April 19, 1966 D. H. H. BOLTON ETAL 3,246,730

MINING APPARATUS COMPRISING AUTOMATICALLY ADVANCING JACKS

Filed June 9, 1964

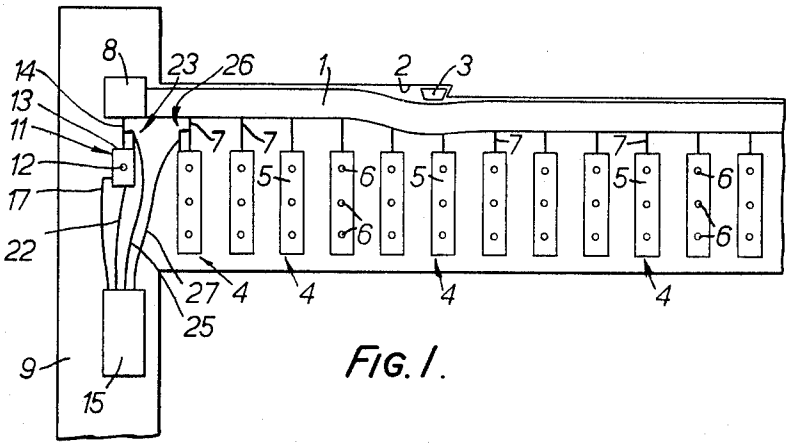


FIG. 1.

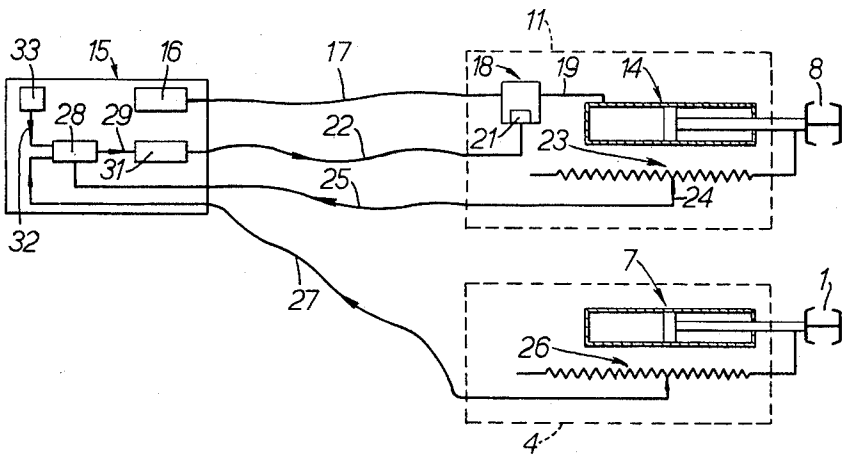


FIG. 2.

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United States Patent Office 3,246,730 Patented Apr. 19, 1966

3,246,730

MINING APPARATUS COMPRISING AUTOMATICALLY ADVANCING JACKS

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Filed June 9, 1964, Ser. No. 373,636
8 Claims. (Cl. 198—126)

This invention relates to minining apparatus which includes a guide means, for example a conveyor, extending along the working face of a mine for guiding a cutting machine along the working face, and a series of fluid-pressure-operated jacks each operable to apply an advancing force to the guide means.

The present invention provides mining apparatus including a guide means extending along the working face of a mine for guiding a cutting machine along the working face, a series of fluid-pressure-operated jacks each operable to apply an advancing force to the guide means, and means responsive to the advance of a portion of the guide means to stop the advance of that portion of the guide means, after a predetermined advance thereof, by rendering the appropriate jack or jacks inoperative, the advance-responsive means being adjustable to vary the amount of the predetermined advance.

The amount of advance of the said portion of the guide means may be indicated by a measure of the extension of a jack associated with that portion of the guide means.

The advance-responsive means may compare a signal indicative of the amount of advance of the said portion of the guide means with a signal of a similar nature indicative of the predetermined required advance in such a manner that, when the advance of the guide means has reached the predetermined amount, the appropriate jack or jacks are rendered inoperative. The signals may be fluid-pressure signals or may be electric signals.

The said portion of the guide means may be an end portion of the guide means located beyond the end of the working face of the mine. The guide means may be a conveyor whose end portion carries a conveyor drive assembly. The advance-responsive means may be adjusted by a signal of the advance of a portion of the guide means opposite the working face in such a manner that the end portion of the guide means is advanced by substantially the same amount as the portion of the guide means opposite the working face.

The advance-responsive means may be manually adjustable to vary the amount of predetermined advance of the portion of the guide means.

One embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings of which,

FIGURE 1 is a diagrammatic view of mining apparatus incorporating the invention, and

FIGURE 2 is a diagrammatic view of part of the mining apparatus shown in FIGURE 1.

