

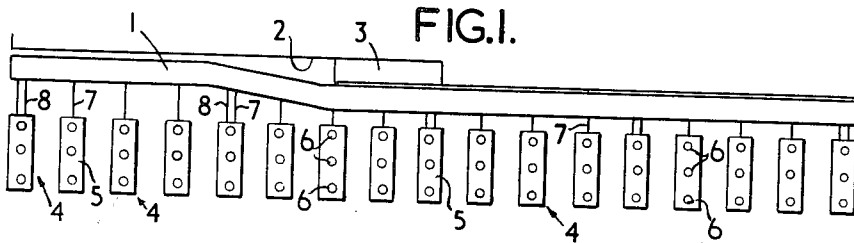
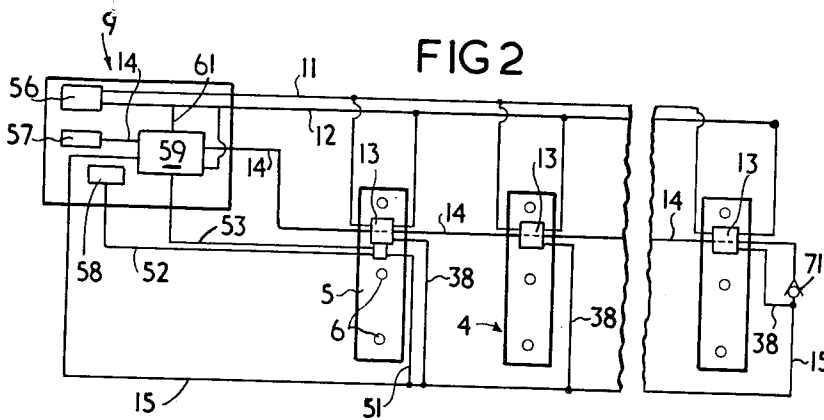
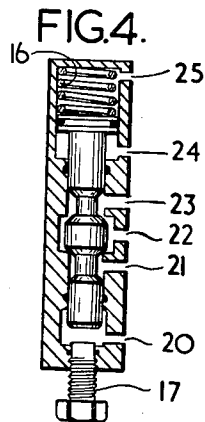
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M. C. POTTS ETAL
MINING APPARATUS

