

Dec. 30, 1958

S. C. MOON

2,866,626

MINING MACHINE PROVIDED WITH ADJUSTABLE CUTTING MEANS

Filed Sept. 14, 1956

3 Sheets-Sheet 1

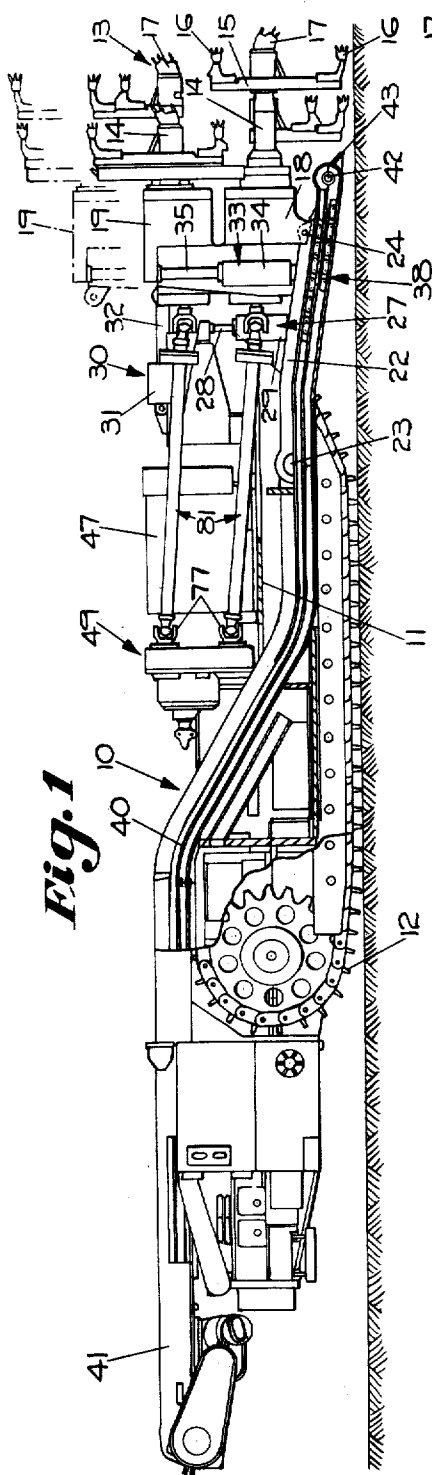


Fig. 1

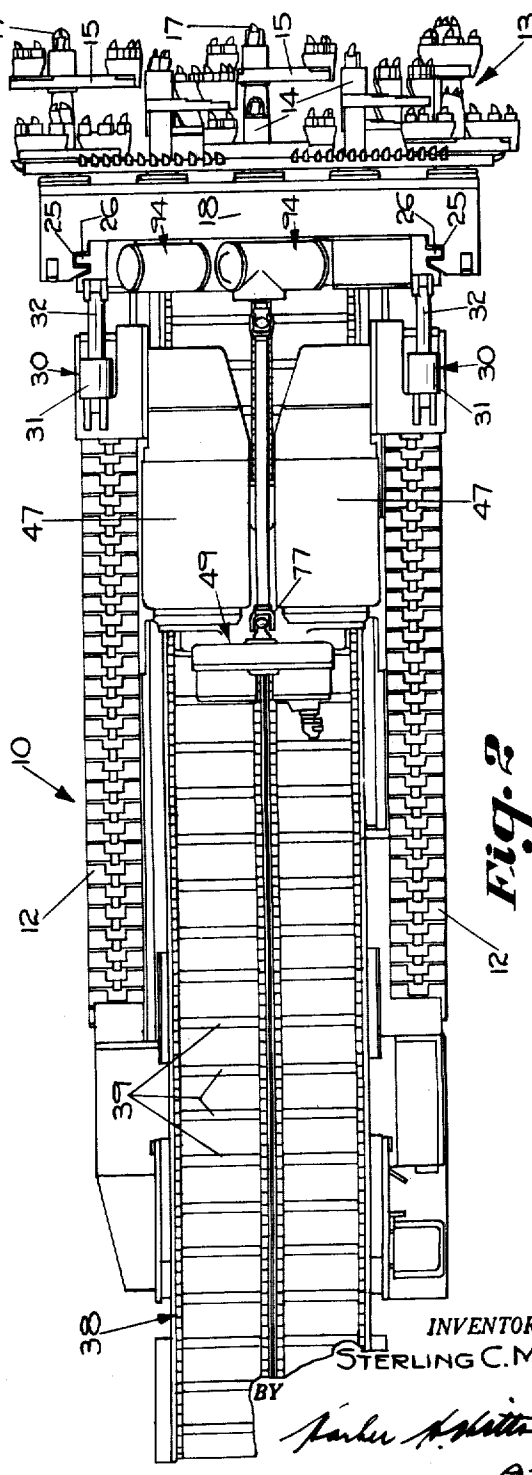


Fig. 2

INVENTOR;
STERLING C. MOON,
BY *Harley A. Pittman*
ATTY.

