Sept. 1, 1953

C. F. OSGOOD

TILTING ARRANGEMENT FOR SHORTWALL COAL CUTTING MACHINES

2,650,811

Filed June 17, 1947

4 Sheets-Sheet 1

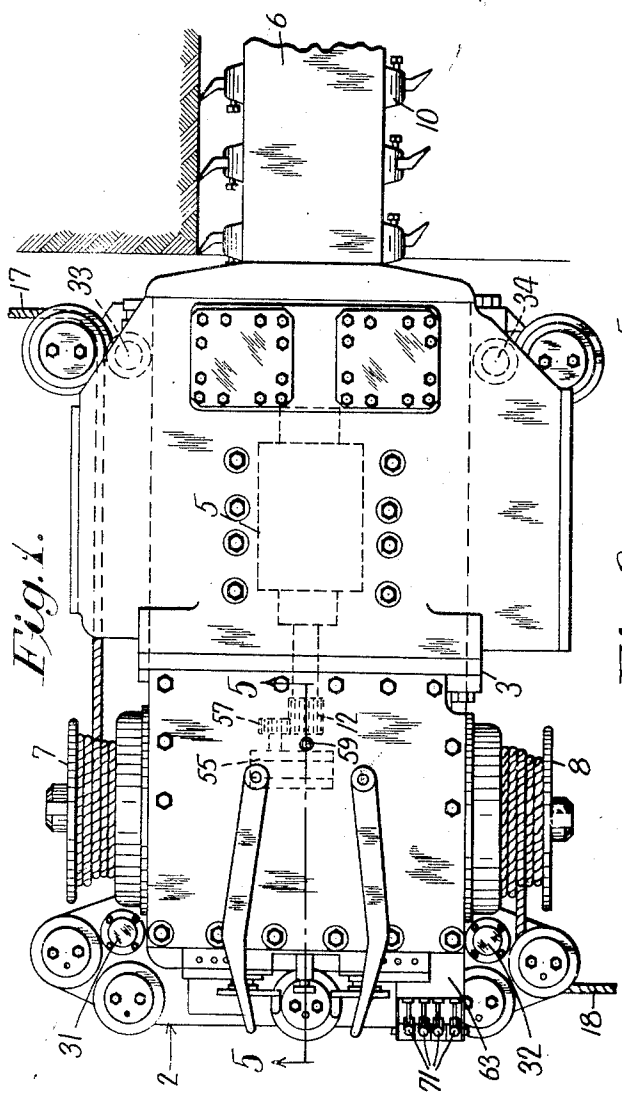

Fig. 1.

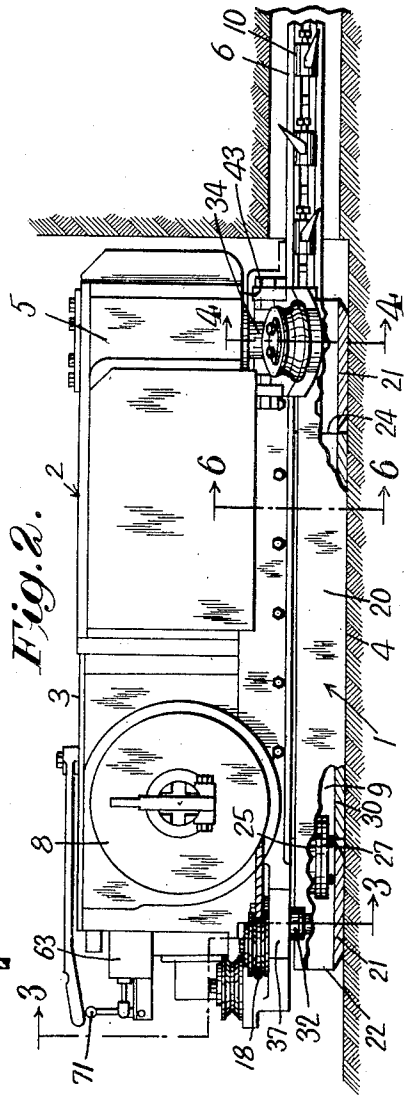

Fig. 2.

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Fig. 3.