3,228,199

Filed May 23, 1963

2 Sheets-Sheet 1



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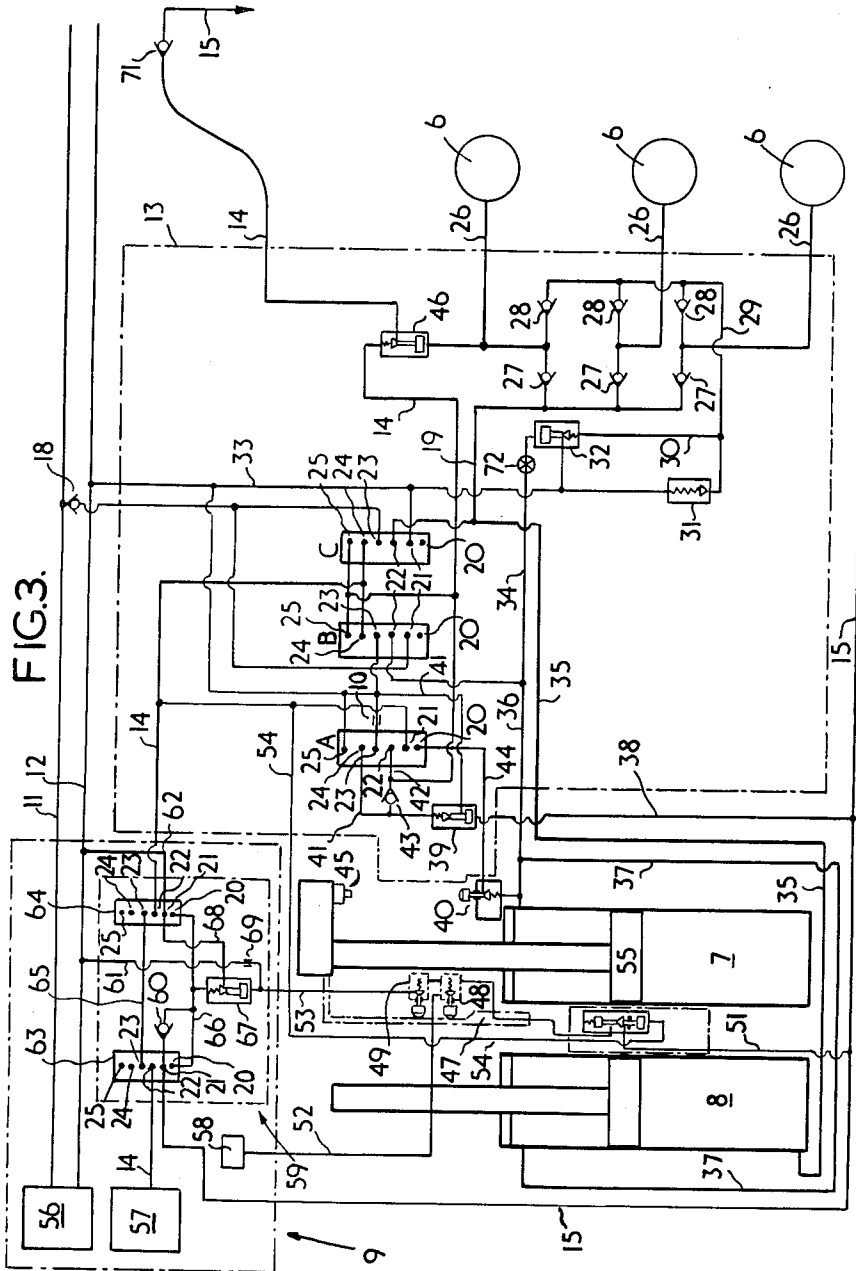
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MINING APPARATUS

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6 Claims. (Cl. 61—45)

This invention relates to mining apparatus.

The present invention provides mining apparatus including a guide means, for a cutting machine, extending along the working face of a mine, a series of roof supports arranged along the working face of a mine, means for advancing the guide means towards the working face, means for advancing the roof supports in a predetermined order towards the working face and the guide means, and means operated by the advance of the guide means by a predetermined amount relative to a selected roof support for preparing for actuation or actuating the support-advancing means.

The guide-means-advancing means may include a series of guide-means-advancing devices, each of which utilizes a roof-support as an anchorage when advancing the guide means. Each guide-means-advancing device may exert an advancing force on the guide means continually during a mining operation except when the roof support it utilises as an anchorage is being advanced. The guide means may be a conveyor.

The support-advancing means, when actuated, may cause the first roof support in the series to undergo an advancing operation, and completion of the advancing operation of the first roof support in the series may cause the support-advancing means to cause the next roof support in the series to undergo an advancing operation, and so on throughout the series.

The support-advancing means may include a main pilot line connected to each roof support in the series successively, the advancing operation of each roof support in the series being initiated by a signal passed on along the main pilot line from the previous roof support in the series when the previous roof support has completed its advancing operation.

The mining apparatus may include a secondary pilot line connected to the last roof support in the series and to a part of the support-advancing means in such a manner as to send a signal to the said part of the support-advancing means to indicate the completion of an advancing operation of the last roof support in the series.

Each roof support may include a valve unit connected in the main pilot line and which, before the advancing operation of its roof support has commenced, prevents passage of the signal to the next support and, when the advancing operation of its roof support has been completed allows passage of the signal, and which after operation to the signal-passing position, is locked in that position by means independent of a future loss of the signal in the main pilot line, until the last roof support in the series has completed its advancing operation.