Dec. 30, 1958

S. C. MOON

2,866,626

MINING MACHINE PROVIDED WITH ADJUSTABLE CUTTING MEANS

Filed Sept. 14, 1956

3 Sheets-Sheet 2

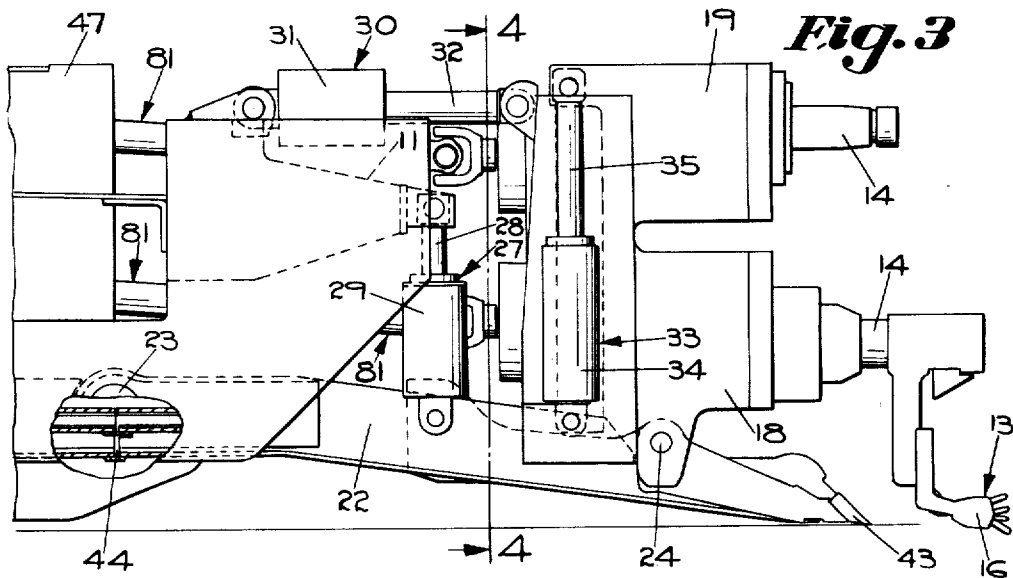
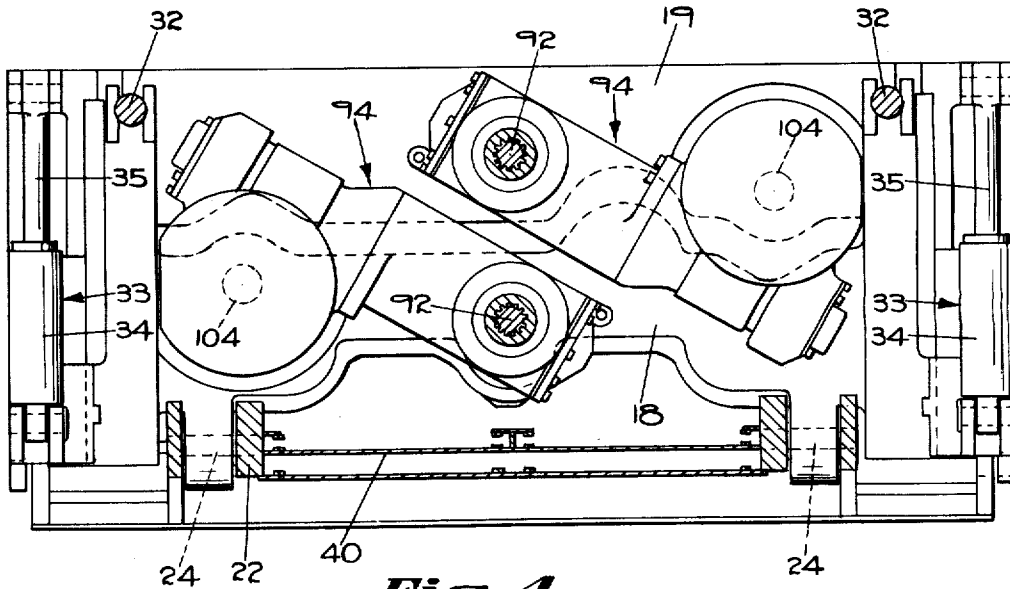


Fig. 4

INVENTOR;
STERLING C. MOON,
BY *Harold H. Peterson*,
ATT'Y.