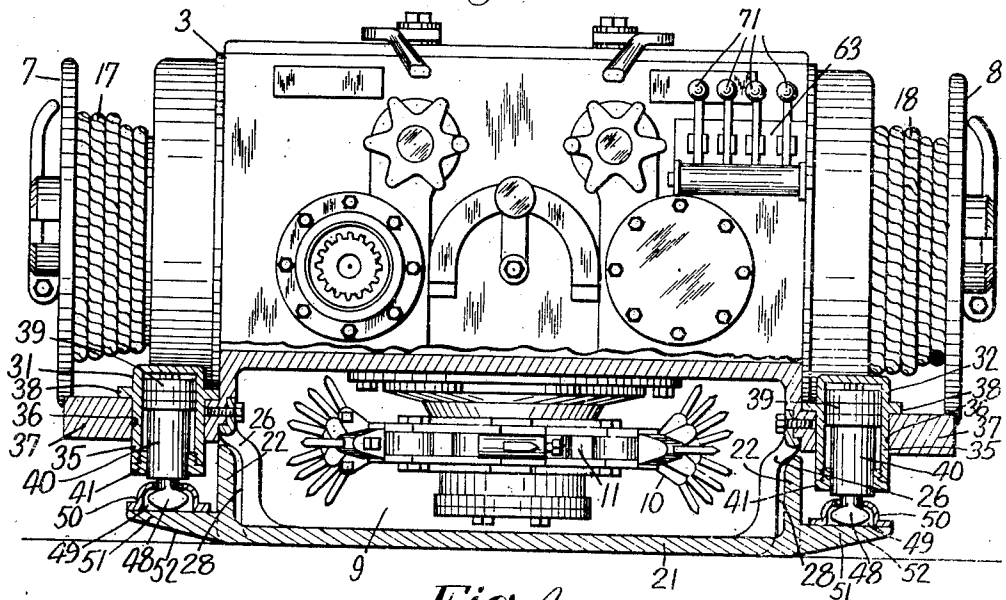

Fig. 4.

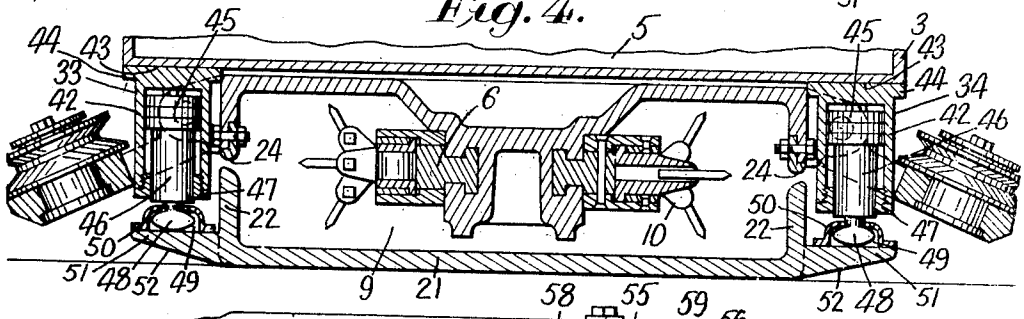

Fig. 5.

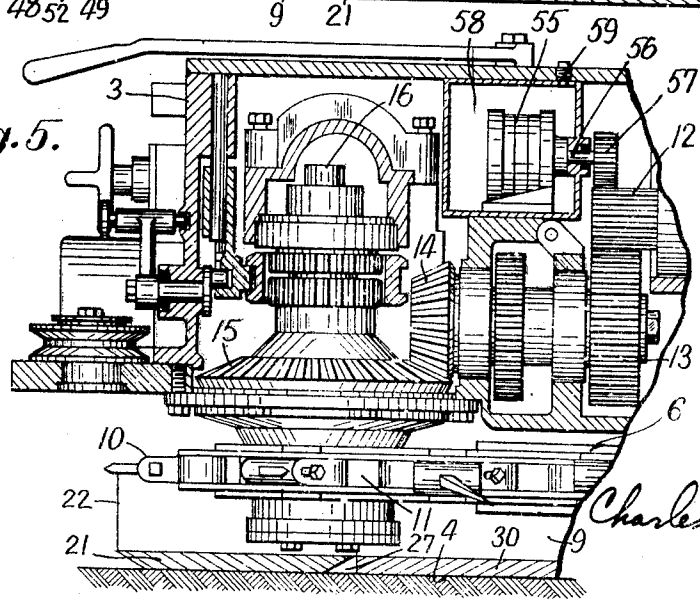

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Fig. 6.

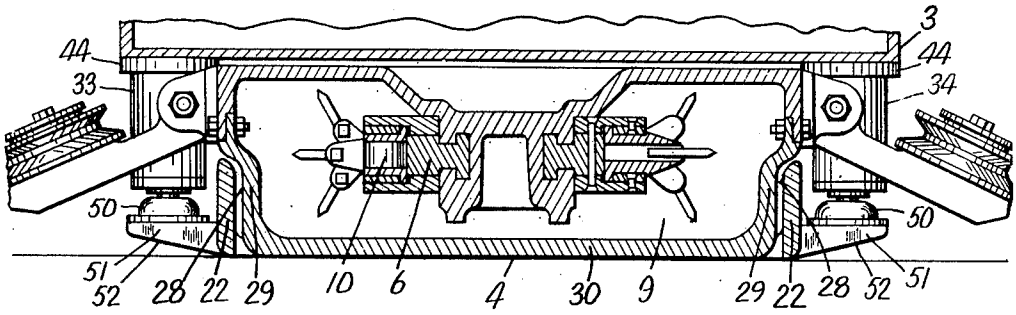

Fig. 7.