The secondary pilot line may also send a signal to each valve unit to cause unlocking of the valve unit when the last roof support in the series has completed its advancing operation. The signal in the main pilot line and the signal in the secondary pilot line may be of the same type and the presence of a signal in the secondary pilot line may cause the main pilot line signal to be removed from that part of the main pilot line connected to the roof supports and applied to the secondary pilot line until the support-advancing means is actuated by advance of the conveyor by the predetermined amount.

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The signal in the main pilot line may be a fluid-pressure signal and the signal in the secondary pilot line may be a fluid-pressure signal.

One embodiment of the 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, with the hydraulic connections and roof bars omitted,

FIGURE 2 is a similar view on a larger scale of part of the mining apparatus showing the hydraulic connections,

FIGURE 3 is a similar view showing the hydraulic circuit associated with the power unit and with the first roof support and,

FIGURE 4 is a similar view showing the construction of a hydraulic valve unit, three of which are associated with each roof support.

With reference to the accompanying drawings, a coal mining apparatus includes a conveyor 1 which extends along the working face 2 of a coal mine and acts as a guide means for a coal cutting machine 3, and to remove coal cut from the working face. A series of roof supports 4 are arranged along the working face and lie on the opposite side of the conveyor 1 to the working face 2.

Each roof support 4 includes a ground-engaging sole beam 5 which carries a number, for example three as shown, of hydraulically-operable telescopic props 6 and a roof-engageable bar (not shown) carried by the props 6. Each roof support 4 is connected to the conveyor 1 by a single-acting hydraulically-operable jack 7 for advancing the support 4 up to the conveyor 1 and some roof supports (for example every fourth roof support as shown) are additionally connected to the conveyor 1 by a double-acting hydraulically-operable jack device 8 for advancing the conveyor relative to the roof support 4 using the roof support 4 as an anchorage.

A hydraulic power unit 9 is located at one end of the working face and a main hydraulic pressure line 11 and a hydraulic return line 12 extend from the power unit 9 along the working face. Each roof support 4 includes a hydraulic control valve assembly 13 to which the pressure and return lines 11, 12 are connected. Each control valve assembly 13 controls the supply of hydraulic fluid to and the return of hydraulic fluid from the props 6 and the jack or jacks 7, 8 of the individual roof supports 4.

With the exception of the last roof support in the series, the control valve assembly 13 of each roof support 4 is connected to the control valve assembly of its adjacent roof support in one direction, from left to right in the drawings, along the working face by a main hydraulic pilot line 14 which is also connected between the power unit 9 and the control valve 13 of the first roof support 4. A secondary hydraulic pilot line 15 extends from the control valve assembly of the last roof support in the series to the power unit 9 and is connected to the control valve of every roof support.

The control valve assembly 13 of each roof support 4 includes three valve units A, B and C, each of which is constructed as shown in FIGURE 4. Each valve unit A, B or C is a six-ported two-position valve. When a valve unit is in the position shown in FIGURE 4, which position will be referred to as the neutral position, port 22 is in communication with port 23. When a valve unit is caused to take up its other position, for example by application of hydraulic pressure to port 20 or port 24, which position will be referred to as the operated position, port 22 then communicates with port 21 instead of port 23. The valve unit is resiliently urged towards its neutral position by a spring 16 and can be brought into the operated position manually by turning a screw 17.

As shown in FIGURE 3, the main pilot line 14, on entering the control valve assembly 13, is connected to the ports 24 of valve units B and C. The main pressure line 11 is connected through a non-return valve 18 to port 23 of valve unit C and port 21 of valve unit B. The return line 12 is connected to port 21 of valve unit C, to port 23 of valve unit B, to port 25 of valve unit A and through a restrictor 10 to port 23 of valve unit A. Ports 20 of valve units B and C are not used.