Dec. 30, 1958

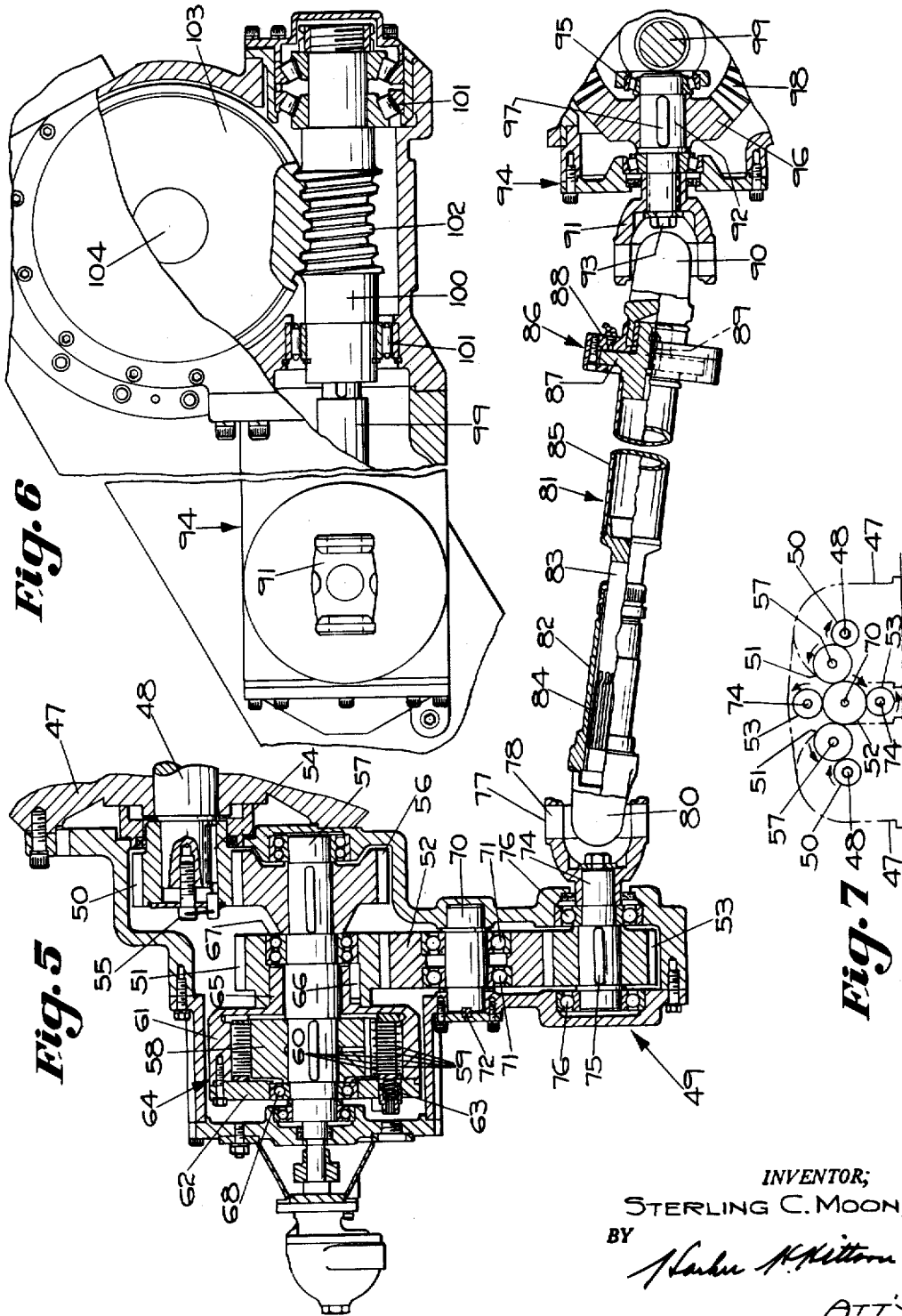
S. C. MOON

2,866,626

MINING MACHINE PROVIDED WITH ADJUSTABLE CUTTING MEANS

Filed Sept. 14, 1956

3 Sheets-Sheet 3



INVENTOR;
STERLING C. MOON,
BY *Harold H. Kitterman*,
ATTY.

1

2,866,626

MINING MACHINE PROVIDED WITH ADJUSTABLE CUTTING MEANS

Sterling C. Moon, Dublin, Ohio, assignor to The Jeffrey Manufacturing Company, a corporation of Ohio

Application September 14, 1956, Serial No. 609,991

10 Claims. (Cl. 262-7)

The instant invention relates to mining machines, and more particularly to a novel drive means for operating the cutting means in a mining machine.

It is the prime object of this invention to provide an improved mining machine provided with cutting means at the front end thereof, which is adapted to be adjusted, and including an improved drive means for operating the cutting means and adapted to permit the adjustment of the cutting means.

It is a further object of the instant invention to provide an improved mining machine which includes cutting means at the forward end thereof which is adjustable in a vertical plane with respect to the body of the machine, and which is also adjustable about an axis which is transverse with respect to the body of the machine, and including an improved drive means for operating the cutting means, said drive means being adapted to permit the aforesaid adjustments of the cutting means.

It is another object of the instant invention to provide an improved mining machine having cutting means at the forward end thereof which is adjustable with respect to the body of the machine, and including an improved drive means for operating the cutting means, which drive means comprises drive shafts which are connected to the cutting means by universal joints and which are extensible and contractible to permit the aforesaid adjustment of the cutting means with respect to the body of the machine.

Still another object of the instant invention is to provide an improved mining machine having cutting means at the forward end thereof which is driven by a pair of motors supported on the main frame of the machine, adjacent each other and spaced one from the other, with drive shafts extending forwardly between the motors, from gear means at the rear of the motors to the cutting means at the front of the machine for operating the latter.

