June 17, 1958 P. L. ALSPAUGH ET AL 2,839,281

BORING TYPE MINING MACHINE HAVING AN ADJUSTABLE BORING HEAD

Original Filed May 11, 1953 4 Sheets-Sheet 1

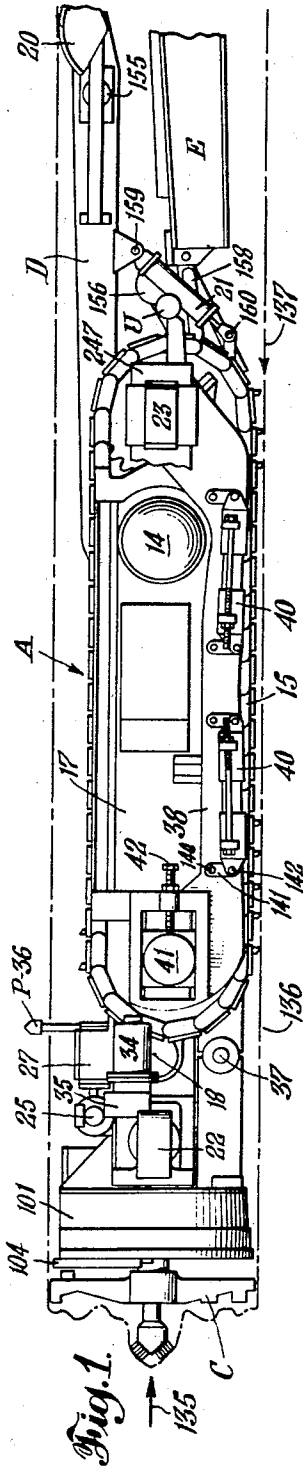

Fig. 1.

