METHOD FOR MINING AND LOADING COAL

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7 Claims. (Cl. 262—1)

1 This invention relates to coal mining and more particularly to a novel and useful method for mining and loading mined coal, especially in mines where the seams are very thin, that is to say, generally seams 30 inches or less in height.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, constructions, arrangements, combinations, and improvements herein shown and described.

The accompanying drawings, referred to herein and constituting a part hereof, illustrate one embodiment of the invention, and together with the description, serve to explain the principles of the invention.

Of the drawings:

Fig. 1 is the plan view of the interior of a mine room showing somewhat diagrammatically a mobile loader embodying the invention in various typical operating positions for loading out shot-down coal at the face of the room;

Fig. 2 is an enlarged plan of the forward portion of said mobile loader;

Fig. 3 is a longitudinal vertical section of those parts of the loader shown in Fig. 2;

Figs. 4, 5 and 6 are diagrammatic views showing the adaptability of the loading head to various pitches and conformations of the floor of a mine;

Fig. 7 is a fragmentary diagrammatic side elevation of the loader head showing same in a typical loading operation under a mass of shot-down coal;

Fig. 8 is a plan view similar to Fig. 1 showing various operating positions of the loader;

Fig. 9 is a diagrammatic view of a cutting machine designed to operate in accordance with the invention;

Fig. 10 is a diagrammatic view showing loading from an inclined bottom.

Fig. 11 is a plan view similar to Fig. 1 showing the use of the loader removing and gobbing bottom road.

The invention also comprises a novel and useful method of under-cutting or kerfing the solid coal face before “shooting” same down, so as to facilitate the rapid and efficient operation of the loader and also to enable the coal to be loaded with a minimum of handling and breakage. In all respects the invention is particularly directed to the mining and loading of bituminous coal in low seam mines where the head space is so low that men cannot work comfortably or efficiently and where the enlarging of the head space by removal of bottom or top rock is costly and unproductive when done by hand. Because of these mining conditions an efficient machine must be held to the lowest possible overall height, yet must be able to handle the largest possible amount of material in its loading movements, the thickness of the seam of coal making it necessary for the machine to traverse a large area quickly in its loading operations so as to handle and convey worthwhile quantities of material.

Having in mind these primary objects, the invention provides a method for mining and loading large quantities of thin seam coal quickly and efficiently with a minimum of head room and without lifting the coal more than a very short distance throughout the entire loading operation. By virtue of the novel mining method embodied in conjunction with our improved loading apparatus, the shattering and breaking of the coal, both from shooting down and from loading, is held to the minimum so that even the most friable coal is taken out in the larger and more valuable sizes. Moreover the coal is handled in such a way that, practically no dirt or impurities from either the top or bottom become intermixed with it during the mining and loading operations. Thus a coarser and cleaner coal product is obtained.

As another important object, the invention makes possible the mobile loading of shot-down coal at the mine face with an apparatus which occupies a minimum of space in the timbered part of the room, especially in the danger area near the face. Consequently it is possible to set the props very close to the mine face, thereby greatly reducing the danger to miners and permitting strict compliance with the most recent laws and regulations requiring close timbering at the face. Nevertheless because of its mobility and maneuverability the machine of the invention can operate in virtually any position or location within a mine and is usable in all types of coal removal operations.

The invention also employs a novel construction which enables the coal-engaging portion or head of the loader to follow and conform very closely to the shape of the mine bottom so that in all cases the loader head will follow and “hug” the bottom regardless of irregularities, variations in slope and direction therein so that the loader will always take out all the coal cleanly.
and completely. This feature is of great importance in thin seam mining to insure that the output of the machine be kept at the peak and also to insure that full advantage is taken of the relatively small head room existing in such mines.

The details of the preferred apparatus for performing the invention are more fully disclosed in our co-pending application, Serial No. 551,528, filed August 30, 1944, and now Patent No. 2,430,364.