Still a further object of the instant invention is to provide an improved mining machine having cutting means at the forward end thereof which is adjustable with respect to the body of the machine, and in which the cutting means is driven from a pair of motors supported on the body of the machine, side by side and spaced one from the other, with the motor shafts being connected to gear means at the rear of the motors and having drive shafts extending forwardly from the gear means to the cutting means for operating the latter, the drive shafts being connected to the gear means and to the cutting means by universal joints, and being extensible and contractible to permit adjustment of the cutting means with respect to the body of the machine.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

In the accompanying drawings:

Fig. 1 is an elevational view partially in section of a coal mining machine constructed in accordance with the instant invention;

2

Fig. 2 is a plan view of the coal mining machine illustrated in Fig. 1;

Fig. 3 is a view in elevation of the forward end of the mining machine illustrated in Fig. 1 showing certain details of the structure;

Fig. 4 is an elevational view, partially in section, taken on the line 4-4 in Fig. 3, and showing certain features of the drive mechanism for operating the coal cutting means;

Fig. 5 is a sectional view of the gear means connecting the motor to the drive shafts for operating the coal cutting means;

Fig. 6 is a view, partially in section, of the gear casing secured to the rear of the coal cutting means for operating the latter; and

Fig. 7 is a diagrammatic view showing the gear train in the gear means of Fig. 5.

The instant invention relates to mining machines and an embodiment thereof is illustrated as applied to a coal mining machine of the continuously operating type. Continuous coal mining machines of the character illustrated in the drawings are generally provided with coal cutting means at the forward end thereof which remove the coal from the face of the mine by a cutting action, and the cut coal is received by a conveyor which extends longitudinally, rearwardly of the coal mining machine, and discharges the cut coal at the rear end of the machine so that the coal mining machine may continuously advance as the coal is cut from the face of the mine. It is customary in such machines that the coal cutting means be adjustable with respect to the body of the machine in order that the path of the coal cutting operation may follow the seam of coal in the mine, which may vary in depth as well as in the course it takes through the strata of the earth. In accordance with the instant invention, the coal mining machine includes a novel driving structure for operating the coal cutting means on the machine, and which permits the coal cutting means to be adjusted with respect to the body of the machine so that it may follow the path of the coal seam. In the preferred embodiment of the invention, the drive for the coal cutting means is derived from a pair of electric motors having their shafts connected to gear means disposed at the rear of the motors. The gear means transmits the power of the motors to drive shafts, which are joined at their opposite ends to the gear means and the coal cutting means by universal joints, with the drive shafts also being extensible and contractible so that the coal cutting means may be freely adjusted with respect to the body of the machine without in any way interfering with and interrupting the drive to the coal cutting means.

Referring to the drawings, there is illustrated a preferred embodiment of the invention as incorporated in a continuous coal mining machine 10, which comprises a main frame 11 supporting a pair of endless tracks 12 and operating mechanism therefor, located one at either side of the machine for propelling the machine in the mine. At the forward end of the mining machine 10 there is provided coal cutting means 13, which is fed into the face of the mine as the machine is propelled by the endless tracks 12, with the coal cutting means 13 operating to cut the coal ahead of the machine and to thereby produce a passage in the mine for the continuous advance of the machine.

The coal cutting means 13 comprises a plurality of horizontal shafts 14 extending forwardly from the mining machine 10, each of the shafts being provided with a cutting arm 15 which may extend radially to both sides of the shaft 14 or to only one side thereof. Each of the cutting arms 15 is provided with a plurality of coal cutting bits 16, which constitute the elements which

3

cut into the face of the mine to remove the coal. The forwardly extending shafts 14 are also provided with cutting bits 17 located on the forward end of shafts 14 and disposed in advance of the cutting bits 16 on the respective cutting arms 15, to advance into the mine face ahead of the coal cutting bits 16 and to serve as a pilot for the advance of the coal cutting bits 16 into the mine face.

The shafts 14, which support the coal cutting arms 15, are arranged in two horizontal rows, one above the other, and project forwardly from a lower cutting head 18 and an upper cutting head 19, arranged one immediately above the other. Each of the cutting heads 18, 19 is, in effect, a gear box providing means for driving the shafts 14 in the respective groups together in timed relation to the other shafts in the respective group, as well as in timed relation to the shafts in the other group so that the cutting arms 15, in their rotation with the shafts 14, will not interfere with each other.

A support frame 22 extends forwardly from the bottom of the main frame 11 of the machine and is secured thereto on a pivot pin 23, disposed on a horizontal axis extending transversely of the machine. The support frame 22 carries the lower and upper cutting heads 18, 19 at the forward end thereof. The lower cutting head 18 is secured to the support frame 22 on a pivot pin 24, which extends horizontally, transversely of the support frame 22 and permits the cutting heads 18, 19 to be pivotally adjusted with respect to the support frame 22 and the main frame 11. The upper cutting head 19 is carried on the lower cutting head 18 for reciprocation with respect to the latter in a vertical plane, whereby the vertical depth of the cut made by the cutting arms 15 may be adjusted as the coal seam spreads or contracts in a vertical direction. Vertical guide tracks 25 on the lower coal cutting head 18 mate with guides 26 on the upper coal cutting head 19, to guide the vertical movement of the upper cutting head 19 with respect to the lower cutting head 18.