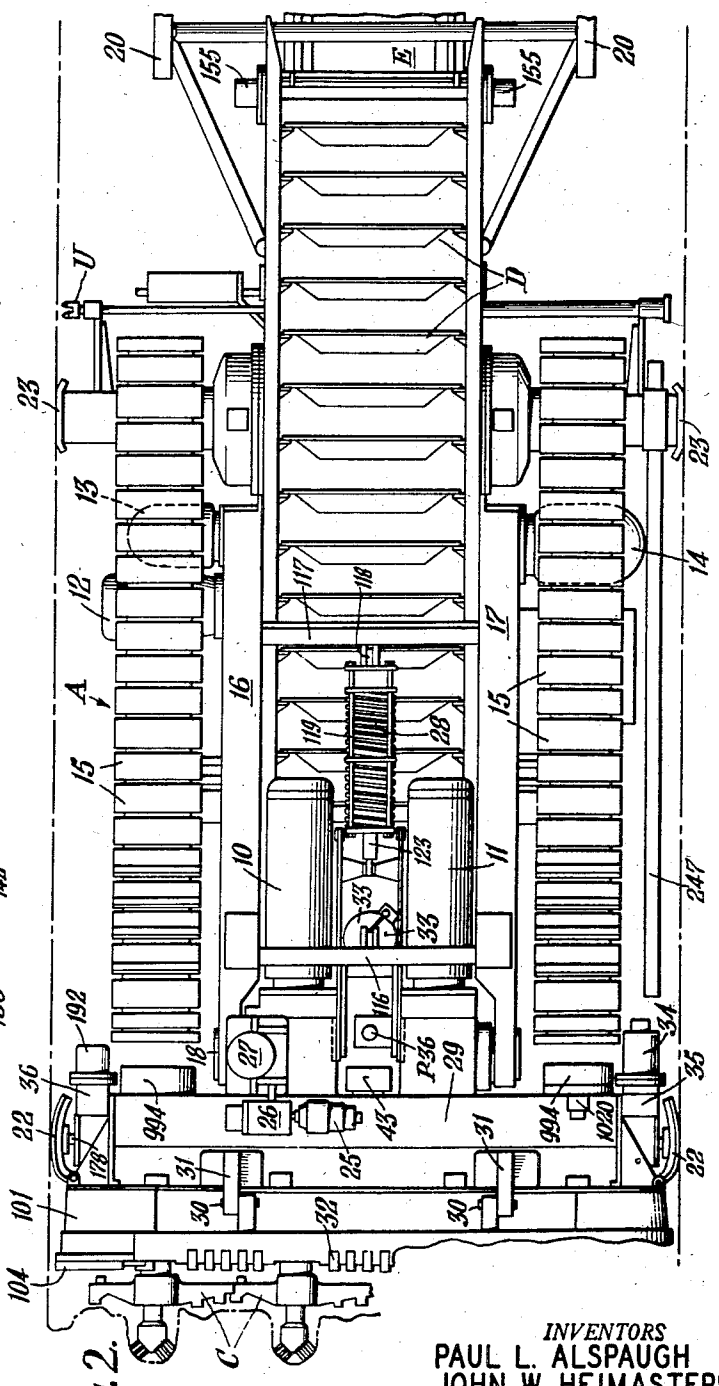

Fig. 2.

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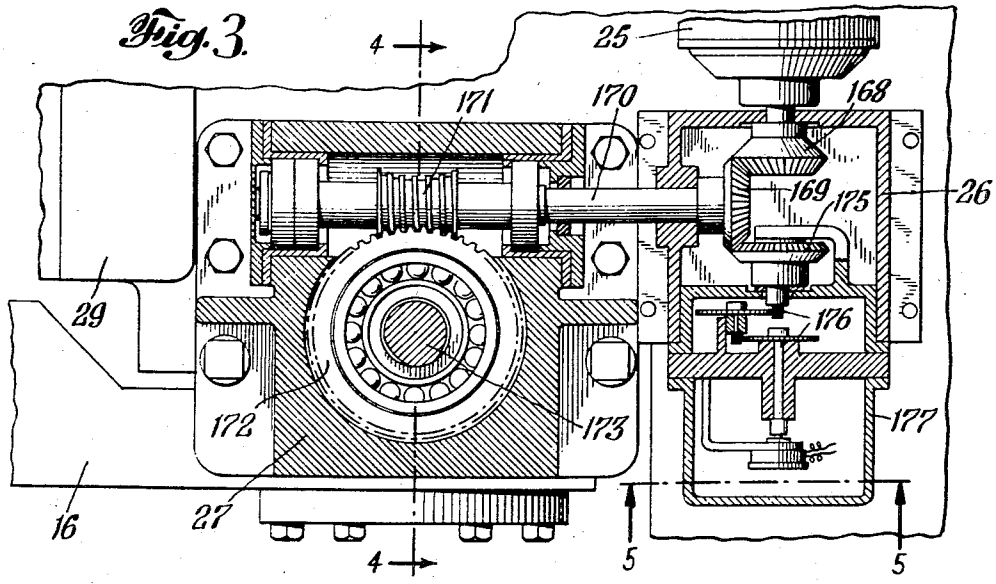
Fig. 3.



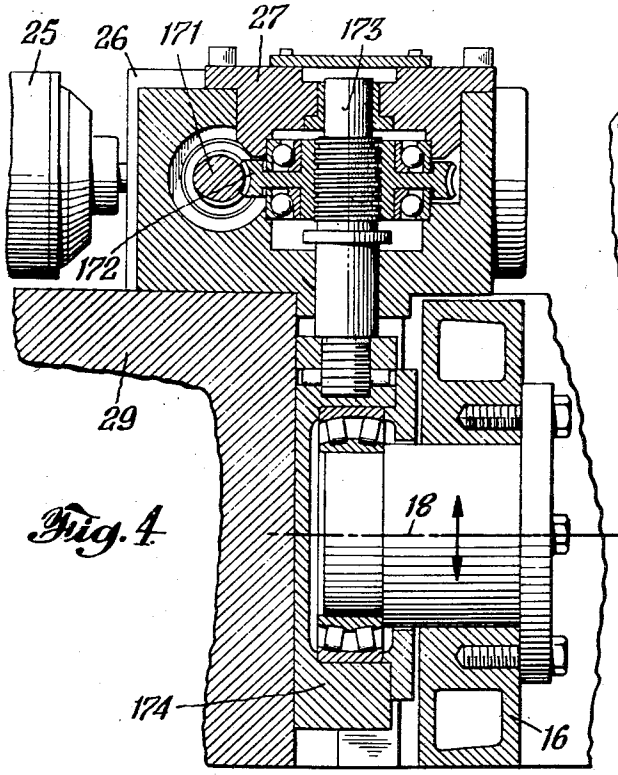


Fig. 4.

