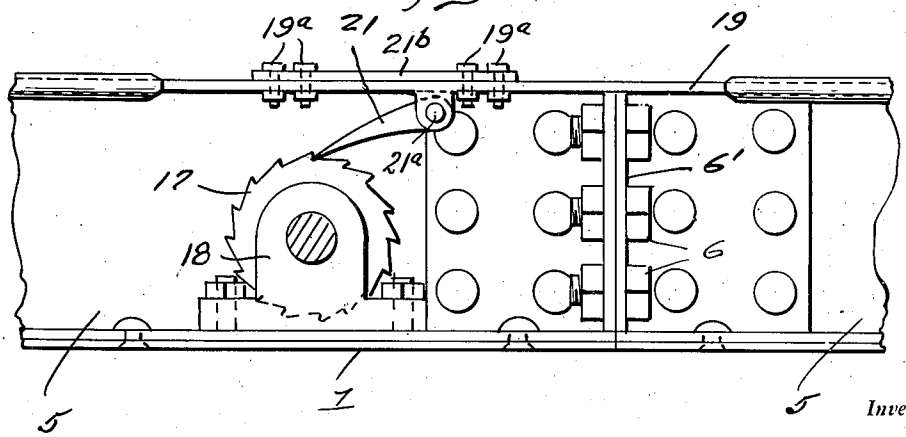


Fig. 12.



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Patented Apr. 23, 1946 2,399,073

UNITED STATES PATENT OFFICE

2,399,073

LONGWALL MINING MACHINE

Charles E. Tibbals, Bluefield, W. Va.

Application August 4, 1944, Serial No. 548,014

11 Claims. (Cl. 262—8)

This invention relates to an improved longwall mining machine particularly adapted to the retreat mining of coal pillars occurring in a relatively flat coal bed.

Present mechanical mining of coal involves a mining cycle of cutting, blasting, and loading. These operations require considerable manual effort and they interfere with each other in highly concentrated conveyor mining, thereby resulting in low equipment and labor operating efficiency. Also, each coal handling operation decreases the lump coal yield and therefore the monetary realization from the product.

The object of the present invention is to combine the cutting and conveying of the coal in one machine, and to eliminate the loading labor. All three of these operations are performed simultaneously, thus vastly increasing labor and machinery efficiency. As handling of the coal during loading is eliminated, the lump coal yield is increased.

More specific objects and features of the present 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 top plan view, partly broken away, of a mining machine constructed in accordance with the present invention, and illustrating the same as it appears in use.

Figure 2 is a vertical section drawn on an enlarged scale, and partly broken away, the plane of section being substantially on line 2—2 of Figure 1.

Figure 3 is an enlarged transverse section taken on line 3—3 of Figure 1.

Figure 4 is an enlarged fragmentary plan view of the right hand portion of the construction shown in Figure 1.

Figure 5 is an enlarged fragmentary section taken on line 5—5 of Figure 4.

Figure 6 is an enlarged section taken on line 6—6 of Figure 4.

Figure 7 is an enlarged fragmentary plan view showing an edge portion of one of the conveyor plates, with one of its louvered slots and two of its cutter bits.

Figure 8 is a fragmentary section taken on line 8—8 of Figure 7.

Figure 9 is a fragmentary section taken on line 9—9 of Figure 7.

Figure 10 is an enlarged fragmentary transverse section taken on line 10—10 of Figure 1.

Figure 11 is a fragmentary top plan view of the construction shown in Figure 10.

Figure 12 is a vertical section taken on line 12—12 of Figure 10.

Referring in detail to the drawings, the present invention consists of a combined shaking conveyor and under-cutter including a series of overlapping metallic plates 1 extending along the face of a coal pillar 2 and resting on the mine floor to form the conveyor. The edges of the plates next to the coal are fitted with replaceable steel bits 3 to form a cutting edge. Socket members 3*a* are fitted and secured on the edges of the plates 1 next to the coal, and one bit 3 is secured in each socket member. The back edges 3*b* of the socket members 3*a* are beveled to extend at such an oblique angle to the longitudinal axis of the shaking conveyor that the socket members force or plow coal dust away from the face onto the plates 1 during rearward movement of the shaking conveyor. These conveyor plates are reciprocated by a driving unit D in a manner similar to a common shaking conveyor and are forced automatically against the coal to form an undercut 4, as and by a means to be later described. It will of course be understood that the common shaking conveyor is reciprocated with a rapid rearward movement and a slow forward movement to effect the forward travel of the coal.