Hydraulic cylinder and piston motor means is utilized for effecting each of the foregoing adjustments of the coal cutting means in the mining machine 10. Hydraulic motor 27, having its piston rod 28 pivotally connected to the main frame 11 of the mining machine and its cylinder 29 pivotally connected to the support frame 22, is operative to effect adjustment of the support frame 22 on its pivot pin 23 relatively to the main frame 11 of the machine 10. Two hydraulic motors 27 are provided, located one at either side of the machine. It will be understood that such adjustment of the support frame 22 effects a vertical adjustment of the coal cutting means 13, and is utilized to follow the path of the coal seam in the mine as it deviates in a vertical direction. By so adjusting the coal cutting means 13, the mining machine 10 is caused to travel upwardly or downwardly to follow the coal seam. When making this vertical adjustment of the coal cutting means 13, the cutting heads 18, 19 may be tilted together about the pivot pin 24 to maintain the coal cutting means 13 in a vertical plane, or to cause the coal cutting means 13 to cut coal in a plane that is inclined with respect to the vertical. The coal cutting means 13 is tilted about the pivot pin 24 by means of a pair of hydraulic cylinder and piston motors 30, each having a cylinder 31 pivotally connected to the main frame 11 and a piston rod 32 pivotally connected to the lower cutting head 18. The cutting heads 18, 19 are adjusted in unison about the pivot pin 24 by the hydraulic motors 30.

A pair of hydraulic cylinder and piston motors 33 are interposed between the lower cutting head 18 and the upper cutting head 19, with one such motor being located at each side of the cutting means 13 for the purpose of effecting a vertical adjustment of the upper coal cutting head 19 with respect to the lower coal cutting head 18.

4

The cylinder 34 of the hydraulic motor 33 is pinned to the lower cutting head 18, and the piston rod 35 of the hydraulic motor 33 is pinned to the upper cutting head 19, reciprocation of the piston rod 35 relatively to the cylinder 34 effecting the vertical adjustment of the upper coal cutting head 19, with the latter being guided in guide tracks 25 by its guides 26. The mining machine 10 includes suitable controls of a conventional form by which the various hydraulic motors are controlled.

The mining machine 10 also includes a chain conveyor 38 extending longitudinally of the machine from the forward end thereof to the rear end of the machine, at which point the coal is discharged. The chain conveyor 38 is formed with a plurality of transversely extending flights 39 which travel over a conveyor bed 40 and sweep the coal along the conveyor bed 40 from the forward end of the machine to the rear end thereof for discharge. The conveyor bed 40 extends from the support frame 22 at the forward end of the machine along the bottom of the machine, under the power and driving means for the cutting means 13, and then upwardly to the top of the machine at the rear portion thereof, and thence to a boom 41 from which the coal is discharged. The support frame 22 includes a shaft 42 at the front end thereof about which the endless chain conveyor 38 is entrained, thereby positioning the receiving end of the conveyor 38 closely adjacent to and immediately behind the coal cutting means 13. The front end of the support frame 22 also includes a horizontally extending blade 43 for scraping along the mine floor and guiding the cut coal onto the conveyor. It is desirable that the disposition of the front end of the conveyor 38 be maintained constant with respect to the coal cutting means so as to always recover the cut coal from the mine floor and, for this purpose, the receiving end of the conveyor 38 is carried on the support frame 22 and is adjustable therewith so as to always be in position to receive the cut coal. The conveyor bed 40 is provided with a transversely extending seam 44 which is aligned with the pivot pin 23 mounting the support frame 22 on the main frame 11 of the machine. This seam 44 permits the conveyor to bend in the area of the pivot pin 23 as the support frame 22 is adjusted.

The power for driving the coal cutting means 13 is derived from a pair of electric motors 47 carried on the main frame 11, side by side in spaced relation to each other. The motor shafts 48 extend rearwardly therefrom to a gear casing 49 which transmits the power of the motor to drive shafts which, in turn, operate the cutting heads 18, 19. The motors 47 are interconnected by means of the gearing in the gear casing 49 to a common idler gear 52 which transmits the power to the drive means for the cutting heads 18, 19. The gear train, by which the motors 48 are interconnected, is illustrated diagrammatically in Fig. 7. Each of the motor shafts 48 has secured thereto a motor pinion 50 which effects rotation of a clutch gear 51 which, in turn, rotates an idler gear 52 which transmits power to a pair of drive gears 53. Each of the drive gears 53 rotates a driving element from which the power is directly transmitted to the coal cutting heads 18, 19.

Fig. 5 shows the gear train of Fig. 7 in greater detail, and it will be understood that since the gearing is symmetrical only one half of the gear train is illustrated. The motor shaft 48 carries a motor pinion 50 which is secured thereto by a key 54 and a cap screw 55. The motor pinion 50 meshes with the teeth of a gear 56 secured to the shaft 57 which extends rearwardly parallel to the motor shaft 48. The motor pinion 50 drives the gear 56 and, in turn, rotates the shaft 57. The opposite end of the shaft 57 has secured thereto a clutch hub 58 which carries a plurality of radially extending clutch disks 59. The clutch disks 59 are separated from each other by a second group of clutch disks 60, which rotate with the clutch back 61, the latter surrounding the clutch hub 58. The clutch back 61 is closed by a cover plate

5

62 in which are mounted a plurality of axially extending springs 63, which press the clutch disks 59, 60 together so that they frictionally engage with each other and cause the clutch back 61 to rotate with the clutch hub 58. These elements form a disk clutch 64 which is adapted to permit the drive to slip if the elements thereof are overloaded, and serves as a safety means in the drive system.