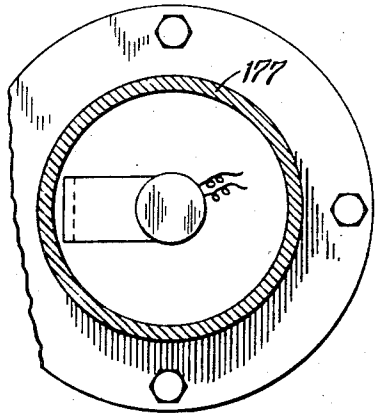


Fig. 5.

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Fig. 6.

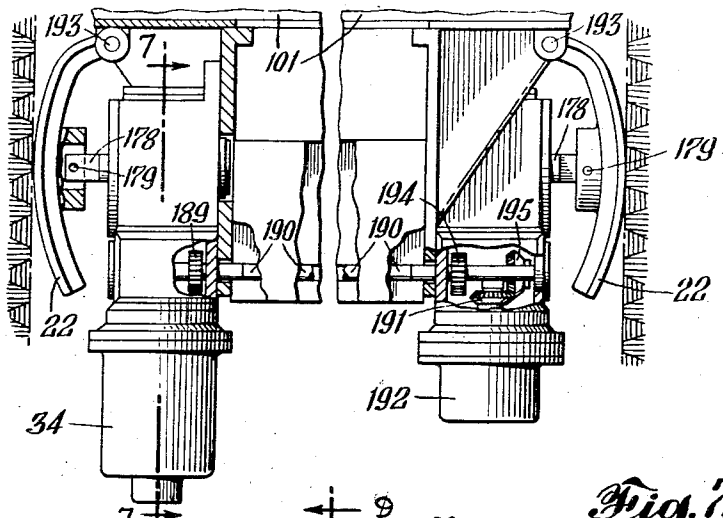


Fig. 7.

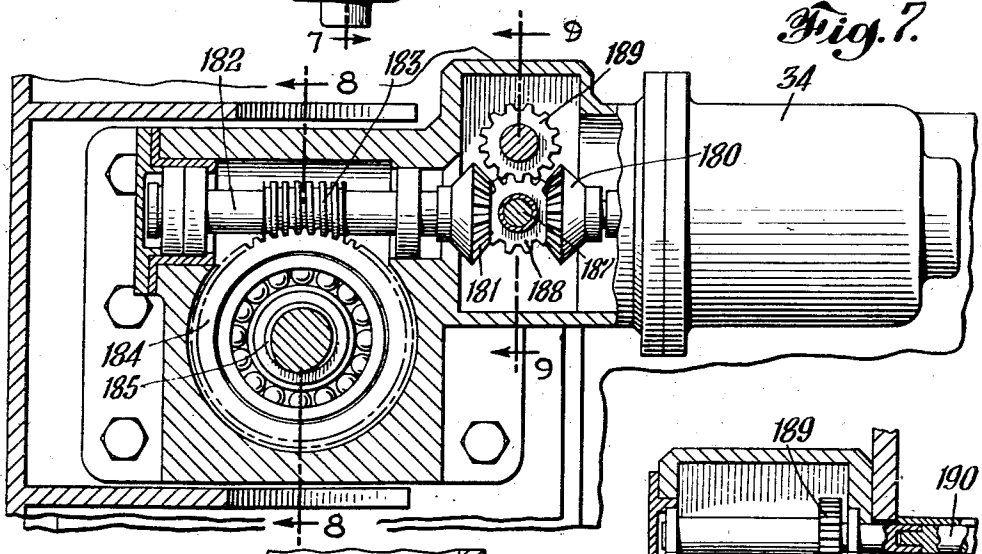
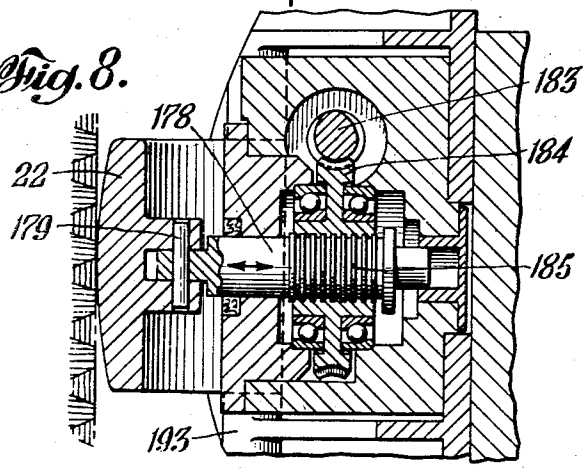