Initially, when the main pressure line 11 has been pressurised and before the main pilot line 14 is pressurised, valve units A, B and C are in their neutral positions. Thus, the main pressure line 11 communicates with the props 6 through valve unit C, line 19, and three lines 26 which each include a non-return valve 27 and are connected to the props 6. The props 6 are therefore pressurised and the roof support is in a roof-supporting condition. The props 6 are also connected through lines 26 and non-return valves 28 with lines 29, 30 connected to a prop relief valve 31 and a prop release valve 32 respectively.

If the hydraulic pressure in any one of the props 6 exceeds a predetermined maximum, the relief valve 31 is operated by the pressure to allow fluid to escape through valve 31 and line 33 to the return line 12. The prop release valve 32 can be operated to connect line 30 to line 33 and the return line 12, so as to collapse the props 6, by the pressurisation of line 34 which is connected to the release valve 32. This operation will be described later.

Also, before the main pilot line 14 is pressurised, the main pressure line 11 communicates through valve unit C via ports 23, 22 with line 35 which is connected with the pushing side of conveyor advancing jack 8. Thus the conveyor 1 is continuously urged toward the working face 2 when the props 6 are set and the roof support is in a roof-supporting condition.

The return line 12 is connected through line 33, ports 23 and 22 of valve unit B with line 34 and line 36. Line 36 is connected to the pulling side of support-advancing jack 7, and to line 37 which is connected to the pulling side of conveyor-advancing jack 8.

The secondary pilot line 15 is connected by a line 38 to a valve unit 39 in such a manner that pressurisation of line 38 opens the valve unit 39. Valve 39 is connected in a line 41 which is connected to port 24 of valve unit A and the return line 12.

A line 42 is connected between port 22 of valve unit A and line 41 and includes a non-return valve 43 which allows flow from port 22 of valve unit A to line 41 and prevents flow in the opposite direction.

A line 44 connected between port 20 of valve unit A and line 36 includes a valve unit 40 which is opened by a projection 45 adjacent the leading end of the support-advancing jack 7 when the jack 7 is fully or nearly fully contracted, i.e., when the support 4 has been advanced up to the conveyor 1. One of the lines 26 is connected to a valve unit 46 in line 14 in such a manner that the presence of a prop-setting pressure in line 26 opens the valve unit 46.

Thus, to summarise the foregoing description of the control valve assembly 13, when the main pressure line 11 has been pressurised and before the main pilot line 14 has been pressurised, the condition of valve units A, B and C are such that the props 6 are set, the conveyor-advancing jack 8 is pushing the conveyor 1 forward and the support-advancing jack 7 is free, i.e. it is neither pushing or pulling.

The further operation of the control valve 13 will be described when the operation of the mining apparatus as a whole is described.

The support-advancing jack 7, of the first roof support whose extension is a measure of the distance through which the conveyor 1 has been advanced relative to the support 4, carries triggering means to initiate an advancing sequence, such as a cam member 47 which is

associated with two valve units 48, 49. Valve unit 48 is connected on one side to the secondary pilot line 15 via line 51 and on the other side to the power unit 9 via line 52 and to one side of the valve unit 49. The other side of valve unit 49 is connected to the power unit 9 via line 53. Also, the line 51 includes a valve unit 55 which opens when the pressure in a line 54 connected to the main pilot line 14 has fallen to a predetermined value.

The power unit 9 includes a main pressure source 56 to which the main pressure line 11 and return line 12 are connected, a pilot pressure source 57 to which the main pilot line 14 is connected, a visual or audible warning device 58 to which line 52 is connected, and a change-over valve assembly 59.

The change-over valve assembly 59 is connected in the main pilot line 14 and is connected to the secondary pilot line 15, to line 53 and to the return line 12 by lines 61, 62. The change-over valve assembly 59 includes two valve units 63, 64 which are similar in construction to valve units A, B and C in the control valve assemblies 13. Ports 24 and 25 of valve units 63, 64 are not used, ports 23 are connected to one another by line 65, port 22 of valve unit 63 is connected by the pilot line 14 to the pilot pressure source 57, port 21 is connected to the secondary pilot line 15 and through a non-return valve 60 to a line 66 connected to both ports 20 and to one side of a valve unit 67. The other side of valve unit 67 is connected to port 21 of valve unit 64 by line 68 and thence to the return line 12 via line 62. Port 22 of valve unit 64 is connected to the pilot line 14. Valve unit 67 is opened by a predetermined pressure in line 53 which is connected to the return line 12 by line 61 which includes a restrictor 69.