The clutch back 61 is formed with a forwardly extending hub 65 to which there is secured a clutch gear 51 by means of a key 66. The clutch hub 65 has a free fit on the shaft 57 and a roller bearing 67 is interposed between the clutch gear 51 and the shaft 57. A second roller bearing 68 is interposed between the clutch cover plate 62 and the shaft 57 so that, in effect, the clutch back 61 is mounted on the shaft 57 for rotation relatively thereto. Thus, when the transmission is overloaded, the shaft 57 may be rotated relatively to the clutch back 61 with the coal cutting means 13 remaining stalled due to the overloading thereof.

In normal operation the clutch disks 59, 60 are pressed together by the springs 63 and are in frictional engagement, and transmit the rotation of the clutch hub 58 to the clutch back 61, thereby rotating the clutch gear 51 with the shaft 57. The clutch gear 51 drives an idler gear 52 which is rotatably mounted on a shaft 70 by means of bearings 71. The shaft 70 is fixedly secured in the gear casing 49 by a key 72. The idler gear 52 in turn transmits the power to a driving gear 53 secured to a driving shaft 74 by a key 75. The driving shaft 74 is rotatably mounted in the gear casing by bearings 76. The driving shaft 74 forms a driving element for transmitting the power from the motor 47 to the coal cutting means 13.

Referring to Fig. 7, it will be seen that the above described power transmission is located between the two motors 47 starting with the motor shafts 48, each of which carries a motor pinion 50. Each motor pinion 50 drives a clutch gear 51 through the system above described and the clutch gears 51 each mesh with and transmit the power of the motors through a single idler gear 52, which thereby interconnects the motors 47. A pair of driving gears 53 is provided, located one above and one below the idler gear 52 in vertical alignment therewith. Each of the driving gears 53 rotates a driving element in the form of shaft 74, the upper one of shafts 74 being connected to the upper coal cutting head 19, and the lower one of shafts 74 being connected to the lower coal cutting head 18, thereby providing an individual drive for each of the cutting heads 18, 19 for reasons which will be apparent as the description proceeds. Drive shafts 81, located one above the other, and extending forwardly from the gear means 49 between the motors 47 effect the connection of the driving shafts 74 to the coal cutting means 13.

Each of the driving shafts 74 has secured to the forward end thereof the clevis 78 of a universal joint 77. The clevis 78 carries one end clevis portion 80 of an elongated drive shaft 81. It will be understood that the clevis portion 80 joins the drive shaft 81 to the driving element 74, so that the drive shaft 81 is rotated by the driving element 74 and may move relatively to the driving element 74 in all planes, as is customary in a universal joint connection.

The drive shaft 81 comprises a hollow internally splined shaft section 82 which is formed integrally with the shaft portion 80. The internally splined shaft section 82 receives a mating shaft portion 83 which is formed with a complementary splined end section 84 adapted to telescope into and cooperate with the splined shaft section 82, making the drive shaft 81 extensible and contractible. The forward end of the shaft portion 83 has welded thereto a tubular shaft section 85 which, at its forward end, is welded to the hub of a shear pin coupling 86. The shear pin coupling comprises a hub

6

member 87 and a shell member 88, which are secured together by shear pins 89 fixing the hub member 87 and the shell member 88 to each other for unitary rotation. The shear pin coupling is the weak element in the drive to the coal cutting means 13, and when an excessive load is put on the driving means the shear pins 89 will break so that the hub member 87 may continue rotating relatively to the shell member 88 in the shear pin coupling, whereby serious damage to the transmission or other operating parts of the machine may be avoided. When the trouble which caused the shear pin coupling 86 to break has been remedied, the shear pin coupling may be readily reassembled and the machine put back into operation. The shell member 88 of the shear pin coupling has welded to its forward end a clevis element 90 which is joined with the clevis 91, to form a universal joint between the drive shaft 81 and the coal cutting means 13. The clevis 91 is secured to the end of a short shaft 92 by a bolt 93 which is axially threaded into the end of the shaft 92 which projects from the rear of a gear casing 94 carried on the rear of the coal cutting means 13. Referring to Fig. 4, it is seen that two such gear casings 94 are provided, one for each of the coal cutting heads 18, 19, the gear casings 94 being similar in construction but oppositely disposed on the rear of the coal cutting heads 18, 19.

The drive shaft 81 rotates and transmits power to the shaft 92 which is rotatably mounted within the gear casing 94 by bearings 95. A miter gear 96 is fixedly secured on the shaft 92 by a key 97 and rotates therewith. The miter gear 96 drives a meshing miter gear 98 which is secured to a shaft 99, extending generally longitudinally of the gear casing 94, as is seen in Fig. 6.

The shaft 99 is drivingly engaged with an axially aligned shaft 100 supported for rotation in the gear casing 94 by bearing means 101. The shaft 100 is formed with a worm 102 which drives a worm wheel 103. The worm wheel 103 is secured to a shaft 104, which is the final element in the power transmission system for driving the shafts 14 of the coal cutting means 13. The shaft 104 is parallel to the coal cutting means shafts 14, and the latter shafts are rotated through a gear system which is contained in each of the coal cutting heads 18, 19, and not forming a part of this invention.

The power transmission described herein includes the gear casing 49 which is directly associated with the power supplying motors 47, and a pair of gear casings 94, one of which is associated with each of the coal cutting heads 18, 19, and which directly transmit the power to the driving elements in the coal cutting heads 18, 19. The drive shafts 81 connect the driving elements of the gear casing 49 to the driven elements in the gear casings 94. Each of the drive shafts 81 includes a universal joint at the opposite ends thereof, and a telescoping splined portion to make each of the shafts 81 extensible and contractible.