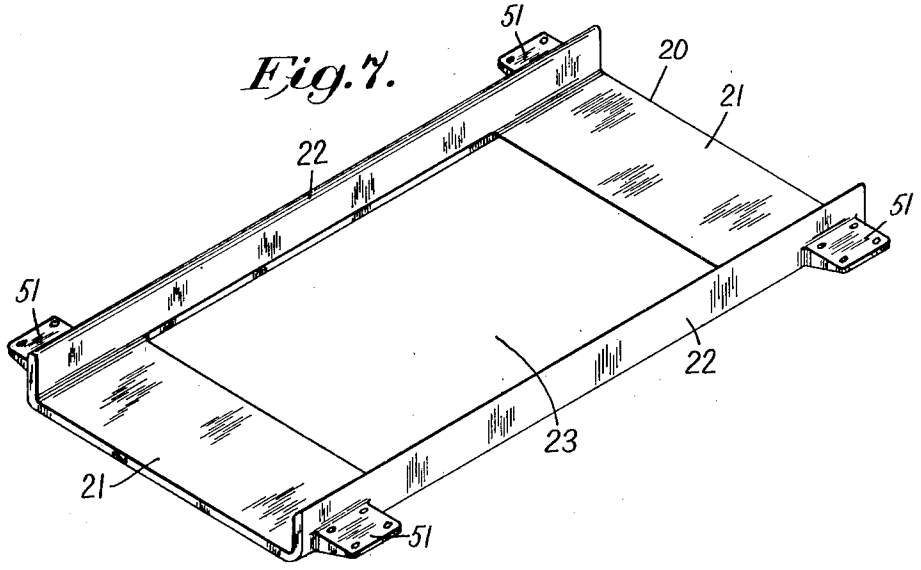

Fig. 8.

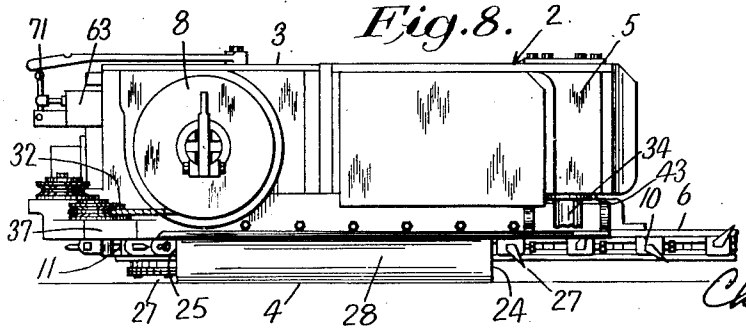

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Fig. 9.

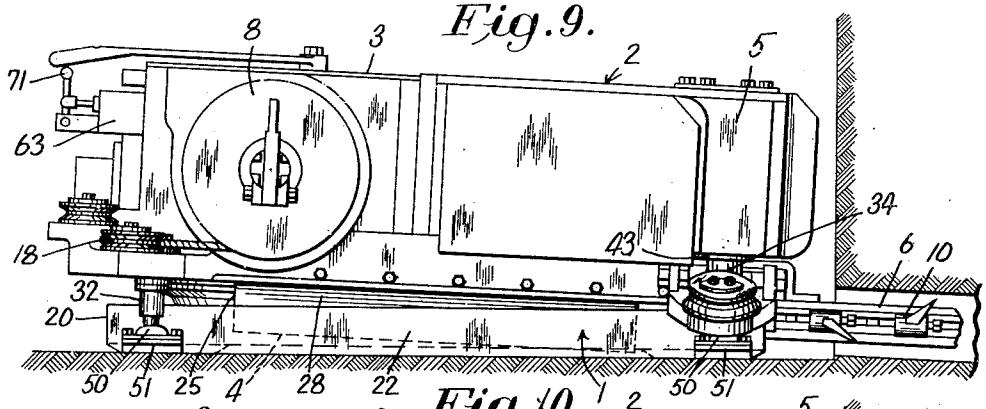


Fig. 10.