With reference to the accompanying drawings, known mining apparatus includes a conveyor **1** extending along the working face **2** of a coal mine. A cutting machine **3** guided by the conveyor **1** is located between the conveyor **1** and the working face **2** and is moving along the face from left to right in the drawing. A row of roof supports **4**, of known construction extends along the working face **2** on the opposite side of the conveyor **1** to the working face **2**. Each roof support **4** includes a floor-engaging member **5** carrying three hydraulic props **6**, and the props **6** carry a roof-engageable member not shown in the drawing. Each roof support **4** is connected to the conveyor **1** by a double-acting hydraulic

jack **7** which is operable to advance the roof support **4** towards the conveyor **1** when the conveyor is fixedly anchored, and is also operable to advance the conveyor **1** relative to the roof support **4** when the latter is fixed in position. In practice, not all the jacks **7** may be double-acting, some may be single-acting and only operable to advance the respective roof supports towards the conveyor **1**. For example, only every fourth jack **7** may be double-acting.

Every double-acting jack **7** is caused to apply an advancing force to the conveyor **1** continually with its roof support **4** acting as an anchorage, except when the roof support **4** associated with the jack **7** is being advanced, for example in the manner described in U.S. patent application Serial No. 282,760, filed May 23, 1963, so that the conveyor **1** and cutting machine **3** are continually urged against the working face **2**.

An end portion **8** of the conveyor **1** is located in a road-way **9** which extends in a direction perpendicular to the length of the working face **2**. A conveyor pusher **11** includes a releasable anchorage such as a hydraulic prop **12** carried by a base **13**. The prop **12** carries a roof-engaging cap not shown in the drawing. The conveyor pusher **11** also includes a double-acting hydraulic jack **14** connected to the conveyor end portion **8**. The conveyor end portion **8** carries a conveyor drive assembly not shown in detail herein, and may also carry a drive assembly for the cutting machine **3**.

A control assembly **15** for controlling the operation of the cutting machine **3**, the conveyor **1** and the roof supports **4** is located at a position remote from the working face **2**, for example in the road-way **9**. This invention is only concerned with the advance of the conveyor **1**, and not with operation of the cutting machine nor the roof supports. A source of hydraulic pressure **16** located in the control assembly **15** is connected to the conveyor pusher **11** by a hose **17**.

As is shown more clearly in FIGURE 2, the hose **17** is connected to an electro-hydraulic valve **18** in the conveyor pusher **11**. The valve **18** is normally closed and is connected by a hose **19** to the jack **14** in such a manner that, when the valve **18** is open, the supply of hydraulic fluid under pressure through the hose **19** to the jack **14** causes the jack **14** to extend and thereby to effect advance of the end portion **8**. The valve **18** can be opened to cause pressurisation of hose **19** from hose **17** by the supply of an electrical current of sufficient strength to its solenoid **21**, along an electric line **22** from the control assembly **15**.

An electrical potentiometer **23** responsive to extension of the jack **14** has its pick-off contact **24** connected to the control assembly **15** by an electrical line **25**. The control assembly **15** supplies electrical power for the potentiometer **23** by wires not shown and the pick-off contact **24** is so arranged that the line **25** conveys to the control assembly **15** an electrical signal indicative of the extended length of the jack **14**.

Another electrical potentiometer **26** is responsive to the extension of the jack **7** associated with the first roof support **4**, and this potentiometer **26** is connected to the control assembly **15** by an electric line **27** which conveys to the control assembly **15** an electric signal indicative of the length of the jack **7**.

In the control assembly **15**, lines **25** and **27** are connected to an electric comparator **28** whose function is to compare the electric signals in lines **25** and **27**. Line **29** is connected to an amplifier **31** which amplifies the output of the comparator **28** and sends the amplified output along line **22** to the solenoid **21** of electro-hydraulic valve **18**. Besides comparing the electric signals in line **25** and in line **27**, the comparator **28** can also compare the electric signals in line **25** and in line **32**

which is connected to a manually-adjustable electric signal source 33.

Thus, in operation of the apparatus, with the prop 12 of the conveyor pusher 11 and the props 6 of the roof support 4 all set against the roof, the double-acting jacks 7 continually urge the conveyor 1 and the cutting machine 3 against the working face 2 as the cutting machine 3 travels to and fro along the working face in a coal-cutting manner. As coal is cut from the working face and the cutting machine leaves the vicinity of each double-acting jack 7, the jack 7 will move the conveyor 1 forwardly.

