MINING MACHINE WITH A CONTROL SYSTEM FOR A MINING HEAD

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References Cited
UNITED STATES PATENTS
2,353,246 7/1944 Knutzen................................. 192/15
3,669,229 6/1972 Ronayne et al. ...................... 192/12 C

2,798,711 7/1957 Silver................................. 299/78 X

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ABSTRACT
A mining machine has a mining head with a rotary drum for cutting and breaking material out of a mine face pivotally mounted on the front end of the machine. A control system for the mining head has a control device to operate a brake to stop the rotary drum and in response to operation of the brake actuate an enabling device which permits the control device to subsequently connect a drive to the drum for rotation thereof. Another control device is operative to connect a drive for propelling the mining machine and in response to connection of the mining machine drive the enabling device is disabled to prevent the connection of the drive for the rotary drum.

23 Claims, 5 Drawing Figures
FIG. 5
MINING MACHINE WITH A CONTROL SYSTEM FOR A MINING HEAD

BACKGROUND OF THE INVENTION

1. Field of the Invention

The instant invention relates to mining machines, and more particularly to a control system for the mining head of a continuous mining machine.

2. Description of the Prior Art

A typical continuous mining machine has a mining head at the front end for cutting and breaking material at the mine face, a gathering head below the mining head to collect the mined material, and a longitudinal conveyor which receives the mined material and conveys it to the rear of the mining machine from which the mined material is discharged into a haulage vehicle or other equipment which takes the material away from the place of the mining operation. The mining machine includes a pair of traction treads upon which the machine is supported and by which the machine may be propelled.

Such a continuous mining machine is described in the patent to McCracken, U.S. Pat. No. 3,495,876, issued Feb. 17, 1970. The mining head has a boom pivotally attached to the front end of the frame of the mining machine and movable upwardly and downwardly about a lateral axis. A rotary drum is transversely mounted on the boom. A plurality of spirally arranged cutter bits on the rotary drum and cutter chains cut and break the material from the mine face when the drum is rotated and the mining head is advanced into the mine face. The traction treads which propel the mining machine are driven at a low speed by a hydraulic motor, when the machine is being moved forwardly to advance the mining head into the mine face. When the mining machine is tramm ing, the traction treads may be driven at a higher speed.

The rotary drum on the mining head is for cutting coal and need only be operated when the mining machine is stationary or is being pushed into the mine face. Therefore, as a safety feature, when the traction treads are propelling the mining machine at the higher speed, the rotary drum should be rendered inoperative. Further, this would prevent damage to the mining head which may result from the impact loads which would be imposed on it if the drum was rotating and it contacted the mine wall or the mine face when the machine was being trammed at the higher speed.

SUMMARY OF THE INVENTION

The instant invention provides a continuous mining machine with a mining head that includes a rotary cutting and breaking drum. The drive for the rotary drum includes a clutch and brake mechanism which is between gears in a gear transmission which transmits power to the drum. A clutch in the clutch and brake mechanism connects the gears in the gear transmission so that power is transmitted to the rotary drum. A brake in the clutch and brake mechanism stops the rotating drum. The clutch and the brake are connected so that when one is operative, the other is inoperative.

In the instant mining machine, the traction treads are adapted to propel the machine at either a low speed or a high speed. The control system for the mining head includes an enabling device which is alternatively mov-
main frame 14. The motors 21, 22 drive motor gear transmissions 23, 24 respectively; first universal shafts 26, 27 respectively; second universal shafts 28, 29 respectively; and input gear transmissions 30, 31, respectively. Each gear transmission 30, 31 drives into a clutch and brake mechanism 33. The clutch and brake mechanisms 33, 33 are identical and oppositely disposed one on each side of the machine 10. Within the orbit of each cutting chain 20, 20 is a gear transmission 32, one of which is shown in FIG. 3 that delivers drive from one of the gear transmissions 30, 31 to the rotary drum 12. The function of the clutch 34 in each clutch and brake mechanism 33 is to connect one of the input gear transmissions 30, 31 to one of the gear transmissions 32, 32 to drive the rotary drum 12. The function of the brake 35 is to stop rotation of the drum 12.