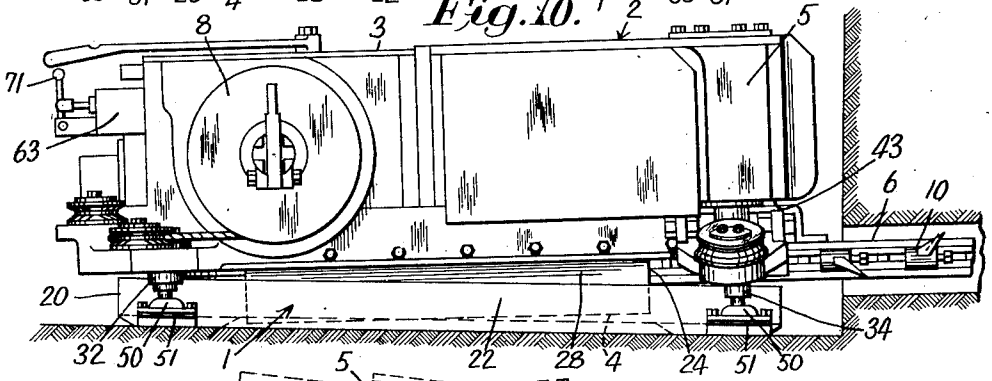


Fig. 11.

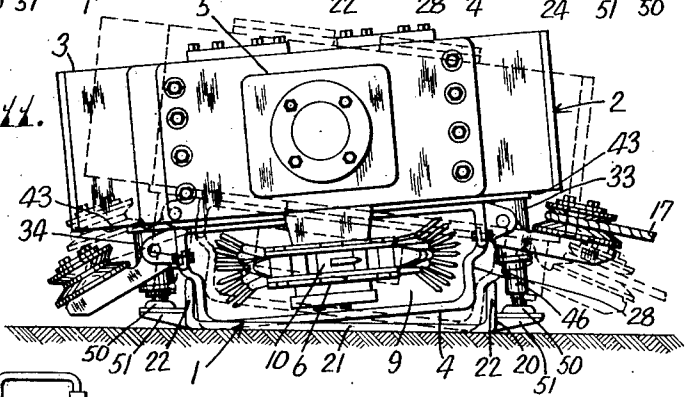
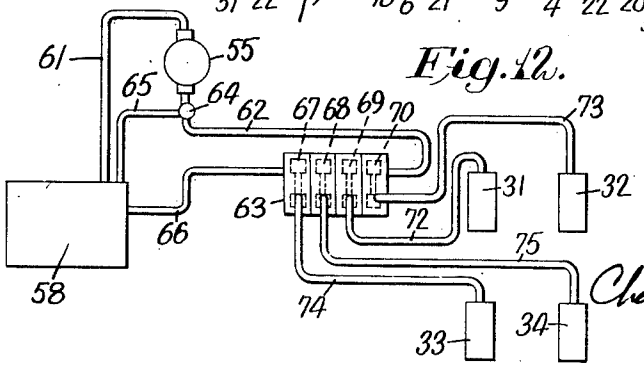


Fig. 12.



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UNITED STATES PATENT OFFICE

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TILTING ARRANGEMENT FOR SHORTWALL COAL CUTTING MACHINES

Charles F. Osgood, Franklin, Pa., assignor to Joy Manufacturing Company, a corporation of Pennsylvania

Application June 17, 1947, Serial No. 755,054

4 Claims. (Cl. 262—30)

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This invention relates to mining machines and more particularly to an improved tilting arrangement for a shortwall, floor type, coal cutting machine.

In a shortwall coal cutting machine of the flexibly fed, floor type, the machine frame slides on its bottom over the floor of a mine and, at times, there is a tendency for the cutter bar to work up or down in the coal due to the unevenness of the mine floor. In order to overcome this tendency, it is necessary frequently to jack up, or pry up with pinch bars, the machine to tilt the same either sidewise or endwise to compensate for the unevenness of the mine floor. It is the common practice, when it is desired to tilt the machine, to jack up the machine by extraneous floor jacks while the machine remains in a stationary position as regards bodily lateral movement. In certain known instances, power operated tilting shoes or skids have been recessed within the machine bottom, but such shoes or skids are limited in action and have a tendency to sink into a soft bottom, rendering them relatively impracticable under certain mining conditions. It is, however, highly desirable, in a shortwall coal cutting machine, to provide, within the machine itself, power operated tilting devices to enable tilting of the machine in any desired direction as the machine is fed over the mine floor during the kerf cutting operation and without the possibility of sinking into a soft bottom. Such a tilting arrangement must not increase the overall height or the lateral dimensions of the machine and must be relatively simple and foolproof.