Briefly described, the invention provides a mobile, track-mounted loader having a flat elongated loading head adapted to be projected into the undercut kerf of a shot-down face of coal without requiring any settings of jacks or other such paraphernalia in front or "inr" of the loading head. The loading head comprises a flat belt conveyor occupying most of the length and breadth of the head so as to be projected entirely through the undercut beneath the shot-down mass to the solid face of the coal. Said conveyor is arranged so that the upper flat portion travels rearwardly and carries with it whatever coal may be deposited upon it. Along either side and across the front end of the loading head are provided power-driven rotary means for digging into and picking up material in their orbits of movement and conveying same upwardly and toward the centrally-disposed conveyor belt for deposit thereupon. Said rotary feeders are thus adapted to clear a path for the advance of the conveyor under and through the coal and cuttings lying in the kerf. Upon the removal of such relatively loose, fine material in the kerf the overhanging shattered masses of coal progressively fall upon the conveyor and are carried by it to the rear.

By a plurality of internal pivot and connections the loading head is so articulated with respect to the rearward portions of the machine and conveyor that it is adapted to lie upon and conform closely to the bottom surface of the mine regardless of whatever irregularities and differences in slope or direction may exist between the planes of support. In this connection the tracks are laid and those of the bottom underlying the shot-down coal. This feature of the invention is of great importance because it enables the loading head always to underlie and remain substantially parallel to the bottom strata of the shot-down coal so that a complete loading of said mass can be effected at all times while the loading head remains at the bottom and thus takes advantage of the entire head room available.

The conveyor within the loading head continues rearwardly beyond the end of said head proper, and is inclined upwardly just enough to overlie a wider intermediate belt conveyor, with respect to which it has horizontal pivotal movement. The intermediate conveyor at its rear end overlies in turn a third rearwardly disposed belt conveyor which carries the coal backwardly at any desired horizontal angle for deposit in the ultimate receptacle. This entire assembly is movable on a carriage along the trackway which is stationed preferably in the center of the mine so that the loader can be readily brought into operating position and as readily withdrawn and conveyed to another part of the mine during intermediate operations in that room.

Novel method steps are employed in preparing the coal for loading by the above-described apparatus. In accordance with the invention the coal is undercut by a kerf cutter in the conventional manner, usually to a depth of about six feet. During the kerf-cutting operation, however, the machine cuttings (comprising the relatively fine coal particles broken up by the machine bits of the cutter bar) are retained or restored to the space within the kerf to build up a relatively thick bed of cuttings therewithin. This step is contrary to the conventional practice of clearing out and removing most of those cuttings from the kerf. As a result, a substantial bed of cuttings is left underlying the overhanging mass of coal after the kerf has been cut. The coal then being drilled and shot down in the usual way, the mass of coal breaks away from the roof and settles onto the bed of machine cuttings so that it is supported by said cuttings several inches above the mine floor. This operation has the incidental advantage of reducing the breakage or degradation of the coal into small lumps, the shot-down mass being parted from the roof and settling in a relatively integral mass on the cuttings bed. The presence of said bed is even more important, however, in facilitating the entry and operation of the loading head within the kerf. The bed of cuttings provides a relatively easy and uniform medium for the advancing and conveying action of the feeder rolls on the loader head so that said head can be moved into and through the kerf space occupied by the bed of cuttings without great difficulty and without disintegrating any of the larger lumps of coal above. When the loading head has been advanced beneath the shot-down mass a sufficient distance and the bed of cuttings in that area has been picked up and loaded out by the feeders and conveyors, then the overhanging mass of shattered coal will fall gradually of its own weight, onto the loader belt and be carried away in prime condition.

By advancing the pivotally connected loading head forwardly and angularly, the entire mass of shot-down coal can thus be loaded out with the minimum expenditure of time and power. It will be noted that, except for the small amount of fine coal comprising the bed of cuttings, none of the coal is lifted or forced upwardly during the loading operation in order to get it upon the loader belt, but falls thereon by gravity. Thus a minimum of vertical space is required for the most efficient operation of the loading apparatus and this feature in itself greatly contributes to the quality of the coal loaded out.