FIG. 3 illustrates one clutch and brake mechanism 33. A shaft 36 with a bevel pinion 37 from the input gear transmission 30 drives a bevel gear 38 which is splined to a hub portion 39 of a clutch input drum 40. A plurality of outer clutch disks 41 are splined to the input drum 40 and alternate with inner clutch disks 42 which are splined to an output shaft 43 with a splined end 44. A gear 45 which is attached to the splined end 44 drives a gear 46 which is part of a gear transmission 32 within the orbit of the cutting chain 20.

When hydraulic fluid under pressure is supplied to the clutch 34, it engages a face 47 on a piston 48 and causes the piston 48, a triple ball bearing 49 and a pressure member 50 which is splined to the output shaft 43, to be moved axially to the left as viewed in FIG. 3. The movement of the pressure member 50 causes the clutch disks 41, 42 to be compressed to thereby couple the clutch input drum 40 and the output shaft 43 to drive the rotary drum 12.

When hydraulic fluid under pressure is supplied to the brake 35 the fluid engages a second face 51 on the piston 48 and moves the piston 48, the triple ball bearing 49 and the pressure member 50 to the right as viewed in FIG. 3 toward an end cap 54. Movement of the pressure member 50 causes inner brake disks 55, which are splined to the pressure member 50, and outer brake disks 56, which are splined to the fixed housing 57, to be compressed to thereby stop rotation of the output shaft 43 and the rotary drum 12.

There is a dowel 63 which prevents rotation of the piston 48 with consequent wear of the seals 60, 61, 62 which engage the piston 48. An axially extending pin 64 prevents the output shaft 43 from moving axially toward the end cap 54.

The mining head 11 is pivotally mounted on the pivot structure 18 and is moved upwardly and downwardly by a pair of hydraulic cylinders 65 located on opposite sides of the machine, one of which is illustrated in FIG. 1. Each hydraulic cylinder 65 is pivotally connected at one end of the main frame 14 and at the other end to the boom 15.

A gathering head 66 is pivotally mounted on the pivot structure 18 on the main frame 14 beneath the mining head 11. Two gathering arms 67, 67 sweep the mined material onto an endless chain and flight conveyor 68.

The gathering arms 67, 67 on the gathering head 66 are driven by the electric motor 22 through the gear transmission 24, a universal shaft 69 and a gear transmission 70 which drivingly connects to the gathering arms 67, 67. The gathering head 66 may be adjusted upwardly and downwardly in order to follow the contour of the mine floor by a pair of hydraulic cylinders 71 located on opposite sides of the machine, one of which is shown in FIG. 1. Each hydraulic cylinder 71 is pivotally connected at one end to the main frame 14 and at the other end to the gathering head 66.

The endless chain and flight conveyor 68 extends longitudinally through the mining machine 10 from the gathering head 66 to the rear of a discharge conveyor boom 73 which is pivotally mounted on the pivot structure 18 on the main frame 14 of the mining machine 10. The conveyor boom 73 is moved upwardly and downwardly by a pair of hydraulic cylinders 74, one of which is shown in FIG. 1, which are disposed on opposite sides of the main frame 14. Each cylinder 74 is pivotally attached at one end to the main frame 14 and at the other end to the conveyor boom 73. The rear end of the discharge conveyor boom 73 may be moved to one side or the other by a double acting hydraulic cylinder 75. This permits an adjustment of the position of the conveyor boom 73 to discharge the mined materials into a haulage vehicle or other equipment for removing the mined material from the mining place.

In FIG. 4 there is shown a transmission drive system for transmitting power from the motors 21, 22 to the traction treads 13, 13L. The motor 21 supplies power for driving the traction treads 13, 13L of the mining machine 10 at a low speed. The motor shaft 77 is continuously rotated and drives gear 78 which drives gear 79 to drive shaft 81. Shaft 81 drives gear 82 to drive gear 83 which drives shaft 84. Shaft 84 drives a planetary gear reducer set 85. The gear reducer set 85 drives the shaft 86 which is connected to a universal shaft 87. The universal shaft 87 is connected to a shaft 88 with a bevel pinion 89 which engages a bevel gear 90. The bevel gear 90 is secured to the input of an over-running clutch 92. A shaft 93 is secured to the output of the over-running clutch 92 and has a gear 94. Gear 94 drives gear 95 on a right-forward clutch 96. Gear 95 drives a gear 97 on a right-reverse clutch 98. Gear 99 on one end of a crossover shaft 100 is also driven by gear 95.