As above described, the coal cutting means 13 is adjustable with respect to the main frame 11 of the mining machine 10. The support frame 22, which carries the coal cutting heads 18, 19 may be adjusted on its pivot pin 23 to raise or lower the coal cutting heads 18, 19. When such adjustment is made, the forward ends of the drive shafts 81 will move with the coal cutting heads 18, 19, while the rear ends of the drive shafts 81 will remain vertically fixed with the universal joints at the rear ends of the drive shafts 81 serving as pivots for the swinging movement of the drive shafts 81. The telescoping sections of the drive shafts 81 permit the shafts to extend and contract so that there is absolutely no interference with the drive while the coal cutting heads 18, 19 are being adjusted. During the aforementioned adjustment of the coal cutting heads 18, 19 they may also be swung about the pivot pin 24 for tilting the coal cutting heads relatively to the support frame 22. Such adjustment will either elongate or shorten the drive shafts 81, which is

7

permitted by the telescoping section of the drive shafts 81. A further adjustment that may occur in the operation of the mining machine 10 is that of raising the upper coal cutting head 19 relatively to the lower coal cutting head 18 to get a greater depth of cut in the mine. When such adjustment is made the drive shaft 81, connecting to the lower coal cutting head 18, remains fixed while the drive shaft 81, connecting to the upper coal cutting head 19, follows the latter in its movement, the universal joints on the opposite ends of the drive shafts 81 permitting it to follow the movements of the upper coal cutting head 19, and the telescoping section of the drive shaft 81 permitting the drive shaft 81 to elongate or shorten as may be required.

The instant invention provides an improved mining machine with cutting means at the forward end thereof which may be adjusted to cause the mining machine to follow an ascending or descending path of the cut, or to increase the depth of the cut made in the mine, and in which there is provided a mechanical system for driving the coal cutting means while such adjustments are made. The mechanical driving means for the cutting means of the mining machine is connected to the power supplying means and to the cutting means by universal joints and also includes an extensible and contractible element that permits the driving means to follow the adjustments of the cutting means so that interruptions of the mining operation are avoided. The arrangement of the power supplying means in the machine is such that the transmission from the power supply means is located at the rear of the latter with driving elements extending forwardly therefrom to the rear of the coal cutting means thereby facilitating the construction of the driving means, and permitting it to operate in such manner as to follow the coal cutting means when the latter is adjusted relatively to the body of the mining machine.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended, and applicant therefore wishes not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of the invention, what it is desired to secure by Letters Patent of the United States is:

1. In a coal mining machine having a main frame, a pair of coal cutting heads disposed one above the other at the front of the main frame, means mounting the cutting heads for vertical adjustment with respect to the main frame, means mounting said cutting heads for swinging adjustment with respect to the main frame about a horizontal axis extending transversely of said main frame, means mounting the upper of said cutting heads for vertical adjustment with respect to the lower of said cutting heads, a pair of motors for driving the cutting heads, said motors being disposed on the main frame in spaced side by side relation rearwardly of the cutting heads, gear means at the rear of and interconnecting said motors to a pair of driving elements, a pair of drive shafts disposed one above the other between said spaced motors and extending from the driving elements to the cutting heads, said drive shafts being connected to the driving elements and to the cutting heads one for driving each of said cutting heads from one of said driving elements, said drive shafts being extensible and contractible and including universal joint means to permit said adjustments of the cutting heads.

2. In a coal mining machine having a main frame, a pair of coal cutting heads disposed one above the other at the front of the main frame, means mounting the cutting heads for vertical adjustment with respect to the main frame, a pair of motors for driving the cutting heads, said motors being disposed on the main frame in spaced side by side relation rearwardly of the cutting heads, gear means at the rear of and interconnecting

8

said motors to a pair of driving elements, a pair of drive shafts disposed one above the other between said spaced motors and extending from the driving elements to the cutting heads, said drive shafts being connected to the driving elements and to the cutting heads one for driving each of said cutting heads from one of said driving elements, said drive shafts being extensible and contractible and including universal joint means to permit said adjustment of the cutting heads.

3. In a coal mining machine having a main frame, a pair of coal cutting heads disposed one above the other at the front of the main frame, means mounting said cutting heads for swinging adjustment with respect to the main frame about a horizontal axis extending transversely of said main frame, a pair of motors for driving the cutting heads, said motors being disposed on the main frame in spaced side by side relation rearwardly of the cutting heads, gear means at the rear of and interconnecting said motors to a pair of driving elements, a pair of drive shafts disposed one above the other between said spaced motors and extending from the driving elements to the cutting heads, said drive shafts being connected to the driving elements and to the cutting heads one for driving each of said cutting heads from one of said driving elements, said drive shafts being extensible and contractible and including universal joint means to permit said adjustment of the cutting heads.