Many features of the invention are also applicable when the kerf is cut at the top of the seam. In this operation, of course, the supporting bed of cuttings cannot be provided and consequently the progress of the loading head into the bottom of the shot-down mass cannot be so rapid and uniform. Nevertheless the loading head is capable of digging its way, as previously described, through the bottom strata of the shot-down mass and lifting and carrying away the coal therein while the overhead portions of that mass fall onto the conveyor. In this form of mining the lack of the cuttings bed is somewhat compensated for by the fact that the drill holes for the explosives are made near the bottom of the seam, so that the shattering effect of the explosive is greatest along the seam bottom. As a result the finer fragments of the shattered mass will be more concentrated in the lower strata and thus, to such extent, will facilitate the entry and operation of the loading head. In this operation as well it will be understood that the loading head, throughout its length, follows the contour of the seam bottom regardless of the pitch and/or
transverse inclination thereof, and all of the beneficial features of said loading head construction are applicable as will be understood and herein after more particularly described.

It will be understood that the foregoing general description of the invention and the following detailed description as well are illustrative and explanatory of the invention but are not restrictive thereof.

Referring now in detail to the present preferred embodiment of the invention illustrated by way of example in the accompanying drawings, a somewhat diagrammatic overall view of the mobile loader in operating position is shown in Fig. 1. This view represents a typical mine room or entry being advanced inwardly toward the solid face I between solid side walls M and N. The shaded area A represents a mass of coal which has been undercut by the method hereinbefore described and then shot-down to lie upon a bed of machine cuttings C therebeneath (Fig. 7). A trackway 5 of two parallel mine rails is laid longitudinally centrally of the room as shown, the tracks terminating just short of the outer face F of the shot-down mass. Rows of roof-supporting timbers or props I are provided throughout the cleared portion of the room, the space between said props usually being approximately 3 ft. from center to center. In the arrangement shown, it will be noted that the inner row of props is spaced quite close to the face F, in practice being placed as close as one foot therefrom. This spacing of the props is in accordance with recent safety recommendations of state and federal mining departments. The spacing of said props I is uniform throughout the room except for the area necessary to accommodate the trackway 5 (approximately 4 ft.); also the props nearest the track in the row adjacent the face F are offset from the track approximately one foot, as shown, for purposes hereinafter described. The width of the room between the walls M and N is, as shown, the customary distance of approximately 24 ft. and the length of depth of the kerf between face I and face F, which determines the lengthwise dimension of the mass of coal B, is approximately 6 ft. in the illustrative example shown. It will be understood, however, that these dimensions are not critical and that the principles of the invention are adaptable to different situations and mining operations.

Referring to the general layout of the loading machine (Fig. 1) same comprises the forward or inward portion 60 known as the loading head, which is made up primarily of the centrally and longitudinally disposed flat belt conveyor 101, the rotary side feeder bars 102 and 103 and the rotary end feeder bar 104 (Fig. 2). The rear end of said loading head may be considered as terminating at the rear end of the feeder bars 102 and 103. However, the conveyor belt 101 continues rearwardly therefrom to the rear roller 105 and between those points the conveyor is inclined upwardly to form the driving and elevating portion 20 of the loading mechanism. The next unit of the apparatus comprises generally the intermediate, wide belt conveyor 30, the inner end of which underlies the rear end of the loader conveyor 101 and the rear end of which inclines upwardly and rearwardly to feed onto the forward end of the conveyor 40, comprising the final unit of the apparatus considered as a whole.

As will be seen from the drawings, means are provided for affording several loci of internal articulation for the conveyor belt 101 so that it and the loader head can turn in a plurality of directions and in several planes in order to effect the greatest possible conformity of the loader head with the surface of the mine floor while enabling the coal conveying apparatus to be kept as low in height as possible. For this purpose a plurality of horizontal transverse hinges or swivels are provided throughout the length of the conveyor 110.

Pivotal freedom of motion about its longitudinal axis is provided for the loading head a short distance to the rear of said first transverse pivot. Thus it will be seen that the loading head 100 has substantial freedom of angular movement upward and downward about the pivot 140 and also can turn about its own longitudinal axis through the pivot provided by joint 141. It will be noted that both said pivot joints are mounted in the space between the upper and lower runs of the conveyor belt 101.

Means are provided for permitting a horizontal angular swinging movement of the entire conveyor 101, including all parts associated therewith, from the loading head back to and including the rear roller 105. This swinging movement is designed to take place about a vertical axis at the rear end of unit 20. Thus it will be seen that the entire frame structure comprising the units 10 and 20 may rotate horizontally about the axis 220 and in the present preferred embodiment of the invention this freedom of rotation is preferably at least 180°.