Gear 95 is connected to a clutch output shaft 101 through the right-forward clutch 96. Shaft 101 drives gear 102. Gear 97 is connected to a clutch output shaft 104 through the right reverse clutch 98. Shaft 104 drives gear 105. One or the other of the forward clutch 96 or the reverse clutch 98 may be engaged to determine the direction of rotation of gear 103 which is driven by either gear 102 or 105. Gear 103 drives shaft 106 which drives gear 107 which drives gear 108. Gear 108 drives gear 109. Gear 109 drives a planetary gear set 110 which drives a pair of sprockets 111, to thereby drive the traction tread 13R.

In the low speed transmission drive power from the motor 21 is transmitted from the right side of the machine to the left side by the crossover shaft 100 which is driven by gear 99. Gear 112 on the end of the crossover shaft 100 drives gear 113 on the left-forward clutch 114, and gear 113 drives gear 115 on the left-reverse clutch 116. Gear 115 is connected to a clutch output shaft 117 through the left-forward clutch 114. Shaft 117 drives gear 118. Gear 115 is connected to a clutch output shaft 119 through the left-reverse clutch 116. Shaft 119 drives gear 120. One or the other of the forward clutch 114 or the reverse clutch 116 may be engaged to determine the direction of rotation of gear.
121 which is driven by either gear 118 or gear 120. Gear 121 drives shaft 122 which drives gear 123. Gear 123 drives gear 124 which drives gear 125. Gear 125 drives a planetary gear set 126 which drives a pair of sprockets 127, one of which is shown, to thereby drive the traction tread 131.

The motor 22 supplies power for driving the traction treads 13R, 13L at the high speed. The motor shaft 129 is continuously rotated and drives gear 130 which drives gear 131. Gear 131 drives a gear 132 on a high speed clutch 133. The gear 132 drives a gear 134 through the clutch 133. Gear 134 drives gear 135 which drives gear 136. The gear 136 drives a shaft 137 which is connected to a universal shaft 138. The universal shaft 138 is connected to a shaft 139 with a bevel pinion 140 which engages a bevel gear 141. The bevel gear 141 drives a shaft 142 which has a gear 143. Gear 143 drives gear 113 on left-forward clutch 114, to thereby provide a high speed drive through the left clutches 114, 116 to the left traction tread 13L as previously described. Gear 113 also drives gear 112.

In the high speed transmission drive, power from the motor 22 is transmitted from the left side of the machine 10 to the right side by the crossover shaft 100 which is driven by gear 112. Gear 99 on the end of the crossover shaft 100 drives gear 95 on the right-forward clutch 96, to thereby provide a high speed drive through the right clutches 96, 98 to the right traction tread 13R as previously described.

Gear 95 drives gear 94 at high speed which drives shaft 101 at the high speed. The bevel gear 90 is driven by the low speed by the motor 21 as previously described, and the output of the over-running clutch 92 overruns the input since shaft 93 is driven at a higher speed than the bevel gear 90.

The continuously rotating motor shaft 77 drives gear 78 which drives gear 79 which drives gear 80. The gear 80 drives a shaft 145 which drives a pump 146. The pump 146 provides hydraulic fluid with a pressure of about 500 p.s.i. This fluid is used to actuate the clutch and brake mechanisms 33, 33; the forward clutches 96, 114; and the reverse clutches 98, 116 as will be described below. It is also used to operate pilots of control valves which control the flow of fluid under a higher pressure to other machine elements.

The gear 80 also drives a shaft 147 which drives a pump 148. Hydraulic fluid leaving pump 148 has a pressure of approximately 2,000 p.s.i. This fluid is used to operate the hydraulic cylinders 65 for the mining head 11, the hydraulic cylinders 71 for the gathering head 66, the hydraulic cylinders 74, 75 for the discharge conveyor boom 73 and other elements of the machine 10.

FIG. 5 is a diagram of the control system for the operation of the mining head 11 of the mining machine 10. The pump 146 is connected to a line 150 which is connected to a line 151. Line 151 is connected to a check valve 152 which is connected to a line 153. The line 153 is connected to a relief valve 155 which is connected to a line 150 by a line 156 to limit the pressure of the hydraulic fluid in the line 150.