An object of the present invention is to provide an improved shortwall coal cutting machine having within itself an improved tilting arrangement whereby the disadvantages of previous known devices are substantially overcome. Another object is to provide a novel skid mounting for a conventional shortwall coal cutting machine, together with improved tilting devices associated therewith whereby the machine cutter bar may be tilted in any desired direction with respect to the horizontal. Still another object is to provide an improved skid mounting for a conventional shortwall coal cutting machine whereby a relatively large bottom contact area is provided, reducing the tendency of the skid mounting to sink into a soft bottom, and having associated therewith improved means for mounting the machine on the skid whereby, when the machine is in lowered position, it rests directly on the mine floor so that its overall height is no greater than a conventional machine without the skid attachment. Yet another object is to provide an improved tiltable skid mounting for a shortwall coal cutting machine wherein the bottom skid is separate from the machine, and tilting devices are arranged between the skid and the machine for tilting the latter bodily as a whole relative to the skid while the latter remains in firm supported contact with the floor of a mine. Another object is to provide an improved tilting arrangement for a shortwall coal cutting machine wherein a skid slidably engages the mine floor at the front as well as at the rear end of the machine and is provided with rigid side members extending between the front and rear floor engaging portions of the skid, together with improved tilting devices extending between the machine and the skid. Yet another object is to provide an improved tilting arrangement for a conventional shortwall coal cutting machine of the floor type for cutting a horizontal kerf near the floor level whereby the machine may be tilted in any desired direction while retaining the cuttings discharge at the rear end of the machine. A further object is to provide an improved tilting arrangement of the fluid operated type whereby a coal cutting machine may be quickly tilted sidewise and endwise with comparative ease and without interrupting the feeding movement of the machine during the kerf cutting operation. Another object is to provide an improved tilting arrangement including a bottom skid having front and rear transverse floor engaging portions recessed within the bottom of the machine and having an open center for receiving the machine bottom so that when the machine is in its lowered position on the skid, the machine bottom rests directly on the mine floor with the transverse floor engaging portions of the skid received in the machine-bottom recesses, whereby when the machine is in lowered position, its overall height is not increased. A still further object is to provide an improved adjustable supporting structure for a coal cutting machine of the floor type having a rear cuttings discharge. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

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This invention is an improvement over that disclosed in my copending application Ser. No. 600,299, filed June 19, 1945, which has been forfeited.

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

In these drawings:

Fig. 1 is a top plan view of a coal cutting machine constructed in accordance with a preferred illustrative embodiment of the invention.

Fig. 2 is a side elevational view of the coal cutting machine shown in Fig. 1, with portions of its bottom structure shown in section to illustrate structural details.

Fig. 3 is an enlarged cross-sectional view, partially in rear end elevation, taken substantially on line 3—3 of Fig. 2 and showing the rear tilting jacks.

Fig. 4 is an enlarged fragmentary cross-sectional view taken substantially on line 4—4 of Fig. 2, showing the front tilting jacks.

Fig. 5 is an enlarged view in longitudinal vertical section taken substantially on line 5—5 of Fig. 1.

Fig. 6 is an enlarged fragmentary cross-sectional view taken substantially on line 6—6 of Fig. 2.

Fig. 7 is an isometric view illustrating the bottom skid per se.

Fig. 8 is a side elevational view, similar to Fig. 2 but on a somewhat reduced scale, showing the coal cutting machine with the skid detached therefrom.

Fig. 9 is a side elevational view showing the machine in tilted position, with the cutter bar inclined downwardly.

Fig. 10 is a view similar to Fig. 9, showing the machine in titlted position, with the cutter bar inclined upwardly.

Fig. 11 is a front end elevational view of the coal cutting machine, showing the machine tilted about a longitudinal axis, with the cutter bar inclined edgewise.

Fig. 12 is a diagrammatic view illustrating the hydraulic system.

In this illustrative construction, as shown in the drawings, the improved adjustable supporting structure or tilting arrangement, generally designated 1, is shown associated with a coal cutting machine of the shortwall floor type generally designated 2, which may be generally similar to that disclosed in a patent to Joseph F. Joy et al., Patent No. 2,131,178, patented September 27, 1938. It will be evident, however, that the invention may be associated with coal cutting machines of other types.

The coal cutting machine shown herein comprises a machine frame 3 having a bottom 4 adapted to rest upon the floor of a mine. The machine frame carries a motor 5, a cutter bar 6, and feeding and controlling drums 7 and 8. Extending throughout the lower portion of the machine frame 3 is a horizontal chamber 9 in which the rearward portion of the cutter bar 6 is arranged. The cutter bar is elongated and relatively narrow and projects horizontally lengthwise of the machine frame and has guided thereon an endless cutter chain 10. The cutter bar is rigidly secured within the lower portion of the machine frame, and the cutter chain is driven by a chain sprocket 11 arranged within the lower portion of the machine frame at the rear end of the chamber 9, as clearly shown in Fig. 5. The motor 5 has its power shaft connected through

spur gears 12 and 13 and bevel gears 14 and 15 to a vertical shaft 16 suitably journaled within the rearward portion of the machine frame, and the chain sprocket 11 is secured to and driven by this shaft. The feeding and controlling drums 7 and 8 are arranged at the opposite sides of the machine frame and are connectible in driven relation with the motor through driving connections, fully described in the above mentioned patent, whereby the drums may be independently rotated in a direction to wind in feeding and controlling cables 17 and 18, respectively wound on the drums. Suitably arranged on the machine frame are guide sheaves, and the cables are adapted to be extended in various manners around these guide sheaves during maneuvering and feeding of the machine, in a well known manner.