Fig. 8.



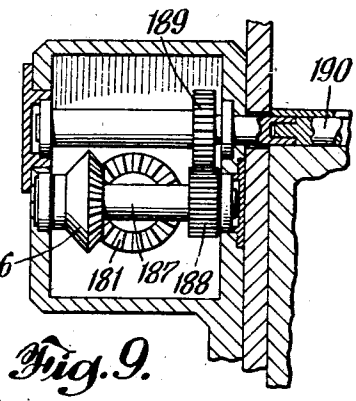


Fig. 9.

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BORING TYPE MINING MACHINE HAVING AN ADJUSTABLE BORING HEAD

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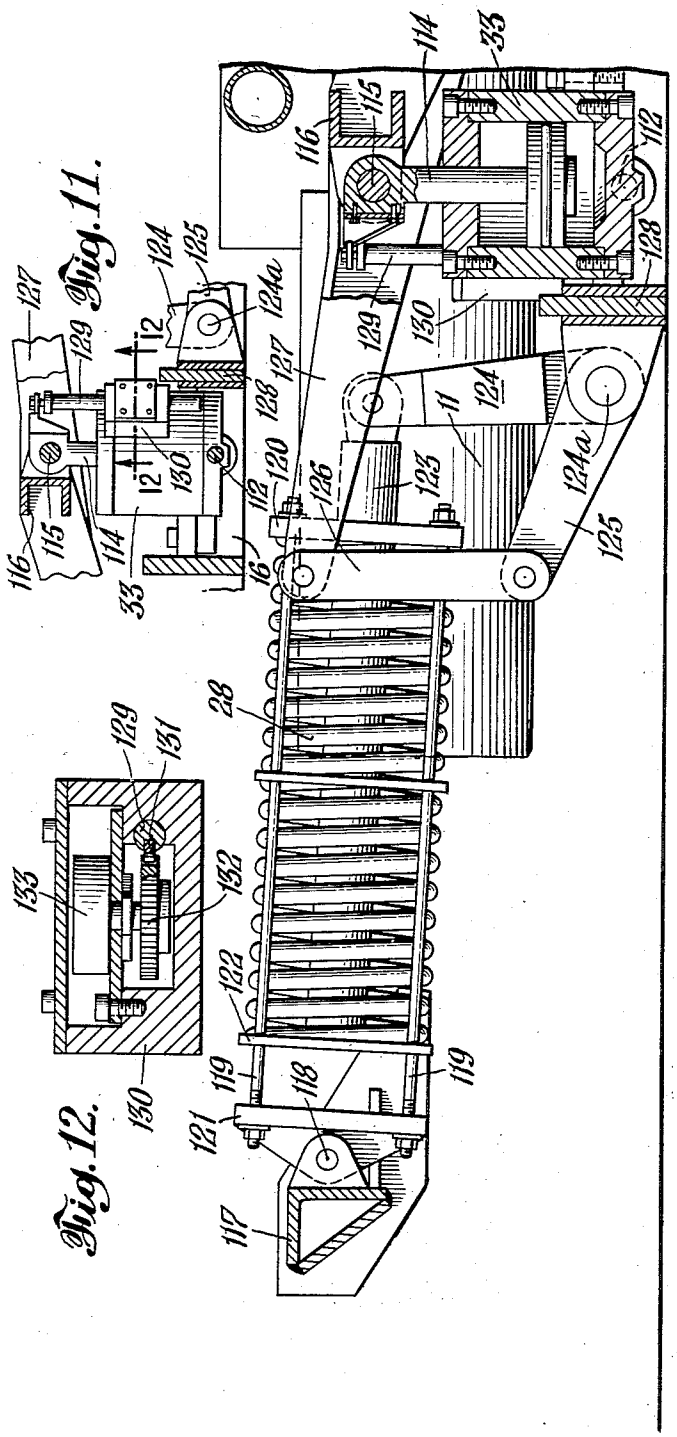