The selective control valve 154 is manually operated with a spring return to center and may be detented to either the left, the right or the center positions. When the control valve 154 is centered, the line 153 is blocked; the lines 158, 159 are ported to tank through the valve 154 and the line 157. When the selective control valve 154 is moved to the right, line 153 is connected to line 158 and the latter connects to the brakes 35, 35 in the clutch and brake mechanisms 33, 33. In this way, hydraulic pressure is supplied to face 51 of piston 48 to move the piston 48 and the pressure member 50 to compress the brake discs 55, 56 to stop rotation of the output shaft 43 and the rotary drum 12. The line 158 is also connected to a line 160 which is connected to a hydraulic pilot 162 on an enabling valve 163. Hydraulic pressure acts on the pilot 162 to move the valve 163 to the left in response to operation of the brakes 35, 35 in the clutch and brake mechanisms 33, 33. The line 159 is ported to tank through valve 154 and line 157.

When the control valve 154 is moved to the left, the line 153 is connected to line 159 which connects to a pilot-operated check valve 164. The check valve 164 connects to the enabling valve 163 by a line 165. When the valve 163 has been moved to the left the line 165 connects to a line 166 and the latter connects to the clutches 34, 34 in the clutch and brake mechanisms 33, 33. In this way, hydraulic pressure is supplied to the face 47 of the piston 48 to move the piston 48 and pressure member 50 to compress the clutch discs 41, 42 to thereby cause rotation of the output shaft 43 and the rotary drum 12. The line 158 is ported to tank through valve 154 and line 157.

The line 150 from the pump 146 connects to a line 167 which connects to a safety valve 168. When the valve 168 is moved to the left, the line 167 is connected to line 169. Line 169 is connected to the pilot-operated check valve 164. Fluid pressure moves the valve 164 to permit fluid pressure from the line 159 to be transmitted to line 165 through the enabling valve 163 to the clutches 34, 34. The valve 168 is a safety valve and is spring-return to the right, which blocks the passage of hydraulic fluid pressure. When the valve 168 is moved to the right, the line 169 is ported to tank through the valve 168 and the line 170. The valve 168 must be moved to the left before other functions of the mining machine 10 can be operated.

Line 169 connects to line 172 which connects to a check valve 173. A line 174 connects the check valve 173 to a manual control valve 175 for the high speed clutch 133. The valve 175 may be detented to either the right or the left and is spring-return to the left. When the control valve 175 is moved to the left, hydraulic fluid pressure cannot be transmitted and a line 176 is ported to tank through the valve 175, line 177 and line 178. When the control valve 175 is moved to the right, hydraulic fluid pressure in the line 174 is transmitted to line 176 to engage the high speed clutch 133. When the high speed clutch 133 is engaged, the crawler traction treads 13R, 13L may be driven at the high speed as previously described. The line 176 is also connected to a line 179 which is connected to a hydraulic pilot 180 on the enabling valve 163 to move the latter to the right in response to operation of the high speed clutch 133. This interrupts the connection between the line 165 and line 166, ports the clutches 34, 34 to tank and prevents the inadvertent engagement of the clutches 34, 34 when the high speed clutch 133 is engaged.

The line 172 also connects to line 182 which connects to line 183. The line 183 connects to a manual selective control valve 184. The valve 184 controls the
right-forward clutch 96 and the right-reverse clutch 98 which operate the right crawler tread 13R. The control valve 184 has three positions and is spring-retumed to its center position. In the center position, hydraulic fluid pressure cannot be transmitted and lines 185, 186 leading to the clutches 96, 98 respectively are ported to tank through valve 184, line 187, and line 178. When the valve 184 is moved to the left, hydraulic pressure from the line 183 is transmitted to the line 186 to engage the right-reverse clutch 98 to thereby drive the right traction tread 13R in reverse. The clutch 96 and the line 185 are ported to tank through the valve 184 and lines 187 and 178. When the valve 184 is moved to the right, the line 183 is connected to the line 185 to engage the right-forward clutch 96 to thereby drive the right traction tread 13R forwardly. The clutch 98 and the line 186 are ported to tank through the valve 184 and the lines 187 and 178. The line 182 is also connected to the manual selective control valve 188. The valve 188 controls the left-forward clutch 114 and the left-reverse clutch 116 which operate the left traction tread 13L. The control valve 188 has three positions and is spring-retumed to its center position. In the center position, hydraulic fluid pressure cannot be transmitted and lines 189, 190 leading to clutches 114, 116 respectively are ported to tank through the valve 188 and line 178.