In accordance with the invention the rear conveyor unit 40 is upwardly and rearwardly inclined to deliver the coal into any suitable receptacle such as a mine car on the track 5. Said conveyor unit 40 is also designed to be rotatable horizontally about its forward end so as to deliver the coal at any point within a substantial arcuate sweep of its rear end.

Preferably, in accordance with the invention, means are provided at the forward ends of both shafts 102 and 103 to enter into and break up coal masses which lie directly ahead of the forward end of the loading head 10. For this purpose frusto-conical disintegrator members 190 and 191 are mounted on reduced, forwardly projecting ends of the shafts 102 and 103 respectively. These disintegrator members are preferably provided with radially extending teeth 192 which operate to carry out the intended purpose of said devices.

Preferably, and in accordance with one important operative feature of the invention, the loading head 10 is moved from place to place within the shot-down coal area B (Fig. 1) by means of traction ropes or cables rather than by the motor-wheel drive of the carriage unit 30. This feature of the invention makes possible the maximum application of power to the advancing and turning movements of the loading head without relying upon the traction of the drive wheels 334 which would tend to slip under any substantial load of the nature required to move the loading head under and through the shot-down mass. Accordingly, means are provided in connection with the forward units 10-20 of the apparatus, to apply drum driven cables to the work of moving the loading head.

A description of the operation of the invention will now be given. As the first step in preparing the coal for the loading out operations to be performed by the hereinabove-described loader, we undercut the solid face of the coal across the room (conventionally a distance of about 24 ft.), using any suitable form of ker-
By these operations a bed C of the relatively fine machine cuttings is built up and maintained in the kerf E, said bed being approximately 4 inches thick in the present illustrative example (Fig. 7). As the next step the undercut mass of coal B as drilled and shot-down by explosive in the usual way, thus parting it from the roof B by a clearance space N. The shot-down mass B will then rest upon and compress the bed of cuttings C, so that said bed is reduced to approximately a thickness of 3/4 inches. The bed of cuttings C so diminishes the fall of the mass B that it remains semi-solid. That is, although fractured throughout by the shoveling and falling action, mass B does not thereupon disintegrate or fall apart into fragments or lumps, but remains for the most part in position as a semi-solid mass which is subject to ready separation into relatively large lumps when the support of the bed C is removed. The bed of cuttings C itself, although compressed by the weight of the shot-down mass B, is nevertheless made up of such relatively fine and friable fragments that it may be readily penetrated and dug out, as by a hand pick, for example. Depending upon the hardness and friability of the coal forming the semi-solid shot-down mass B, more or less of the supporting bed of cuttings may be removed, but when an overhang thereof has been produced, depending in extent upon the nature of said coal mass B, the undercut portion thereof will fall of its own weight and break up over the space from which the supporting bed has been removed (Fig. 7). In some very hard coals it may be necessary to strike the overhanging mass with a pick in order to loosen or start its fall but ordinarily it will fall of its own weight when a sufficient clearance of the supporting bed C therebeneath has been made.

After the coal mass B has been shot down and is resting upon the bed of cuttings as previously described, the invention next brings into operation the mobile loader hereinafore described in detail. First, of course, the cutting machine 600 has been moved from the room or place and the place is fully prepared and prepared for work in Fig. 1. The loader is then brought up to the shot-down face F (Fig. 1), being propelled thereto by the carriage wheels 304.

As a next step of the loading operation, it is then feasible to move the loading head directly forwardly into the kerf E and bed of machine cuttings C and then gradually to advance same as the machine cuttings and the shot-down mass of coal B are progressively being loaded and conveyed away as shown by Fig. 15, the loading head being so moved until it reaches the solid wall I. For this operation the rope 269 is extended through the sheave on bracket 268 and is run forwardly to be fixed to a roof jack J at the forward end of the roadway ahead and near to the shot-down face F (Fig. 1). The opposite rope 267 is extended through the sheave on bracket 265, forwardly around sheave on roof jack J—1 and thence across face F—2 to be fixed to the right-hand roof jack —2 adjacent wall N. Then by taking up the ropes on both drums, the loading head 10 will be projected forwardly in a path parallel to the tracks 5 and beyond the ends thereof (Fig. 7) and ultimately into the advanced position shown in Fig. 1.