Fig. 10.

Fig. 11.

Fig. 12.

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BORING TYPE MINING MACHINE HAVING AN ADJUSTABLE BORING HEAD

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Original application May 11, 1953, Serial No. 353,932. Divided and this application September 16, 1954, Serial No. 456,364

4 Claims. (Cl. 262—7)

This invention relates to steering mechanisms for bore-mining machines of the type shown in our copending parent application Serial No. 353,932, filed May 11, 1953, of which this application is a division.

The bore-mining machine according to our said parent application is provided with a driving head from which rotary cutting devices extend forwardly to engage the material being mined. Hard tipped bits on the rotary cutting devices cut circumferential grooves in the seam face, and break out the material betwen the groves. The machine is also provided with conveyor means disposed under the driving head for transporting the cuttings rearwardly of the machine. The actual mining operation is remotely controlled at a station which is remote from the machine, being located outside of the bore hole.

Objects of the present invention are to provide an articulated machine, whereby the cutting head is raised or lowered to direct the course of the machine up or down, and to provide horizontal steering and correction for spiral. Such spiralling can result from an accumulation of material on one track lifting that side of the machine. Instruments in the control house show this spiralling action, and correction is made by raising or lowering the head on one side by moving a trunnion bearing and shaft up or down in ways in which the bearing is mounted.

According to the present invention, the bore-mining machine comprises a self-propelled carriage with a head having front face cutting means mounted thereon to pivot about a horizontal-transverse axis thereof, means for adjusting the relative tilt of said cutting means with respect to the carriage to regulate the vertical component of the course of the machine, and means for tilting said axis with respect to the carriage for counteracting the tendency of the machine to spiral in operation. The machine is provided with motor means for driving the cutters, the motor being mounted on said head on the side of such axis opposite that of said cutters whereby said motor means assists in counterbalancing th weight of said cutters. Preferably spring means assist said motor means in counterbalancing said cutters, and power means are preferably provided for tilting said head about such axis, the power means being releasable to permit a substantially free tilting movement of said head during withdrawal or re-entry of said machine in the hole cut by it.

In the drawings:

Fig. 1 is a side view of a bore-mining machine illustrating the invention;

Fig. 2 is a fragmentary top plan view of the machine shown in Fig. 1;

Fig. 3 is a fragmentary view partly in top plan and partly in section of the transmission mechanism controlling lateral tilt or spiral of the cutting head;

Fig. 4 is a view mainly in section taken on the line 4—4 of Fig. 3;

Fig. 5 is a fragmentary view in section taken along the line 5—5 of Fig. 3;

Fig. 6 is a fragmentary view partly in plan and partly in section of the mechanism for changing the horizontal course of the machine;

Fig. 7 is a view mainly in section taken on the line 7—7 of Fig. 6;

Fig. 8 is a sectional view taken along the line 8—8 of Fig. 7;

Fig. 9 is a sectional view taken on the line 9—9 of Fig. 7;

Fig. 10 is a view partly in side elevation and partly in section, showing the rear portion of the machine;

Fig. 11 is a fragmentary view partly in side elevation and partly in section showing the hydraulic cylinder which controls the cutting head for changing the boring direction of the machine in a vertical plane; and

Fig. 12 is asectional view taken along the line 13—13 of Fig. 12.