In the neutral position of valve units 63, 64, wherein communication is established between ports 22 and 23, line 65 connects the portion of main pilot line 14 leading from the pilot pressure source 57 to the portion of the main pilot line 14 leading to the control valve 13 of the first roof support. Therefore, line 65 is in effect a portion of the main pilot line 14.

The function and operation of the apparatus described above will become clear from the following description of a complete cycle of operations of the apparatus.

Initially, the valve units A, B and C of the control valve 13 of every roof support 4 are in their neutral positions, as in FIGURE 4, with the result that, assuming the main pressure source 56 to be pressurising the main pressure line 11, all the roof supports are set against the roof, all the conveyor-advancing jacks 8 are urging the conveyor 1 towards the coal face and all the support-advancing jacks 7 are free.

As the cutter 3 moves to and fro along the working face 2 in coal-cutting operations, the cutter 3 and the conveyor 1 are advanced by the conveyor-advancing jacks 8 which, together with the support-advancing jacks 7, gradually extend. Eventually it will become necessary for the roof supports 4 to be advanced, one by one, towards the conveyor 1.

To initiate the first advancing sequence of the roof supports 4, the pilot pressure source 57 is switched on to pressurise that portion of the main pilot line 14 which passes through the change-over valve 59 and enters the control valve 13 of the first roof support 4. The main pilot pressure operates valve units B and C causing the ports 22 to communicate with their ports 21 instead of their ports 23. Thus, the operation of valve unit B causes main pressure from main pressure line 11 to be applied to lines 34, 36, 37. Pressure in line 34 opens valve unit 32 to enable release of the props 6 and hence release of the roof support from the roof; pressure in line 36 pressurises the pulling side of the support-advancing jack 7 to cause the roof support to advance towards the conveyor 1, and pressure in line 37 causes the conveyor-advancing jack 8 to retract since it is not actually connected to the conveyor 1. The pushing side of conveyor-

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advancing jack 8 is connected by operation of valve unit C to the return line 12 through line 33 and it will be seen that line 19 is similarly connected to the return line 12, thus enabling the props 6 to collapse. (The pushing side of support-advancing jack 7 is permanently connected to atmosphere by a port, not shown.)

When the roof support 4 is nearly fully advanced up to the conveyor 1, the projection 45 on the leading end of support-advancing jack 7 engages and opens valve unit 40 which causes line 44 to become pressurised from line 36. Thus, valve unit A is operated. Pilot pressure at port 21 is thus communicated to port 22 and therefore through lines 42 and 14 to valve unit 46 and through non-return valve 43 and line 41 to port 24. Since valve unit 39 is closed, the pressure is now trapped in port 24 and the valve unit A is locked by this pressure in the operated position.

Pilot pressure in line 14 is also applied to ports 25 of valve units B and C which are thereby returned to their neutral positions. Thus the props 6 are pressurised to return the roof support to a roof-supporting condition, the pulling sides of support-advancing jack 7 and conveyor jack 8 are connected to the return line 12 and the pushing side of conveyor-advancing jack 8 is connected to the main pressure line 11. Thus, after an advance of the roof support, valve unit 40 is actuated to cause the roof support 4 to become reset against the roof and to cause the conveyor-advancing jack 8 to resume pushing the conveyor 1 forwardly.

If necessary, line 35 may include a restrictor to ensure that the conveyor-advancing jack 8 does not resume pushing the conveyor 1 forwardly until the props 6 have had sufficient time to reset the roof support against the roof.