Before beginning such forward movement the cutting machine, for example that conventionally shown in Fig. 9. Said machine comprises a cutter bar 600 having a cutter chain 651 with cutting teeth designed to travel along and around the kerf in the usual manner. The rear housing 605 of the machine contains the conventional drive mechanism, rope drum 603 and controls 606, which may be of any standard arrangement. Ordinarily in such a machine the cuttings from the cutting chain are carried rearwardly thereby along the bottom of the main housing 602 to be discharged through an opening at the rear 610 of said housing, said rear end normally being left open for that purpose. In accordance with the present invention, said rear end 605 is either permanently closed or provided with an adjustable closing such as the hinged gate 605 which, as shown, may be tilted upwardly or downwardly to close more or less of the rear end opening, said closure thereof controlling the amount of cuttings, if any, permitted to escape through said rear opening. When the gate is fully closed, as is it will be in the operation of the invention hereinafter described, the cuttings dragged into the base of the machine by the chain will be returned into the kerf from which they came without escaping out of the rear of the machine. A similar arrangement, not shown, may be provided for the same purpose in machines of the type where the cuttings are allowed to escape from the side rather than the rear of the machine. It is found that not all the cuttings are required to be kept in the kerf; a controlled amount thereof may be allowed to escape through the variable opening of gate 605.

Assuming a typical thin seam of coal A (Figs. 7 and 9) having a thickness of approximately 20 inches, a kerf E approximately six inches in height and approximately 6 feet in depth is cut along the bottom thereof, leaving thereabove an overhanging bed of coal B approximately 25 inches high.

In accordance with the invention, steps are taken to build up a substantial bed of machine cuttings in the kerf E, i.e. the relatively fine fragments of coal formed by the cutting action of the teeth on the bottom of the cutting machine. In prior practice, it has been customary for the machine man's helper (called a "scraper") to shovel that portion of the machine cuttings carried out from under the kerf by the cutting chain away from the side of the kerf to prevent said cuttings from being carried back into the kerf by the return movement of the cutting chain. It has also been customary for the scraper to have a long-handled shovel for removing from within the kerf the remaining machine cuttings not carried out by the conveying action of the cutting chain. This practice has prevailed because heretofore it has been desired to provide the maximum fall for the coal when it is shot down so as to break it up to the greatest extent and thus make it less difficult to load out by hand. In accordance with the present invention, however, it is desired to retain and/or return within the kerf virtually all of the machine cuttings. Consequently the practice of removing the cuttings from the rear or side of the machine when same are carried out by the cutting chain, is eliminated, said cuttings being returned into the kerf as aforesaid. Likewise the former practice of the scraper in shovelling the machine cuttings from under-the cut is not followed.
2,479,132 conveyor 101, the feeder rolls 102, 103 and 104 and the disintegrator cones 180 and 181 are all set in operation. The feeding and cutting teeth 178 (or rolls 175a, as the case may be) on roll 104, assisted by the cones 180 and 181, dig into and load onto conveyor 101 the relatively easily penetrated coal fragments comprising the bed of cuttings C (Fig. 7). This operation leaves a space in the kerf B into which the loading head can be advanced. It will be understood that the maximum height of the loading head (Fig. 3) is preferably less than that of the compressed bed C after the mass B has been shot down, although this is not essential for the reason that the feeder members or loading shafts of the loading head are so designed as to dig and load shot down coal in addition to the machine cuttings. As said advance progresses under the pull of the ropes 267 and 269, the side feeder rolls 102 and 103 also enter the kerf and dig and load onto the conveyor 101 the parts of the bed C lying along the sides of the advancing head 10, thereby facilitating its advance through said bed and kerf. As the loading head is so advanced along the path continuously being cleared for it by the feeding or conveying action of the feeders, the support provided for the over-hanging mass B is progressively removed. Consequently the large coal lumps and other fragments making up that mass will fall of their own weight onto the moving surface of the loading head conveyor 101, as shown in Fig. 7. In some cases, though rarely, it may be necessary to loosen an arched or relatively solid portion of mass B with a hand pick to facilitate its cascading onto the conveyor. Thus the loading head will quickly and steadily advance until it reaches the solid wall T and all the broken coal in the kerf and above the rectangular space occupied by the head and for some little distance on either flank thereof will have been loaded out to the waiting receptacle by the action of the series of conveyors 10, 20, 30 and 40 (Fig. 3). When the coal overlying said rectangular area has been fully loaded out, then it will be practicable to begin to load out the coal in the right-hand half of mass B as shown in Figs. 1 and 8. For this purpose it is desired to swing the loading head 16 gradually toward the right, while simultaneously advancing the entire loader forwardly along the track 5 to the extent necessary to ultimately bring the loading head by forward and turning movements into the position shown at the extreme right-hand of Fig. 1 and Fig. 8. This operation is performed by a series of advancing and turning movements permitted by the rotation of the loading head 16 and its rear extension 20 about the pivot 220. For the purpose of effecting such movements the jack J—1 is removed so that the pull exerted from jack J—2 operates directly upon the side bracket 225 and its sheave 255. Also, jack J is removed and advanced to the position J—3, the rope 269 being attached thereto and run directly from the drum 256. This rope arrangement induces a lateral pull upon the loading head causing same to swing gradually to the right so that the loader is advanced forwardly so that the end of the loading head tends to follow the face I of the solid coal and to sweep thereacross and around through the successive positions shown in Fig. 8.