4. In a coal mining machine having a main frame, a pair of coal cutting heads disposed one above the other at the front of the main frame, means mounting the upper of said cutting heads for vertical adjustment with respect to the lower of said cutting heads, a pair of motors for driving the cutting heads, said motors being disposed on the main frame in spaced side by side relation rearwardly of the cutting heads, gear means at the rear of and interconnecting said motors to a pair of driving elements, a pair of drive shafts disposed one above the other between said spaced motors and extending from the driving elements to the cutting heads, said drive shafts being connected to the driving elements and to the cutting heads one for driving each of said cutting heads from one of said driving elements, said drive shafts being extensible and contractible and including universal joint means to permit said adjustment of the cutting heads.

5. In a coal mining machine having a main frame, a pair of coal cutting heads disposed at the front of the main frame, means mounting the cutting heads for adjustment with respect to the main frame, a conveyor for removing the coal cut by the coal cutting heads carried by the main frame and extending longitudinally of the machine with the coal receiving end of the conveyor being disposed adjacent the coal cutting heads, a pair of motors for driving the cutting heads, said motors being disposed on the main frame in spaced side by side relation rearwardly of the cutting heads, a gear means at the rear of and interconnecting said motors to a pair of driving elements, a pair of drive shafts disposed one above the other between said spaced motors and extending from the driving elements to the cutting heads, said drive shafts being connected to the driving elements and to the cutting heads one for driving each of said cutting heads from one of said driving elements, said drive shafts being extensible and contractible and including universal joint means to permit said adjustment of the cutting heads.

6. A coal mining machine including a main frame, a pair of cutting heads at the front of said main frame, a pair of motors for driving said pair of cutting heads, said main frame carrying said motors in spaced side by side relation rearwardly of said cutting heads, gearing at the rear of and interconnecting each of said motors to a pair of driving elements, and a pair of drive shafts disposed between said spaced motors one for driv-

ing each of said cutting heads from one of said driving elements.

7. A coal mining machine including a main frame, a pair of cutting heads at the front of said main frame, said cutting heads being adjustable with respect to the main frame and with respect to each other, a pair of motors for driving said pair of cutting heads, said main frame carrying said motors in spaced side by side relation rearwardly of said cutting heads, gearing at the rear of and interconnecting each of said motors to a pair of driving elements, and a pair of drive shafts disposed between said spaced motors one for driving each of said cutting heads from one of said driving elements.

8. In a coal mining machine having a main frame, a support frame adjustably mounted at the forward end of the main frame, a pair of coal cutting heads adjustably carried by the support frame, means for adjusting the support frame and the coal cutting heads carried thereby relatively to the main frame, means for adjusting the coal cutting heads relatively to the support frame, a pair of motors for driving the cutting heads, said motors being disposed on the main frame in spaced side by side relation rearwardly of the cutting heads, gear means at the rear of and interconnecting said motors to a pair of driving elements, a pair of drive shafts disposed one above the other between said spaced motors and extending from the driving elements to the cutting heads, said drive shafts connecting the driving elements to the cutting heads one for driving each of said cutting heads from one of said driving elements, said drive shafts being extensible and contractible and including universal joint means to permit said adjustments of the support frame and the cutting heads.

9. In a coal mining machine having a main frame, a support frame pivotally mounted on a transverse axis at the forward end of the main frame for adjustment, a lower coal cutting head pivotally carried by the support frame for adjustment relatively to the support frame about a transverse axis, an upper coal cutting head carried by the lower coal cutting head for vertical adjustment relatively to the lower coal cutting head, means for adjusting the support frame and the coal cutting heads carried thereby relatively to the main frame, for adjusting the coal cutting heads relatively to the support frame, means for adjusting the upper coal cutting head relatively to the lower coal cutting head, a pair of motors for driving the

cutting heads, said motors being disposed on the main frame in spaced side by side relation rearwardly of the cutting heads, gear means at the rear of and interconnecting said motors to a pair of driving elements, a pair of drive shafts disposed one above the other between said spaced motors and extending from the driving elements to the cutting heads, said drive shafts being connected to the driving elements and to the cutting heads one for driving each of said cutting heads from one of said driving elements, said drive shafts being extensible and contractible and including universal joint means to permit said adjustments of the support frame and the cutting head.

10. In a coal mining machine having a main frame, a support frame adjustably mounted at the forward end of the main frame, a pair of coal cutting heads carried by the support frame, a conveyor for removing coal cut by the coal cutting heads extending longitudinally of the machine, the forward end of the conveyor being carried by the support frame adjacent the coal cutting heads for the reception of the coal cut thereby, means for adjusting the support frame and the coal cutting heads and the conveyor relatively to the main frame, a pair of motors for driving the cutting heads, said motors being disposed on the main frame in spaced side by side relation rearwardly of the cutting heads, gear means at the rear of and interconnecting said motors to a pair of driving elements, a pair of drive shafts disposed one above the other between said spaced motors and extending from the driving elements to the cutting heads, said drive shafts being connected to the driving elements and to the cutting heads one for driving each of said cutting heads from one of said driving elements, said drive shafts being extensible and contractible and including universal joint means to permit said adjustment of the support frame and the cutting heads.

References Cited in the file of this patent

UNITED STATES PATENTS

2,607,431	Buckendale	Aug. 19, 1952
2,691,513	McElhattan	Oct. 12, 1954
2,715,527	Cartlidge et al.	Aug. 16, 1955
2,740,618	Snyder et al.	Apr. 3, 1956
2,745,648	Robins	May 15, 1956
2,777,681	Ball	Jan. 15, 1957