Now referring to the improved adjustable supporting structure or tilting arrangement 1 whereby the machine may be tilted about transverse and longitudinal axes to change the angle in altitude of the cutter bar, it will be noted that underlying the machine frame is a bottom skid 20 having, at its ends, front and rear transverse platelike floor engaging portions 21, 21 connected in rigid relation by parallel, longitudinally extending, vertical side frame portions 22, 22. The transverse skid portions 21, 21 and the side frame portions 22, 22 are so arranged to provide an open center 23 within the skid. As shown in Fig. 8, the lower portion of the machine frame at the front and rear ends thereof is transversely cut away at 24 and 25 to provide open sides 26 (Fig. 3), and to provide transverse recesses 27, respectively extending beneath the cutter bar and beneath the cutter chain drive sprocket. When the coal cutting machine is in its lowered position, with its bottom within the open center of the skid and resting on the mine floor, the transverse platelike portions 21, 21 of the skid are received in the transverse recesses 27, 27 in the bottom portion of the machine frame, with the vertical side portions 22, 22 of the skid extending longitudinally within laterally opening recesses 28, 28 in the sides of the bottom portion of the machine frame, as clearly shown in Fig. 3. The vertical side walls 29 of the bottom portion of the machine frame are bent inwardly to form the side recesses 28, as shown in Fig. 6, and the bottom plate 30 of the machine rigidly connects the side frame portions 29 in the manner shown. By the arrangement thus provided, the outer sides of the vertical side portions 22, 22 of the skid are recessed within the sides of the bottom portion of the machine frame so that the sides of the skid lie substantially flush with the sides of the bottom portion of the machine frame. The coal cutting machine is supported on the bottom skid by a plurality, herein preferably four, of extensible power jacks, herein preferably hydraulic jacks, designated 31, 32, 33 and 34, herein arranged near the four corners of the machine frame and skid. The rear jacks 31 and 32 each comprises a vertical reciprocable cylinder 35 mounted in a vertical bore 36 formed in a projection 37 integral with the side of the machine frame. These cylinders have flanges 38 secured, as by screws, to the upper surfaces of the projections 37 in the manner shown. Contained in the cylinders 35 are pistons 39 having piston rods 40 extending downwardly through the lower heads 41 of the cylinders. The front jacks 33 and 34 each comprises, as shown in Fig. 4, a vertical reciprocable cylinder 42 arranged be-

neath the projecting sides 43 of the motor 5 and having upper flanges 44 secured, as by screws, to the bottom surfaces of the motor projections. The cylinders 42 contain pistons 45 having piston rods 46 extending downwardly through the lower heads 47 of the cylinders. The four piston rods 40, 40 and 46, 46 have secured to their bottom extremities oblate feet 48 seated loosely in sockets 49 formed in socketed members 50 secured, as by screws, to lugs or brackets 51 projecting laterally from and integral with the vertical sides 23 of the bottom skid. The bottom surfaces of these skid-brackets 51 are upwardly and outwardly inclined at 52 to facilitate lateral sliding movement of the skid over the mine floor. These four hydraulic jacks 31, 32, 33 and 34 may be operated in such manner as to tilt the coal cutting machine bodily sidewise about a longitudinal axis at either side of the bottom skid or to tilt bodily the machine either upwardly or downwardly endwise about transverse axes located at the opposite ends of the skid, thereby to change the angle in altitude of the cutter bar, as will later be fully explained. The oblate feet 48 of the jack pistons, loosely received in the sockets 49 of the bottom skid, are free to move slightly laterally in the sockets to compensate for the tilting of the jacks with the machine frame with respect to the bottom skid