A side member 5, consisting of channel iron sections, is fastened to the edge of the conveyor away from the coal to stiffen the plates 1 and to retain the coal on the conveyor. Bolt connections 6 are provided between the sections of the side member 5. The ends of the bottom plates 1 overlap but are not secured together for a considerable part of their width, so that the conveyor is slightly flexible laterally. An angle bracing strip 5*a* is provided between and riveted to each plate 1 and its associated section of side member 5 adjacent the outer edge of said plate. The adjacent ends of these bracing strips may be overlapped, as shown in Figures 10 and 11. Louvered slots 7 are provided in the bottom plates 1 to remove dust that might collect under the conveyor. These slots are so arranged that upon rearward movement of the conveyor the coal dust will pass upwardly through the louvered slots 7 from beneath the plates 1.

The end of the conveyor next to the driving

unit D is fitted with a pan 32 which is elevated at the discharge end to discharge the coal into a standard conveyor 33. The drive unit D is a standard shaking conveyor drive unit fitted with an auxiliary drive shaft 9 which is supported in a heavy frame 10. The shaft 9 is long enough to permit about five feet of lateral conveyor travel toward the face of the pillar with one set-up of the drive unit. A sleeve 11 which carries a drive arm 12 is keyed at 13 to the shaft 9 so as to permit the sleeve and the driving arm to move laterally with the conveyor. Guide members 14 carried by frame 10 slidably receives sleeve 11 and transmit the lateral shaft stresses to the frame 10, and heavy screw jacks 15 are set against the mine roof to hold the drive unit rigidly in position.

The feed mechanism consists of a feed screw 16 located near each of the conveyor joints 6'. These feed screws are rotated by driving ratchet wheels 17 supported in bearings 18 fastened to the side member 5 of the conveyor. Thrust washers 29 are placed between the ratchet wheels 17 and the bearings 18 to receive the lateral pressure. The ratchet wheels are operated by a tension rod 19 which extends the full length of the conveyor and is slidably connected adjacent each joint 6' to the side member 5, as at 19*a*, for limited sliding movement relative to the latter. An adjusting nut 22 on the tension rod 19 is arranged to strike a stop block 20 fastened to the driving arm 12, so that when said adjusting nut strikes said stop block, the rod 19 is pulled forward to cause pawls 21 to rotate the ratchet wheels 17, all but one of said pawls being pivoted to ears on the rod 19 as at 21*a*. Rod 19 is held in tension by a heavy spring 23 at the back end of the conveyor, and the ratchet wheel next to the drive shaft 9 is operated by a short push rod 25 connected to rod 19 and carrying a further pawl 21. Rod 25 is also connected to the side of pan 32 like rod 19 is connected to member 5, as at 19*a*. The rods 19 and 25 are slidably connected to plates 21*b* riveted on the upper flanges of side member 5 and pan 32.

The rod 25 is welded at one end to rod 19, and both rods are flattened, as shown, where they are slidably connected to the plates 21*b*.

As the feed screws 16 are rotated, they are fed toward the pillar 2 by thread boxes arranged to pivot in the bases of screw jacks 27 engaged with the floor and roof of the mine. Each thread box 26 is mounted in a ball 29 to permit the feed unit to pivot with the motion of the conveyor. A flexible coupling 30 is used to connect each feed screw 16 to the short shaft 31 of the adjacent or associated ratchet wheel.

In operation, the coal is undercut by the present machine and is then broken down onto the conveyor by suitable means such as compressed air picks, hydraulic pressure tubes, or the use of explosives. 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. The means for breaking the coal down is not shown, as it may be a well known mining device.