When the valve 188 is moved to the left, the line 185 is connected to the line 190 to engage the left-reverse clutch 116 to thereby drive the left-forward tread 13L in reverse. The clutch 114 and line 189 are ported to tank through valve 188 and line 178. When the valve 188 is moved to the right, the line 182 is connected to the line 189 to engage the left-forward clutch 114 to thereby drive the left traction tread 13L forwardly. The clutch 116 and the line 190 are ported to tank through the valve 188 and the line 178.

In operation of the mining machine 10, the machine 10 is advanced to the place of the mining operation. The control valve 154 is moved to the left to engage the clutches 34, 34 for rotation of the drum 12, the mining head 11 is raised and the control valves 184, 188 are moved to the right to engage the clutches 96, 98, respectively, to sump the machine 10 into the mine face. If the machine 10 is to be advanced at an angle, the control valves 184, 188 may be moved so that one tread is driven forwardly while the other tread is driven in reverse, or one tread may be stationary while the other tread is driven. When the machine 10 has been sump into the mine face the appropriate depth, the valves 184, 188 are returned to their centers to stop the traction treads 13R, 13L. The mining head 11 is then lowered so that the rotary drum 12 can cut downwardly on the mine face. When the mining head 11 has been lowered as far as possible, the control valves 184, 188 are moved to the left to engage the reverse clutches 98, 116, respectively, to thereby drive the traction treads 13R, 13L in reverse. When the machine 10 is moving in reverse, the drum 12 continues to rotate to remove the cusp on the floor formed by the rotary drum 12.

When the rotary drum 12 is to be stopped, the control valve 154 is moved to the right to apply the brake 35 in each clutch and brake mechanism 33. When the rotary drum 12 is stopped, the control valve 154 is moved to its center position.

When the mining machine 10 is to be moved away from the place of the mining operation, the control valve 175 may be moved to engage the high speed clutch 133. When the high speed clutch 133 is engaged, either the right traction tread 13R or the left traction tread 13L, or both, may be driven at the high speed. In response to the engagement of the high speed clutch 133, the enabling valve 163 is pilot-operated to the right. When the valve 163 is at the right, hydraulic pressure cannot be transmitted to the clutches 34, 34 in the clutch and brake mechanisms 33, 33. Consequently, when the high speed clutch 133 is engaged, the rotary drum 12 will not rotate even though the control valve 154 is inadvertently moved to the left.

After the high speed clutch 133 is disengaged, the control valve 154 may be moved to operate the rotary drum 12. To operate the rotary drum 12, the control valve 154 must be moved to the right to simultaneously apply the brake 35 in each clutch and brake mechanism 33, and to pilot-operate the enabling valve 163 to the left. After the enabling valve 163 has been moved to the left, the control valve 154 may be moved to the left to operate the clutches 34, 34 in the clutch and brake mechanisms 33, 33 to the engaged position.

It can be seen that the instant invention provides a control for the mining head which includes an enabling device which can be moved to permit the operation of the rotary drum on the mining head or can be disabled to prevent the operation of the rotary drum. When the high speed clutch is engaged to permit the traction treads to be driven at the high speed, the enabling device is simultaneously disabled. When the high speed clutch is disengaged, the brake for the rotary drum may be engaged and the enabling device simultaneously moved to a position in which the rotary drum may be subsequently operated.

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 it is defined by the claims hereeto appended. Applicant therefore wishes not to be restricted to the precise construction herein described.

Having thus described and shown an embodiment of the invention, what is claimed and desired to be secured by letters patent of the United States is:

1. A mining machine comprising: a mining head at the front of the mining machine for cutting and breaking material from a mine face; propulsion means to propel the mining machine and to advance said mining head into the mine face; drive means for operating said mining head; drive connecting means to drivingly connect said drive means to operate said mining head; brake means to stop operation of said mining head; selective control means alternatively operable to operate said drive connecting means or to operate said brake means; enabling means to permit operation of said drive connecting means; and means responsive to operation of said brake means to operate said enabling means to an enabling condition for subsequent operation of said drive connecting means.