The attainment of a satisfactory pressure in the props 6 and hence in lines 26 causes valve unit 46 to open. Thus, when the roof support has been satisfactorily reset against the roof, valve unit 46 opens and pilot pressure in line 14 is passed on to the next roof support in the series, and this next roof support now undergoes an advancing operation.

Each roof support in turn advances and when the valve unit 46 in the control valve assembly 13 of the last roof support 4 in the series opens, main pilot pressure is applied through a non-return valve 71 to the secondary pilot line 15.

Pressurisation of the secondary pilot line 15 indicates that an advancing sequence of the roof supports has been completed and, if desired, an indicating means for this purpose, visual or audible, may be provided on the power unit 9. Since the secondary pilot line 15 is connected at the change-over valve assembly 59 through port 21 of valve unit 63, non-return valve 60 and line 66 to ports 20 of valve units 63 and 64, these valve units are operated. Thus, the main pilot line 14 is broken, the portion leading to the pilot pressure source 57 being connected to the secondary pilot line 15 and the portion leading to the control valve assembly 13 of the first roof-support (and to the control valve assemblies of all the other roof supports) is connected to the return line 12. Since valve unit 67 is closed, pressure is now locked in line 66 by non-return valve 60 and valve units 63 and 64 are held in the operated position.

Therefore, the portion of the main pilot line 14 passing from the change-over valve assembly 59 through the control valves 13 of all the roof-supports 4 to non-return valve 71 is de-pressurized. Also, pressure in the secondary pilot line 15 opens the valve unit 39 in each control valve assembly 13 to connect line 41 to the return line 12, hence unlocking the valve units A which return to their neutral positions.

Thus, the hydraulic circuit has now been brought back to its initial condition, with the exception that the portion of the main pilot line between the pilot pressure source 57 and the change-over valve assembly 59 is connected to and pressurises the secondary pilot line 15.

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As the pressure in the portion of the main pilot line 14 extending from the change-over valve assembly 59 through the various control valve assemblies 13 drops, the pressure in line 54 drops also and, when a predetermined low pressure has been reached, valve unit 55 opens and allows the pressure in the secondary pilot line 15 to reach one side of the valve unit 48 and one side of valve unit 49 through line 51. The purpose of valve unit 55 will be explained later.

As the cutter 3 continues to cut coal, the conveyor-advancing jacks 8 will push the conveyor 1 forwards and, with the support-advancing jacks 7 jacks 8 will gradually extend. When the support-advancing jacks 7 of the first roof support has extended a predetermined amount (less than and preferably about three-quarters of the full extension), the cam member 47 will engage and open valve unit 48 to cause line 52 to be pressurised from line 51 and the secondary pilot line 15. Pressurisation of line 52 operates the warning device 58 and this indicates that an advancing sequence will shortly be starting. A further small extension of the support-advancing jack 7 causes the cam member 47 to engage and open valve unit 49 to cause line 53 to become pressurised from line 51 and the secondary pilot line 15. Pressurisation of line 53 opens valve unit 67 and line 66 is connected to the return line 12 via lines 68 and 62. Thus, the valve units 63 and 64 are unlocked and return to their neutral positions. The portion of the main pilot line 14 leading from the pilot pressure source 57 to the change-over valve 59 is therefore re-connected by line 65 to the portion of main pilot line 14 leading to the control valve assembly 13 of the first roof support, and the pressure from the main pilot source 57 initiates an advancing operation of the first roof support and, therefore, all the roof supports advance in turn. The pressure in the secondary pilot line 15 leaks away to the return line 12 via lines 51, 53 and 61.

Thus, every time the conveyor 1 is advanced a predetermined distance in front of the first roof support (a distance less than the full extension of the jack 7), cam member 47 opens valve unit 49 to initiate a fresh advancing sequence provided, of course, that the previous advancing sequence has finished. If the previous advancing sequence has not finished there is no pressure in the secondary pilot line 15 non-return valve 71 having not yet been unseated and the opening of the valve unit 49 will not cause opening of the valve unit 67. When the previous advance sequence finishes, pressurisation of the secondary pilot line 15 will cause the change-over valve assembly 59 to operate, and the portion of the main pilot line 14 passing through the control valve assemblies 13 will be de-pressurised to eventually cause valve unit 55 to open and allow pressure from the secondary pilot line 15 to reach valve unit 67 through already open valve unit 49.