The cutting head comprising the front end face cutters C and the motors and gearing for driving these cutters are all tiltable as a unit (gear box) about a trunnion axis 18, Figs. 1 and 2, in order that the course of the machine can be changed upwardly or downwardly. For removal of the cusps of coal left between the rotatable cutters C at the top and bottom of the hole, transversely fixed blade 32 is provided on the cutting head at the front of the shroud.

To laterally shift the front of the machine, guide shoes 22 on the cutting head are laterally adjustable together to the right or to the left. Guide shoes 23 at the rear end of the machine are not adjustable. A motor 25 drives a reduction unit 26, described below, for raising or lowering the right end of the trunnion axis 18 for the correction of any lateral tilt (spiral), this drive being through a worm in the housing 27 which is described in detail below. The motors 10 and 11 are arranged on the side of the trunnion axis 18 opposite the main body of the head, to assist in counterbalancing the cutting head and to eliminate universal joints which might otherwise be needed. The weight of these motors is assisted by a counterbalancing spring 28.

An hydraulic cylinder 33, Fig. 2, located between the motors 10 and 11, is provided for tilting the cutting head to change the vertical course of the machine. At the left front side of the machine is a motor 34 which drives a worm gear enclosed within housing 35 for laterally shifting the guide shoes 22. Enclosed within housing 36 are gears shown in Fig. 6 for driving a horizontal position indicator 192, comprising a potentiometer and actuating means for indicating on a voltmeter, located outside the bore hole, the position of such guide shoes 22.

In Fig. 3 is shown the mechanism for correcting spiralling of the machine. From the motor 25 a bevelled gear 168 drives a correspondingly bevelled gear 169 on the shaft 170. A worm 171 on shaft 170 drives worm gear 172. As shown in Fig. 4 this worm gear 172 is rotatable but held against axial movement so that the threaded stud 173 with which the worm gear 172 cooperates is caused to move upwardly or downwardly. Stud 173 is secured to vertically movable bearing block 174 in which is journalled the right end of the trunnion axis 18. This trunnion end portion is carried by the chassis side frame member 16. Since the trunnion is substantially fixed against change in elevation, rotation of the worm gear 172 in one direction causes the adjacent side of the front gear box to be raised or lowered with the adjacent side of the cutting head.

From Fig. 3 it will also be seen that a bevelled gear 175 is driven from the gear 169 and this in turn through reduction gear 176 causes the arm of a potentiometer within the casing 177 to be moved with the result that an operator in the control room of the launching plat-

form is given an indication of the relative position of the right side of the cutting head and whether it is above or below normal and how much. The motor **25** is then remotely actuated to turn in either direction and by an amount needed to correct any lateral tilt that may exist in the machine.

In Figs. 6, 7, 8 and 9 each thrust shaft **178** is moved in or out oppositely to the corresponding shaft on the other side of the machine to adjust the position of the guide shoes **22** to control the direction of the cut by the machine in a horizontal plane. Each thrust shaft **178** is pivotally connected at **179** to its guide shoe and the latter is pivotally connected at **193** to the front gear box frame. The motor **34** is adapted to move such guide shoes simultaneously by means of a beveled gear **180** on the shaft of motor **34** driving the beveled gear **186** (Fig. 9) not shown in Fig. 7, which in turn drives another beveled gear on the shaft **182**. Worm **183** on shaft **182** drives the worm **184** which, as shown in Fig. 8, is held against axial movement. Another worm **185** on the thrust shaft **178** is moved to the right or left according to the direction of rotation of the gear **184** and the driving motor **34**.

In Fig. 9 is shown a beveled gear **186** located to be in cooperation with both the beveled gears **180** and **181**. This gear **186** is on shaft **187** and drives the meshing gears **188** and **189**, the latter being on a shaft **190** which extends laterally across the machine from the left to the right side. On the right side a somewhat similar gearing arrangement drives a beveled gear **191** which in turn actuates the arm of a potentiometer whereby the position of the guide shoes is indicated to an operator in the control room of the launching platform. The mechanism for actuating the right guide shoe **22** is not shown in detail since it is similar to that on the left side of the machine except that when one guide shoe moves in toward the machine the opposite guide shoe moves in an opposite direction. The gear **194** and the beveled gear **195** are only a portion of the gears referred to above.