After the coal has been loaded out in the right-hand half of the mass B, the same operation is repeated in the opposite sense toward the left to load out the other half of the mass, as indicated in Fig. 1. In this operation jack J—3 will be moved to position J—4 and jack J—2 to the proper position to the right of that occupied by J—3 (Fig. 8).

The use of ropes and jacks to effect all loading and operational movements of the mobile loader is important because it provides the necessary power to turn and translate the loading head into and through the material. This function could be effected, very inadequately if at all, by the drive of the track wheels 304 because it is impossible to provide sufficient traction in that manner. However, it will be noted that the loading head can be advanced or projected into shot-down coal, such as the mass B, without having to set up or make place for any jacks in areas beyond where coal has been loaded out. That is the loading head is, by the arrangements shown and described, projected first into that portion of the coal to be loaded ahead of any jack or other apparatus set up to pull it thereto. Similarly the loading head is turned through its arcuate lateral loading operations by pull exerted on the sheave brackets 265 and 268, which brackets are located well to the rear of the forward end of the loading head. This arrangement obviates setting up any jack or other support or apparatus ahead of the actual loading movements of the loading head and thus makes it possible to project the loading head into a shot-down mass and clear out the coal in that mass without any advance jacking, timpering or other preparatory operations.

By following the outline of the loading head 10 through its successive loading positions, it will be noted that all of the shot-down coal in the width of the 24 ft. place has been loaded out, during which operations the loading head 10 has remained entirely within the shot-down coal area B and thus timpering is possible within 6 inches to 1 foot of the face P of the shot-down mass of coal. The only change from the conventional arrangement required by the plan of close timpering shown in Fig. 1 is the mobility of props 8 one foot from their usual positions as previously described.

It will be apparent from the foregoing that the loading head 10 is adapted to travel easily and relatively rapidly through the kerf B so that in loading the compacted bed C is comprised of fragments relatively small in size and of homogeneous content which present a readily penetrable mass to the action of the feeder members. Moreover it will be noted that all of the shot-down coal constituting the fragmented mass B is supported above the loading head by the bed C so that in loading the said coal always falls downward onto the conveyor belt 101. Consequently practically none of the lumps of coal are ever lifted or elevated during their removal from the mass B. This feature of the invention not only affords the minimum handling of said lumps during the loading operation (thereby minimizing degradation thereof) but it also prevents their coming in contact with the mine floor and so avoids the contamination thereof which frequently results from intermingling with rock and dirt particles adjacent to the floor.

Due to the ability of the loading head to take on coal lying on both sides and the front end of said head, a large floor area is quickly covered and loaded out with the minimum travel of the 75 head. It will be noted further that the coal car-
ried rearwardly by the conveyor 101 is maintained at a low level throughout its travel, the only elevation in the path of the coal necessary to deliver same from the rear end of the conveyor 101 onto the central conveyor unit and thence onto the rear conveyor unit 40. Each of these elevations is, by virtue of the low height characteristics of the machine as a whole, of the lowest possible extent and if so arranged we have found that no piece of coal will be raised more than 12.1/2 inches above the floor of the mine throughout its travel on the mobile loader.