The apparatus described is used with those cutters 3 which have to be continually urged against the working face 2. The speed of operation of the cutter 3 and the time taken for an advancing sequence of the series of roof supports to be completed are so arranged that, when an advancing sequence has been initiated by the predetermined extension (preferably about three-quarters of the full extension) of the support-advancing jack 7 of the first roof support 4, the advancing sequence is completed before any conveyor-advancing jack 8 has become fully extended. If a conveyor-advancing jack 8 did become fully extended the cutter 1 would not be urged against the portion of the working face 2 in front of the jack 8.

If there is a power failure or if the power unit 9 is shut down when an advancing sequence has commenced but not finished, the locking in their operative positions of valve units A of the control valve assembly 13 of those roof supports which have advanced ensures that, when the power unit 9 is re-started, the advancing sequence carries on from the position along the series of roof supports that it had previously reached. This feature is the subject

of United States patent application Serial No. 302,786, filed August 19, 1963. If the valve units A were not locked in their operative positions after the advance of their roof supports, they may have reverted to their neutral positions because the system pressure has leaked away and subsequent re-starting of the power unit 9 would cause a fresh advancing sequence to commence instead of the previously-commenced sequence finishing.

If there is a power failure or if the power unit 9 is shut down when an advancing operation has been completed, and a fresh advancing operation has not started, the locking in their operative positions of valve units 63 and 64 in the change-over valve assembly 59 ensures that, when the power unit 9 is re-started, the secondary pilot line 15 is re-pressurised. If valve units 63 and 64 were not locked in their operating positions, they may have reverted to their neutral positions because the system pressure has leaked away and subsequent re-starting of the power unit 9 would cause a fresh advancing sequence to commence straight away, instead of being commenced by the opening of the valve unit 49. This feature is the subject of United States application Serial No. 304,505, filed August 26, 1963, now Patent No. 3,198,087.

As described previously, the valve units A, B, C and the valve units 63, 64 are each constructed in the manner shown in FIGURE 4 and can be manually operated if desired, so that the position of any roof support in the series can be adjusted by manual operation if necessary.

The valve unit 55 ensures that a fresh advancing sequence cannot be initiated until the pressure in the portion of the main pilot line 14 passing through the control valve assemblies 13 of the roof supports has fallen sufficiently to ensure that all the valve units A, B and C are in their neutral positions.

The power unit 9 may include means which indicate if a stoppage has occurred in the advancing sequence and means which indicate how far along the series of roof supports the advancing sequence has reached. These are described in United States applications Serial No. 282,412, filed May 22, 1963, and Serial No. 282,396, filed May 22, 1963.

In one installation of the described apparatus, the full pressure in the main pressure line 11 was 3,000 lbs. per sq. in., and the pressure in the main pilot line 14 was 1,700 lbs. per sq. in. The advancing sequence was initiated when the support advancing jack 7 (whose maximum extension was 24 inches) had extended 15 inches.

An advancing sequence of the series of roof supports took 15 minutes and the cutter 3 cut 3 inches every 8 minutes.

In this installation, each control valve assembly 13 included a manually-operable valve unit 72 in line 34. This valve unit 72 is normally left open but, if a support is manually operated, the valve unit 72 can be closed manually to prevent release of the props 6 when pressure is applied to the pulling side of the support advancing jack 7. This enables the conveyor to be moved backwards if necessary.