2. A mining machine as recited in claim 1, in which said drive connecting means comprises clutch means, means to engage said clutch means, means to engage said brake means, and common actuating means to disengage said brake means when said clutch means is engaged and to disengage said clutch means when said brake means is engaged.

3. A mining machine as recited in claim 2, in which said enabling means comprises a device to connect said
selective control means to said clutch engaging means and alternatively to disconnect the selective control means from said clutch engaging means thereby to render the clutch inoperative in its disengaged condition.

4. A mining machine as recited in claim 1 including means to operate said enabling means to a disabled condition in which said drive connecting means is rendered inoperative.

5. A mining machine as recited in claim 4 including second control means for operating another machine function, second means responsive to operation of said other machine function to operate said enabling means to a disabled condition in which said drive connecting means is rendered inoperative.

6. A mining machine as recited in claim 1, in which said drive connecting means comprises a clutch that is combined with said brake means, a clutch operator to engage said clutch, a brake operator to engage said brake means, and a connection of said clutch operator and said brake operator one to the other to disengage the clutch when the brake means is engaged and to disengage the brake means when the clutch is engaged.

7. A mining machine as recited in claim 6 including high speed operating means to operate said propulsion means at a higher speed for tramping the mining machine, and said enabling means having means that is responsive to said high speed operating means to disengage the enabling means and thereby to disengage the clutch and to render the clutch inoperative.

8. A mining machine as recited in claim 1, including hydraulic operating means for said drive connecting means, hydraulic operating means for said brake means, said selective control means including means to apply hydraulic fluid to one or the other of said hydraulic operating means alternatively to operate said drive connecting means or said brake means, respectively, and a passage in said enabling means for hydraulic fluid to said hydraulic operating means for said drive connecting means.

9. A mining machine as recited in claim 8 including high speed operating means to operate said propulsion means at a higher speed for tramping the mining machine, hydraulic operating means to engage said high speed operating means, means responsive to said hydraulic operating means to disengage said enabling means in order to block the hydraulic fluid from said hydraulic operating means for said drive connecting means and thereby to render the drive connecting means inoperative.

10. A mining machine as recited in claim 9 in which said enabling device comprises a hydraulic valve which in its enabling condition transmits hydraulic fluid to said hydraulic operating means for said drive connecting means and in its disabling condition blocks the hydraulic fluid from said hydraulic operating means for said drive connecting means, first pilot operating means being connected to hydraulic operating means for said brake means, and second pilot operating means being connected to said hydraulic operating means for said high speed operating means.

11. A mining machine as recited in claim 1, in which said drive connecting means comprises a clutch that is combined with said brake means, hydraulic cylinder and piston means to alternatively operate said clutch or said brake means, said piston having a first piston face and a second piston face that are oppositely disposed, said selective control means including means to apply hydraulic fluid pressure alternatively to said first piston face to engage said clutch or to apply hydraulic fluid pressure to said second piston face to engage said brake means, said enabling means including a hydraulic fluid passage to transmit hydraulic fluid pressure to said first piston face, and said responsive means including hydraulic fluid pressure means to operate the enabling means when said brake means is engaged.

12. A mining machine as recited in claim 11, second responsive means including hydraulic fluid pressure means to operate said enabling means to a disabled condition and thereby to render the clutch inoperative.

13. A mining machine as recited in claim 1 including high speed operating means to operate said propulsion means at a higher speed for tramping the mining machine, means responsive to said high speed operating means to operate said enabling means to a disabling condition in which the drive connecting means is rendered inoperative.

14. A mining machine as recited in claim 13 including a clutch for said high speed operating means, means to engage said clutch for operation of the mining machine at said higher speed, means responsive to engagement of said high speed clutch to operate said enabling means to said disabling condition in which the drive connecting means is rendered inoperative.