After the coal in the shot-down area B has all been loaded out the mobile loader is moved back into the position shown in Fig. 1, ready to be moved by traction drive to another place.

In Figs. 4, 6, 7 and 11 illustrate that phase of the invention wherein support for Such a roof is advantageous is providing support for Such a roof. Figs. 6, 10 and 11 illustrate that phase of the invention wherein support for Such a roof is advantageous is providing support for Such a roof.
seam bottom K—2 has a longitudinal pitch as shown.

Referring again to the operations illustrated in Figs. 6 and 10, it will be seen that the pony truck 500 is preferably placed below the loading head 10, generally intermediate the front and rear ends thereof, and the supporting rollers 510 and 511 thereof are elevated by the means previously described so to bring the forward end of the head 10 just above the lip T of the seam bottom K—2. When so positioned the head can then be moved forward by jacks and ropes in the usual manner so as to enter the mass B of shot-down coal resting on the bottom K—2. In advance the loader is projected forwardly where thereof will travel over the rollers 510 and 511 which afford support for the loading head until sufficient of its length rests upon the seam bottom K—2 so as to insure that it will continue to move therealong in conformity with the width of said bottom. As will appear from Fig. 10, the rear roller 511 of the pony truck will be raised to a level above that of the forward roller 510 so as to impart the proper initial inclination to the head 10. When the head 10 has advanced far enough to establish support and position upon the seam bottom K—2, the rollers 510 and 511 of the pony truck may be lowered and the truck rolled back to its usual position adjacent the carriage of unit 30.

It will be understood that the pony truck may be used in a similar manner for the condition illustrated in Fig. 6, except that the rollers 510 and 511 will be elevated equal amounts because of the fact that the bottom K—1 is level. It will further be understood that after the loading head has been advanced forwardly into the position indicated in Fig. 10, it, the Equivalent position shown in Figs. 1 and 3, thereafter the loading head may be moved laterally and diagonally forwardly to load out the entire width of the square shot-down face across the room at both sides thereof, as indicated in Figs. 1 and 8. Throughout this entire operation the remaining units of the loader stay substantially within the trackway area, which is of the greater height previously described. In Fig. 11 there is also shown the manner in which the loader may be used for “gobbing” or slaying away rock which has been drilled and shot either from the top or bottom in advance of the trackway 5 preparatory to shooting down and loading the next forward mass of coal B in the room. It will be understood that after the loader has cleared away all the shot-down coal lying on a bottom K—I (Fig. 6), for example, the loader will be temporarily withdrawn and the cutting machine 600 (Fig. 18) brought into position on the bottom K—I to cut the next advance kerf in the solid face I. The cutting machine will then be withdrawn and that part R of the rock bottom K—I lying ahead of the trackway 5 will be drilled and shot to a width and depth equal to that of said trackway. Then the loader will be again moved into loading position and the loading head will be advanced at the level of the track bottom in the usual way by ropes and jacks at right angles to the trackway 5. In this manner the loading head may be utilized promptly to load out and clear the depressed space in advance of the trackway. It will be understood that the loader may be used in the same manner to remove rock shot from the top of the mine, above and in prolongation of the trackway, when the desired additional height is obtained in that manner instead of by removing bottom rock. After the bottom or top rock has been drilled and shot as described, the rear discharge conveyor 40 may be used to gob or stow the rock loaded in the manner just described. As will be clear from the previous description the rear, forwardly inclined conveyor 40 is rotatable about the vertical axis 40 so that it may be set at any desired horizontal angle with respect to the trackway 5 and the intermediate conveyor unit 30. Hence by turning the discharge conveyor 40 as shown in Fig. 11, for example, the rock loaded out by the loading head 10 may be promptly disposed to the sides of the track to form the gob usually produced by hand operations. Wherever necessary, props 7 may be temporarily removed to permit the conveyor 40 to enter and turn through spaces in the room at the sides of the trackway.