We claim as our invention:

1. Mining apparatus including a cutting machine and a guide means extending along the working face of a mine, and guiding said cutting machine as it traverses the working face, a pressure-fluid supply duct extending along the working face, and a series of roof supports arranged along the working face, each roof support including fluid-pressure-operated prop means arranged in use to support the roof, a fluid-pressure-operated jack connecting each roof support to said guide means to advance the roof support by reaction from the guide means, and certain of said roof supports including a fluid-pressure-operated jack arranged, when in use, to urge the guide means and the cutting machine against the working face by reaction from said certain roof supports, a control valve assembly included in each roof support, arranged to control the supply of fluid under pressure from said supply duct to

the corresponding prop means, and to the corresponding jack for advancing the guide means, if one be included in such roof support, and to the corresponding support-advancing jack, to cause its roof support to undergo an advancing operation, triggering means responsive to advance of the guide means by a predetermined amount relative to the first roof support in the series and operatively connected to the control valve assembly of said first roof support to cause operation of that control valve assembly in a support-advancing manner, and each control valve assembly being operatively connected to the control valve assembly of the next roof support in the series to cause operation of such next control valve assembly in a manner to advance such next roof support, upon completion of the advancing operation of the preceding roof support.

2. Mining apparatus including a cutting machine and a guide means extending along the working face of a mine, and guiding said cutting machine as it traverses the working face, a pressure-fluid supply duct extending along the working face, and a series of roof supports arranged along the working face, each roof support including fluid-pressure-operated prop means arranged in use to support the roof, and each roof support including a fluid-pressure-operated jack reacting from said guide means and arranged, when supplied with pressure fluid, to advance its roof support towards the working face, means urging said guide means and the cutting machine against the working face, a control valve assembly included in each roof support, arranged to control the supply of fluid under pressure from said supply duct to the corresponding prop means and to the corresponding jack, triggering means responsive to advance of the guide means towards the working face by a predetermined amount relative to the first roof support in the series, to cause operation of the control valve assembly of the first roof support in a manner to supply pressure fluid to its jack and thereby to advance the first roof support, and each control valve assembly being operatively connected to the control valve assembly of the next roof support in the series to cause operation of such next control valve assembly in a manner to advance in the same manner such next roof support, following completion of the advancing operation of the preceding roof support.

3. Mining apparatus according to claim 2 wherein the predetermined amount of advance is less than the stroke of the corresponding jack by such an amount, and the control valve assembly is so arranged, that the several roof supports undergo advancing operations before the jacks become fully extended.

4. Mining apparatus according to claim 2 wherein the triggering means includes a fluid-flow control valve arranged to be operated by a predetermined extension of the successive jack in the series.

5. Mining apparatus according to claim 2, including means operatively connected to the last roof support in the series, and to the triggering means, to condition the triggering means for operation upon completion of the advancing operation of said last roof support, but to prevent operation of the triggering means, and so to prevent initiation of a fresh advancing sequence, until the preceding advancing sequence is completed.

6. Mining apparatus including a cutting machine and a guide means extending along the working face of a mine, and guiding said cutting machine as it traverses the working face, a pressure-fluid supply duct extending along the working face, and a series of roof supports arranged along the working face, each roof support including fluid-pressure-operated prop means arranged in use to support the roof, and each roof support including a first fluid-pressure-operated jack connected to said guide means and arranged, when supplied with pressure fluid, to advance its roof support towards the working face, certain of said roof supports also including a second fluid-pressure-operated jack arranged to urge the guide means and the

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cutting machine against the working face, a control valve assembly included in each roof support, arranged to control the supply of fluid under pressure from said supply duct to the corresponding prop means, and to the corresponding jack or jacks, triggering means responsive to advance of the guide means by a predetermined amount relative to the first roof support in the series, under the influence of its second jack, to cause operation of the control valve assembly of the first roof support in the series in a manner to supply pressure fluid to its first jack and thereby to advance the first roof support, and each control valve assembly being operatively connected to the control valve assembly of the next roof support in the series to cause operation of such next control valve assembly in a manner to advance in the same manner such next

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roof support, following completion of the advancing operation of the preceding roof support.

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