Now referring to the hydraulic system for supplying liquid under pressure to the cylinders of the power jacks 31, 32, 33 and 34, it will be noted that arranged within the frame of the machine is a conventional pump 55, having its power shaft 56 driven by a spur gear 57 meshing with the motor shaft gear 12, as shown in Fig. 5. The pump 55 is preferably arranged within a liquid tank 58 having a suitable filler plug 59. As shown diagrammatically in Fig. 12, the pump has its intake conduit 61 connected to the tank 58, and the pump discharge conduit 62 is connected to the supply passage of a valve box 63, herein conveniently located at the rear end of the machine frame. The pressure conduit 62 is connectible through a relief valve 64 and conduit 65 back to the tank 58. The exhaust passage of the valve box 63 is connected by a return conduit 66 back to the tank. The valve box 63 has bores containing four conventional slide valves 67, 68, 69 and 70 (shown diagrammatically in Fig. 12) provided with suitable operating levers 71. The valve box is connected through conduits 72, 73, 74 and 75 to the upper ends of the cylinders of the four hydraulic jacks. By suitably manipulating the levers of the valves 67, 68, 69 and 70, liquid under pressure may be supplied to the jack cylinders as desired, either in pairs or concurrently, so that the pairs of side jacks may be operated to tilt the machine in one direction or the other about a longitudinal axis, or the pair of end jacks may be operated to tilt the machine in either direction about a transverse axis, as desired. By operating the four jacks concurrently, the machine may be elevated while the cutter bar is maintained in a substantially horizontal position to vary the height of the cut. The valves may be positioned to vent the cylinders back to the tank or to trap fluid in the cylinders.

The general mode of operation of the improved coal cutting machine is as follows: The feeding and controlling cables 17 and 18 may be extended from their respective drums 7 and 8 around certain of the guide sheaves, as shown in Fig. 1, and laterally from the machine to suitable anchor

jacks located at the ribs of the mine room. The drums may be operated and controlled, in the manner fully described in the patent above referred to, so that the cutter bar may be sumped beneath the coal at one rib, then fed transversely across the coal face, and thereafter withdrawn from beneath the face at the opposite rib, all in manners well known to those skilled in the art. By reversing the motor, rewinding the cables on the drums, reversing the cutter bits on the cutter chain and reversing the pump connections, the machine may operate in the reverse direction. During the kerf cutting operation, the slide valves 67, 68, 69 and 70, controlling the hydraulic jack devices 31, 32, 33 and 34, may be operated to effect tilting of the coal cutting machine bodily about transverse and longitudinal axes with respect to the bottom skid to vary the angle in altitude of the cutter bar, thereby to facilitate the cutting functions. For example, two of the jacks at one side of the machine may be concurrently operated to tilt the machine about a longitudinal axis at one side of the skid, and in like manner the two jacks at the opposite side of the machine may be concurrently operated to tilt the machine about a longitudinal axis relative to the skid in the opposite direction. Thus the cutter bar may be tilted in either direction selectively about parallel longitudinal axes to effect edgewise tilting of the cutter bar in the manner shown in Fig. 11. The pair of jacks at the rear end of the machine may be concurrently operated to raise the rear end of the machine relative to the skid to tilt the machine about a transverse axis located at the front end of the skid to incline the cutter bar downwardly, as shown in Fig. 9. The front jacks may be concurrently operated to raise the front end of the machine relative to the skid to incline the cutter bar upwardly, as shown in Fig. 10, about a transverse axis located at the rear end of the skid. And all four jacks may be concurrently operated to elevate the machine to locate the cutter bar in a horizontal position some distance above the floor level. Accordingly, by suitable manipulation of the four valves, the four jacks may be operated to tilt the machine in any desired direction relative to the bottom skid, and liquid may be trapped in the cylinders to lock the jacks in adjusted position. By venting the cylinders, the machine may be lowered on the skid, to bring its bottom onto the mine floor.

As a result of this invention, an improved adjustable supporting structure or tilting arrangement is provided for a conventional shortwall coal cutting machine whereby the machine may be tilted about transverse and longitudinal axes relative to the bottom skid to change the angle in altitude of the cutter bar. By embodying the hydraulic jack devices in a conventional shortwall coal cutting machine, the cutter bar may be tilted in any desired direction to change the angle in altitude of the cutter bar while the cuttings brought back from the kerf by the cutter chain are moved through the bottom chamber of the machine frame to discharge at the rear end of the machine. By incorporating the jack devices within a shortwall coal cutting machine between the machine frame and the bottom skid, it is possible to tilt the cutter bar without the use of extraneous jacks or pinch bars. The improved adjustable skid mounting for the coal cutting machine enables the cutter bar to be tilted as desired without interrupting the feeding movement of the machine. The improved skid structure eliminates the need of separate tilting

shoes or skids recessed within the machine bottom, as in previous known devices, so that the sinking of the skids or shoes into a soft bottom is avoided. By the provision of the improved power operated jack devices embodied within a conventional shortwall floor type coal cutting machine, the tedious and time-consuming task of jacking up the machine at frequent intervals by means of extraneous jack devices or pinch bars during movement of the machine over an uneven floor is wholly avoided. By the provision of the improved bottom skid structure arranged and constructed in the manner disclosed, a relatively large contact area with the mine floor is afforded, thereby reducing the tendency of the skid sinking into a soft bottom, and by recessing the skid within the machine bottom, with the machine bottom arranged within the open center of the skid, the overall height of the machine when the latter is in its lowered position is not increased. Other uses and advantages of the improved adjustable supporting structure or tilting arrangement will be clearly apparent to those skilled in the art.