As shown more clearly in Figure 5, the block 20 is carried by the arm 12 adjacent the inner end of the latter and adjacent the shaft 9, while the outer end of arm 12 is pivoted at *a* to brackets *b* and *b'* fixed to the adjacent side of pan 32. The spring 23 is anchored at one end to the rear end of rod 19 and at its other end to the rear end of the conveyor. It will thus be apparent that after adjusting nuts 22 engage block 20, the conveyor will move rearwardly a greater distance than rod 19. This lag in rod 19 causes the relative displacement between the rod 19 and the conveyor so as to in effect cause forward shifting of pawls 21 relative to the conveyor, thereby rotating ratchet wheels 17. In this way, lateral adjustment of the conveyor and undercutter toward the pillar is effected upon completion of each rearward movement of the conveyor and undercutter, thereby setting the cutter bits 3 for the next cutting operation which results in deepening 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 and operation, as well as the 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 combined conveyor and undercutter including a plate assembly adapted to be reciprocated upon the mine floor and having detachable undercutting bits mounted along one longitudinal edge thereof and a coal retaining wall mounted along the other longitudinal edge of the same, a driving unit for imparting longitudinal reciprocating movement to said conveyor and undercutter with a quick rearward and slow forward motion, and means actuated by said driving unit to automatically laterally feed said conveyor and undercutter uniformly from end to end toward the pillar being mined upon actuation of the same by said unit.

2. A construction as defined in claim 1, wherein the conveyor and undercutter comprises a plurality of plates mounted in end-to-end overlapping relation, and wherein the coal retaining wall is jointed to form the sole connection between said plates, whereby the conveyor and undercutter is laterally flexible.

3. The construction defined in claim 1, wherein the conveyor and undercutter comprises a plurality of plates mounted in end-to-end overlapping relation, each plate being provided with a longitudinal series of louvered slots to permit upward passage of coal dust therethrough upon rearward movement of the conveyor and undercutter.

4. The construction defined in claim 1, wherein said last-named means comprises a tension rod extending longitudinally of the conveyor and undercutter at the outer side of the latter and provided at predetermined intervals with pivoted pawls, a tension spring connecting the rear end of said tension rod with the rear end of said conveyor and undercutter, ratchet wheels mounted on and movable with the conveyor and undercutter and engaged by said pawls, and means to automatically effect relative longitudinal movement between the tension rod and the conveyor and undercutter upon movement of the latter in one direction, said feeding means including screw jacks anchored in the mine and having screw shafts coupled to said ratchet wheels for actuation by the latter.

5. The construction defined in claim 1, wherein the driving unit includes a drive shaft extending transversely of the conveyor and undercutter, a frame fixed beneath said drive shaft, a

sleeve guided by said frame and movable longitudinally of the drive shaft, and an arm rigid with said sleeve and pivoted to the conveyor and undercutter, said sleeve being slidably keyed to said shaft to permit lateral adjustment of the conveyor and undercutter together with the actuating arm relative to the drive shaft.

6. In a longwall mining machine, an elongated combined conveyor and undercutter including a plate assembly adapted to be reciprocated upon the mine floor with a rapid rearward and slower forward movement, socket members secured on the edge of said assembly adjacent the coal face and having oblique back edges disposed so that the socket members plow coal dust away from the coal face onto the plate assembly during rearward movement of the assembly, and cutting bits carried by said socket members.

7. A longwall mining machine comprising an elongated shaking conveyor and undercutter including a plate assembly adapted to be reciprocated 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, and 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.

8. The construction defined in claim 7, in combination with transversely arranged feed screws disposed at spaced points along the outer edge of the assembly and having their inner ends journaled on said coal-retaining wall, ratchet wheels secured on the inner ends of said feed screws, an actuating element for said ratchet wheels including a rod slidably carried by said wall and carrying pawls engaging 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.

9. The construction defined in claim 7, in combination with transversely arranged feed screws disposed at spaced points along the outer edge of the assembly and having their inner ends journaled on said coal-retaining wall, ratchet wheels secured on the inner ends of said feed screws, an actuating element for said ratchet wheels including a rod slidably carried by said wall and carrying pawls engaging 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 rearward stroke of the assembly, said undercutting bits being arranged to have an undercutting action upon the forward stroke of the assembly.

10. The construction defined in claim 7, 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 an upstanding arm rigid with said sleeve and pivoted to the conveyor and undercutter.

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, detachable 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, and means to automatically feed the assembly laterally uniformly from end to end toward the coal upon each rearward stroke of the assembly.

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