The potentiometer 26 responsive to the extension of the jack 7 on the first roof support 4 continually sends to the comparator 28 a signal indicative of the extension of this jack 7, that is to say a signal indicative of the amount of advance of the portion of the conveyor 1 in front of the first roof support 4. Also, the potentiometer 23 responsive to the extension of the jack 14 of the conveyor pusher 11 continually sends to the comparator 28 a signal indicative of the extension of the jack 14, that is to say a signal indicative of the distance between the conveyor end portion 8 and the prop 12 of the conveyor pusher 11.

While the difference between the two signals is small, the amplified output from the comparator 28 is not sufficient to operate the electro-hydraulic valve 18, but when the portion of the conveyor 1 in front of the first roof support 4 has advanced a predetermined amount relative to the conveyor end portion 8, the difference between the signals in lines 25 and 27 will be sufficient to cause the amplified output in line 22 to actuate the electro-hydraulic valve 18 with resultant actuation of the jack 14 and advance of the conveyor end portion 8 with the prop 12 acting as an anchorage. As the conveyor end portion 8 advances, the signal from the potentiometer 23 approaches the value of the signal from the potentiometer 26 and, when the difference between the two signals falls to a predetermined amount, the amplified output of the difference becomes too small to maintain the actuation of the electro-hydraulic valve 18 which therefore closes, and the jack 14 ceases advancing the conveyor end portion 8. It may be arranged that the value of the signal in line 22 required to actuate the electro-hydraulic valve 18 is a predetermined amount greater than that required to maintain the valve 18 in the actuated position so as to reduce the likelihood of the valve 18 being continually actuated and de-actuated.

Thus, the conveyor end portion 8 advances in a manner consistent with the advance of the portion of the conveyor 1 opposite the working face 2. From time to time, it is necessary to advance the prop 12 by releasing it from the roof and contracting the jack 14, and to advance the roof supports 4 by releasing the props 6 of each roof support 4 from the roof and contracting the relevant jack 7. The roof supports 4 may be advanced in a predetermined sequence by known means while the cutting machine 3 is still operating or the cutting machine 3 may be operated until all the jacks 7 are fully extended whereupon the cutting machine 3 is stopped and the roof supports 4 are then advanced in a predetermined sequence.

To cater for inaccuracies which may occur, the full extension of the jack 7 of the first roof support 4 may be arranged to cause the full extension of the jack 14.

If it is desired to advance the conveyor end portion 8 by some manually-selected predetermined amount, the comparator 28 is caused to compare the signals in lines 25 and 32 instead of the signals in lines 25 and 27. The signal in line 32 is adjusted by manual adjustment of the electric signal source 33 to produce a signal in line 32 indicative of the required advance of the conveyor end portion 8.

If due to the characteristics of the cutting machine 3, the conveyor 1 does not require to be continually urged against the face, but requires to be advanced by adjustable amounts, each double-acting jack 7 may be controlled in a manner similar to the control of jack 14 by the manually-adjustable electric signal source 33. In this case each double-acting jack 7 has an electro-hydraulic valve 18 and potentiometer 23, and the control assembly 15 is operable to connect the comparator 28 to the potentiometer of any desired double-acting jack 7.

If, when advancing the conveyor 1, it is necessary for two or more double-acting jacks 7 to apply an advancing force to the conveyor 1 at the same time, an equivalent number of comparators 28 may be provided, the control assembly 15 being operable to connect comparators 28 and associated amplified outputs to the respective double-acting jacks 7.

We claim:

1. Mining apparatus including a guide means extending along the working face of a mine for guiding a cutting machine along the working face, a series of fluid-pressure-operated jacks each operable to apply an advancing force to the guide means, and adjustable means responsive to the advance of a portion of the guide means to stop the advance of that portion of the guide means, after an adjustable predetermined advance thereof, by rendering the appropriate jack or jacks inoperative.

2. Mining apparatus according to claim 1 wherein the adjustable means is adjusted by the extension of a jack associated with the said portion of the guide means.

3. Mining apparatus according to claim 1 wherein the adjustable means includes means for producing a signal indicative of the amount of advance of the said portion of the guide means, means for producing a signal indicative of the required amount of advance of the guide means, and comparing means arranged to compare the signals and render the appropriate jack or jacks inoperative when the signals are substantially equal.

4. Mining apparatus according to claim 3 wherein the signals are electric signals.

5. Mining apparatus according to claim 1 wherein the said portion of the guide means is an end portion of the guide means located beyond the end of the working face of the mine.

6. Mining apparatus according to claim 1 wherein the guide means is a conveyor and the end portion carries a conveyor drive assembly.

7. Mining apparatus according to claim 5 wherein the adjustable means is adjusted by the amount of advance of a portion of the guide means opposite the working face to cause the end portion of the guide means to be advanced by substantially the same amount as the portion of the guide means opposite the working face.

8. Mining apparatus according to claim 1 wherein the adjustable means is manually adjustable to vary the amount of required advance of said portion of the guide means.

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