While I have 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. In combination, a shortwall coal cutting machine of the floor type having a frame whose bottom is adapted to rest on the floor of a mine, a cutter bar projecting horizontally lengthwise of said frame and an endless cutter chain guided for circulation about the margin of the cutter bar for cutting a horizontal kerf near the floor level, said machine having the bottom of its frame transversely recessed at its front and rear ends with said recesses extending beneath said cutter bar and cutter chain, a bottom skid having transverse front and rear floor engaging portions rigidly connected by longitudinal side frame portions, said portions providing an open center within said skid, said transverse floor engaging portions when the machine is resting on its bottom on the mine floor received in said transverse frame recesses with the bottom of the machine frame disposed within the open center of said skid, and means for pivotally mounting said machine on said skid for bodily tilting movement relative thereto about a generally horizontal axis including power operated jack devices connected between the machine frame and said skid and means for operating said jack devices to exert an upwardly directed force on the machine frame to tilt the machine about said axis relative to said skid to incline the machine bottom relative to the mine floor thereby to change the angle in altitude of said cutter bar.

2. In combination, a shortwall coal cutting machine of the floor type having a frame whose bottom is adapted to rest on the floor of a mine, a cutter bar projecting horizontally lengthwise of said frame and an endless cutter chain guided for circulation about the margin of the cutter bar for cutting a horizontal kerf near the floor level, said machine having the bottom of its frame transversely recessed at its front and rear ends with said recesses extending beneath said cutter bar and said chain and having the sides

of its lower portion disposed inwardly to provide longitudinal side recesses, a bottom skid having transverse front and rear floor engaging portions rigidly connected by longitudinal side frame portions, said portions providing an open center within said skid, said transverse floor engaging portions when the machine is resting on its bottom on the mine floor received in said transverse frame recesses and said longitudinal side frame portions received in said side recesses with the bottom of the machine frame disposed within the open center of said skid, and means for pivotally mounting said machine on said skid for bodily tilting movement about a generally horizontal axis including power operated jack devices connected between the machine frame and skid and means for operating said jack devices to exert an upwardly directed force on said machine frame for tilting the machine about said axis relative to said skid to incline its bottom relative to the mine floor thereby to change the angle in altitude of said cutter bar.

3. In combination, a shortwall coal cutting machine of the floor type having a frame whose bottom is adapted to rest on its bottom on the floor of a mine and having a horizontal plane cutter bar extending lengthwise of said frame and an endless cutter chain guided for circulation about the margin of said cutter bar for cutting a horizontal kerf near the floor level, said machine having the bottom of its frame transversely recessed at its front and rear ends with said recesses extending beneath said cutter bar and cutter chain, a generally rectangular bottom skid on which the machine is mounted and arranged substantially within the lateral dimensions of said frame and provided with a central opening, said skid having skid portions received in said transverse frame recesses when the machine bottom is resting on the mine floor within said skid opening, and means for pivotally mounting said machine on said skid for bodily tilting movement about a generally horizontal axis including extensible jack devices connected between said machine frame and said skid portions and means for operating said jack devices to exert an upwardly directed force on the machine frame for tilting the latter about said axis relative to said skid to incline the machine bottom relative to the mine floor thereby to change the angle in altitude of said cutter bar.

4. In combination, a shortwall coal cutting machine of the floor type having its bottom adapted to rest on the floor of a mine, said machine having a machine frame, a horizontal plane cutter bar secured to said frame and extending lengthwise thereof near the floor level and an endless cutter chain guided for circulation about the margin of said cutter bar for cutting a horizontal kerf near the floor level, a generally rectangular bottom skid on which the machine is mounted and said skid arranged substantially within the lateral dimensions of said frame, said skid having transverse front and rear floor engaging portions underlying the machine frame below the cutter bar and cutter chain and longitudinal side frame portions rigidly connecting said end portions, said portions providing an open center within the skid for receiving the machine bottom when the machine is in lowered position on said skid with its bottom resting on the mine floor, and means for pivotally mounting the machine on said skid for bodily tilting movement about a generally horizontal axis including adjustable tilting devices

arranged between said skid and the machine frame and means for operating said tilting devices to exert an upwardly directed force on the machine frame for tilting the latter about said axis to incline the machine bottom relative to the mine floor thereby to change the angle in altitude of said cutter bar.

CHARLES F. OSGOOD.

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