Referring to Fig. 10, the hydraulic cylinder **33** is pivotally secured over a beam **128** extending between the side fame members **16** and **17**. The piston rod **114** is pivotally connected at **115** to a cross-bar **116** extending under the pivotal cutting head and secured thereto. Another cross-bar **117** extends between the frame members and is provided with a pivotal connection **118** to which is secured the assembly for the heavy spring **28**. This assembly includes four longitudinal rods **119** secured to end plates **120** and **121**. The end plate **121** is secured to the pivotal connection **118**. A slidable pressure plate **122** bears directly against the spring **28** and transmits force from the spring to the rod **123**, urging the rod toward the left, Fig. 10. This rod **123** is pivotally connected to the arm **124** of a bell crank lever which is pivoted at **124***a* to a bracket secured to cross piece **128** which is, in turn, fastened between frame members **16** and **17**. The other arm **125** of the bell crank lever is pivotally connected to a lever arm **127** that is secured to the pivotal cutting head above trunnion axis **18**. Since, as noted above, the motors **10** and **11** do not entirely counterbalance the cutting head the additional counterbalancing spring **28** is provided. The force of this spring is transmitted through the links and levers illustrated, tending to pull down the rear end of the lever arm **127** against the weight of the gear box in front of the trunnion axis **18**.

Fig. 11 shows some of the elements just described in connection with Fig. 10 in which a position indicating rod **129** moves through position indicator **130** secured on the outside of cylinder **33**. Within this position indicator **130** is a rack bar **131**, Fig. 12, which slides with the position indicating rod **129**. A pinion **132** engages the rack **131** and actuates a potentiometer **133** for indicating to an operator in the control room of the launching platform the exact position of tilt assumed by the cutting head. Knowing this, the operator in the control room can open or close valves to admit hydraulic fluid to whichever side of the piston in cylinder **33** is needed for tilting the cutting head the amount desired upward or downward.

We claim:

1. A bore-mining machine comprising a self-propelled carriage, a driving head having front face cutting means positioned and mounted thereon to continuously cut a bore shaped to receive said carriage, said driving head being mounted on said carriage to pivot about a horizontal-transverse trunnion axis thereof, means for adjusting the relative tilt of said driving head and its cutting means about said trunnion axis with respect to said carriage to regulate the vertical component of the course of the machine, and means for tilting said trunnion axis with respect to the carriage for counteracting the tendency of the machine to spiral in operation.

2. A mining machine comprising a self-propelled carriage, a driving head provided with at least a pair of oppositely rotating front face cutters positioned and journaled thereon to cut a bore shaped to receive said carriage, said driving head being pivotally mounted on said carriage on a transverse trunnion axis about which said head is adjustable to direct the course of the machine with an up or downward component, means for tilting said trunnion axis with respect to the carriage for counteracting the tendency of the machine to spiral in operation, power means for tilting said head about such axis, and means for releasing said power means to permit a substantially free tilting movement of said head during withdrawal or re-entry of said machine in the hole cut by it.

3. A bore-mining machine comprising a self-propelled carriage having front face cutting means mounted thereon to pivot about a horizontal-transverse trunnion axis thereof, means for adjusting the relative tilt of said cutting means with respect to said carriage to regulate the vertical component of the course of the machine, a bearing block vertically movably mounted on said carriage and journaling one end of said trunnion axis, and means for raising and lowering said bearing block for tilting said trunnion axis with respect to the carriage for counteracting any tendency of the machine to spiral in operation.

4. A bore-mining machine comprising a self-propelled carriage, a driving head having front face cutting means mounted and positioned thereon to cut a bore shaped to receive said carriage, said driving head being mounted on said carriage to pivot about a horizontal-transverse trunnion axis thereof, means actuated by remote control from outside of said bore for adjusting the relative tilt of said driving head and its cutting means about said trunnion axis with respect to said carriage to regulate the vertical component of the course of the machine, and means actuated by remote control from outside of said bore for tilting said trunnion axis with respect to the carriage for counteracting any tendency of the machine to spiral in operation.

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