While in the foregoing, application of the invention to the mining and loading out of a face of coal in an advancing room has been illustratively described, it will be understood that the mobile loader of our invention and the operation of the method herein disclosed are equally applicable to other mining operations in mines of the type described, particularly those wherein the room and pillar system is employed. For example, the loader may be utilized in making crosscuts, in retreatting pillar removing operations and in fact in any and all of the mining operations customarily employed in said room and pillar system. This versatility of operation is largely a result of the maneuverability of the units of the machine around and into various parts of the mine and with respect to each other. That is, the loading head can be swung through a very wide angle with respect to the middle unit 30 and also the rear unit 40 can be swung similarly so that the apparatus as a whole can be positioned and operated in virtually any angular relation to be found in any of the various mining operations. Moreover it will be understood that the loader need rarely be idle because it can be readily moved from one room or place to another over the usual track system in the mine, so that while the kerf cutting machine is preparing a face in one room, the loader may be used in its phase of the operation in another room and vice versa.

The invention in its broader aspects is not limited to the specific mechanisms shown and described but departures may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

What we claim is:

1. The method of mining and loading a seam of coal which comprises undercutting a kerf in a face of substantially width, shooting down onto the seam bottom the mass of said coal over said kerf, forming a relatively narrow passageway of greater height than the seam along the room short of the shot-down face, projecting a coal digging and conveying means from a support in said passageway onto the seam bottom of the shot-down mass and loading out said mass for the full width of said room by advancing said means into said mass along the seam bottom thereof and across said bottom to the sides of the room to load out said coal and convey it to a receptacle in said passageway while keeping said support in the passageway.

2. The method of mining and loading a seam of coal which comprises undercutting a kerf in a
room face of substantial width, shooting down onto the seam bottom the mass of said coal over said kerf, forming a relatively narrow depressed passageway of greater height than the seam along the room bottom short of the shot-down face, raising a coal digging and conveying means from a support in said passageway onto the seam bottom of the shot-down mass and loading out said mass for the full width of said room by advancing said means into said mass along the seam bottom thereof and transversely across said bottom to the sides of the room to load out said coal and conveying the coal so loaded to a receptacle in said passageway while keeping said support in the passageway.

4. The method of mining and loading a seam of coal which comprises undercutting a kerf in a room face of substantial width, shooting down onto the seam bottom the mass of said coal over said kerf, forming a depressed passageway of greater height than the room along the approximate center line of the room short of the shot-down face, raising a coal digging and conveying means from a support in said passageway onto the seam bottom of the shot-down mass and loading out a square face for the full width of said room by advancing said means into said mass along the seam bottom thereof and across said bottom to the sides of the room to load out a square face and conveying the coal so loaded to a receptacle in said passageway while keeping said support in the central passageway.

5. The method of mining and loading a seam of coal which comprises cutting a kerf along the bottom of said seam and across a room face of substantial width, forming a bed of cuttings within said kerf to provide support for the undercut coal, shooting down onto said bed the mass of undercut coal, forming a relatively narrow passageway below the seam bottom along the center of the room short of the shot-down face, projecting coal digging and conveying means from a support in said passageway into and through the bed of cuttings on the seam bottom and loading out the mass of shot-down coal for the full width of said room by advancing said means through said bed along the seam bottom to the solid face and across said bottom to the sides of the room to remove the supporting bed of cuttings and conveying away the coal which falls onto said conveying means after removal of said bed therebeneath, while maintaining said support in the depressed central passageway.

6. The method of mining coal which comprises cutting a kerf at the bottom of a seam, building up a supporting bed of coal cuttings within said kerf to a substantial depth, shooting down the undercut seam above said kerf, and loading the fragmented, shot-down coal by inserting a relatively shallow, long and narrow digging and conveying member into the bed of cuttings beneath said fragmented shot-down mass and projecting said member for a substantial distance into and through said bed, digging out and carrying away the cuttings of said bed in the path of the member so as to remove the supporting effect of the bed from the overhanging fragmented coal and thereby causing said overhanging fragments to fall upon the member and be conveyed out of the mass.

7. A method as specified in claim 6 wherein the digging and conveying member is moved laterally toward both sides of the mass from the point of original insertion so as to load out the entire shot-down mass by advancing and lateral movements.

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REMBRANDT PEALE, Jr.

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