15. A mining machine comprising a mining head at the front of the mining machine for cutting and breaking material from a mine face, said mining head having a rotary cutting and breaking drum, endless traction treads to propel the mining machine and to advance said rotary cutting and breaking drum into the mine face, power transmission means to rotate said rotary cutting and breaking drum, clutch means in said power transmission means to connect elements of the power transmission means to rotate said rotary cutting and breaking drum, brake means to stop rotation of said rotary cutting and breaking drum when said clutch means is not engaged, a selectively operable control alternatively to engage said clutch means or to engage said brake means, an enabling device to permit operation of said clutch means to engagement, and means responsive to engagement of said brake means to operate said enabling device for subsequent operation of said clutch means to engagement.

16. A mining machine as recited in claim 15, in which said clutch means and said brake means are combined in a clutch-brake mechanism, and said clutch-brake mechanism includes means to disengage the brake means when the clutch means is engaged and to disengage the clutch means when the brake means is engaged.

17. A mining machine as recited in claim 15 in which said clutch means and said brake means are combined in a clutch-brake mechanism, hydraulically operated engaging means alternatively operable to engage the clutch means and simultaneously to disengage the brake means or to engage the brake means and simultaneously to disengage the clutch means, said engaging means including a first piston face for hydraulic fluid to engage the clutch means and a second piston face for hydraulic fluid to engage the brake means, and said en-
abl ing device including a passage for hydraulic fluid to said first piston face.

18. A mining machine as recited in claim 17 including means to operate said enabling device to a disabled condition in which the enabling device blocks the hydraulic fluid from said first piston face and said clutch means is rendered inoperative.

19. A mining machine as recited in claim 17, in which said enabling device comprises a hydraulic valve, first pilot operating means for said enabling device hydraulic valve to operate the valve to its enabling condition in which it permits operation of said clutch means, a connection of said first pilot operating means to the hydraulic fluid for said brake means in order to actuate the first pilot operating means in response to operation of said brake means, and second pilot operating means for said enabling device hydraulic valve to operate the valve to a disabled condition in which it blocks hydraulic fluid from operating said clutch means and thereby renders the clutch means inoperative, and hydraulic fluid means to actuate said second pilot operating means.

20. A mining machine as recited in claim 19 including hydraulic control means to control an operating function of the mining machine, and a connection of said hydraulic control means to said second pilot operating means to actuate the second pilot operating means by said hydraulic fluid means at the same time as the operating function of the mining machine.

21. A mining machine as recited in claim 15, high speed operating means for said endless traction treads to propel the mining machine at a higher speed for tramming the mining machine, clutch means for said high speed operating means, engaging means to engage said high speed clutch means, and said enabling device including means responsive to the high speed clutch engaging means to operate said enabling device to a disabled condition and thereby to render said power transmission clutch means inoperative.

22. A mining machine as recited in claim 15, high speed operating means for said endless traction treads to propel the mining machine at a higher speed for tramming the mining machine, clutch means for said high speed operating means, hydraulic fluid actuated engaging means to engage said high speed clutch means, and said enabling device including hydraulic fluid means that is responsive to the high speed clutch engaging means to operate said enabling device to a disabled condition and thereby rendering said power transmission clutch means inoperative.

23. A mining machine as recited in claim 15, in which said clutch means and said brake means are combined in a clutch-brake mechanism, hydraulically operated engaging means alternatively operable to engage the clutch means and simultaneously to disengage the brake means or to engage the brake means and simultaneously to disengage the clutch means, said engaging means including a first piston face for hydraulic fluid to engage the clutch means and a second piston face for hydraulic fluid to engage the brake means, said enabling device comprises a hydraulic valve with a passage for hydraulic fluid to said first piston face, first pilot operating means for said enabling device hydraulic valve to operate the valve to its enabling condition in which it permits operation of said clutch means, a connection of said first pilot operating means to the hydraulic fluid for said brake means in order to actuate the first pilot operating means in response to operation of said brake means, second pilot operating means for said enabling device hydraulic valve to operate the valve to a disabled condition in which it blocks hydraulic fluid from operating said clutch means and thereby renders the clutch means inoperative, high speed operating means for said endless traction treads to propel the mining machine at a higher speed for tramming the mining machine, clutch means for said high speed operating means, hydraulic fluid actuated engaging means to engage said high speed clutch means, and a connection of said hydraulic fluid actuated engaging means to said second pilot operating means to operate said enabling device to said disabled condition in response to engagement of said high speed clutch means.

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