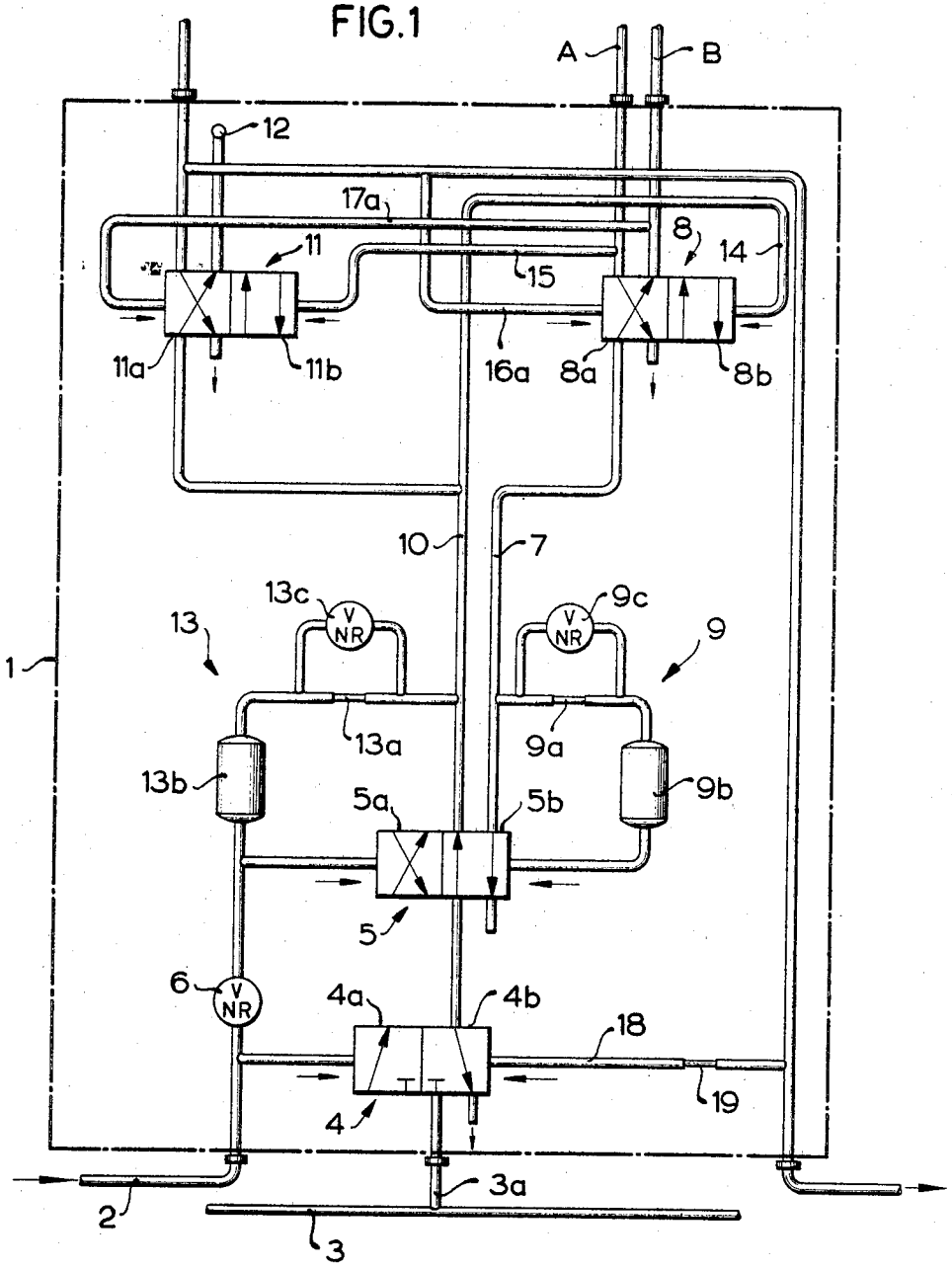
Dec. 9, 1969 H. RIESCHEL 3,482,407

CONTROL SYSTEMS FOR SELF-ADVANCING MINE ROOF SUPPORT UNITS

Filed April 5, 1968 2 Sheets-Sheet 1

FIG.1



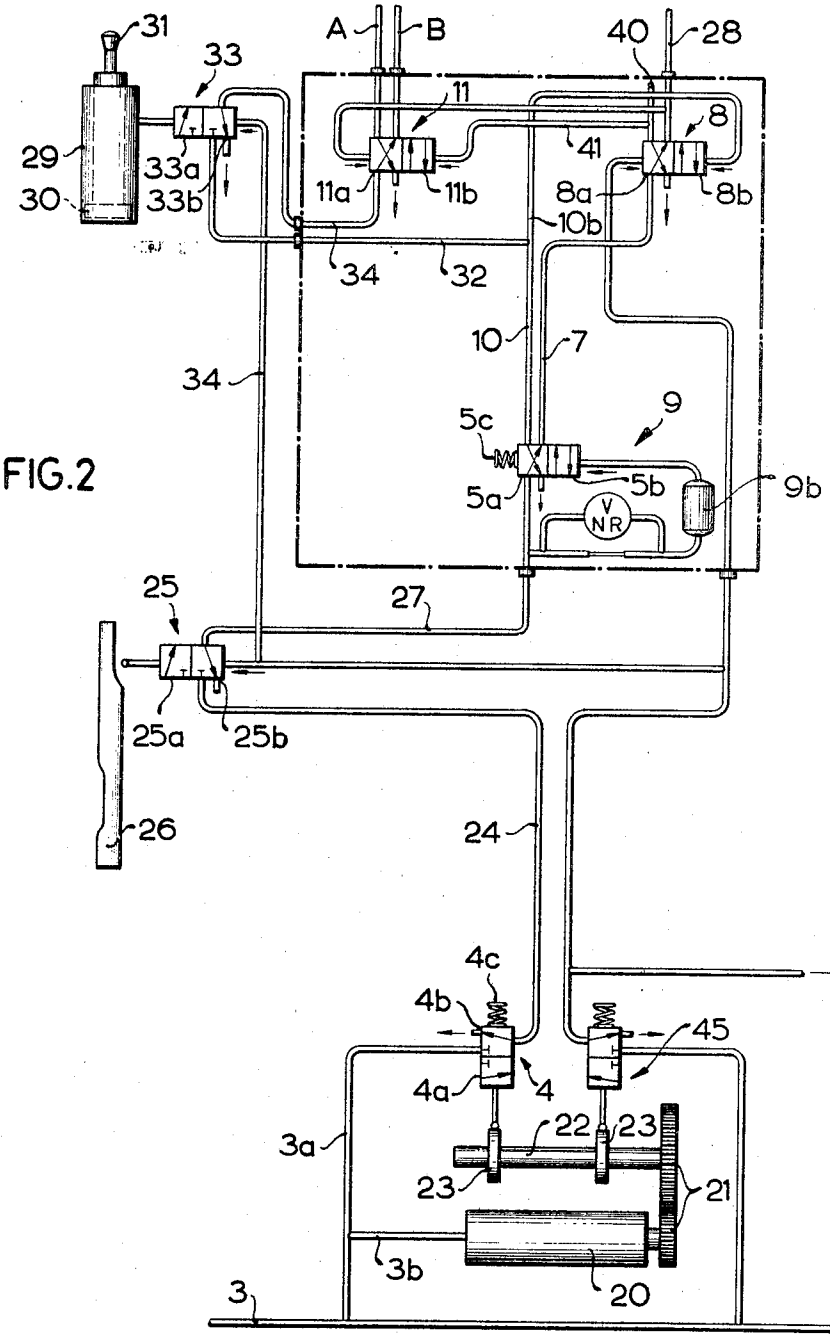
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FIG.2



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CONTROL SYSTEMS FOR SELF-ADVANCING MINE ROOF SUPPORT UNITS

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Int. Cl. E21d *23/18, 23/26;* F16k *35/00*
U.S. Cl. 61—45 5 Claims

ABSTRACT OF THE DISCLOSURE

The specification describes an intermediate circuit integer in control circuitry of a series of self-advancing mine roof support units. A trigger impulse is fed to a valve with two outputs and the valve is caused to move over from one output position to the other by a pulse delays means responsive to the trigger pulse. In this manner for a single trigger pulse two pulses for a series of alternating pulses are obtained in the two outputs of the valve.

The present invention relates to the control of self-advancing mine roof support units. Such mine roof support units are generally caused to advance one after the other in sequence along the coal face. The units may be in the form of frames or pairs of frames. In some cases the units instead of being advanced one after the other may be advanced in groups of units, all units in a group being advanced together.

The present invention consists in a fluid control system for causing the sequential advance of self-advancing mine roof support units, comprising

(a) for each unit, a primary fluid-operated control circuit which is arranged to be triggered by a fluid pulse and when so triggered to provide two successive output pulses in different ducts, and

(b) for each unit, a secondary control circuit which is arranged to cause advancing of the respective unit in response to the output pulses from the primary fluid-operated circuit,

characterized in that the primary control circuit comprises

(i) an input valve, with two outputs, for receiving the trigger pulses, and transmitting corresponding pulses through its outputs, and

(ii) at least one fluid pulse delay means which has a parallel-connected one-way valve, is arranged to be pressurized by the trigger pulse, and is arranged to move the input valves so as to change over the output connections.

The primary and secondary circuits can be arranged for operation by air or low-pressure liquid.

Preferably the system comprises two two-way valves connected respectively with the two outputs of the input valve, two outputs of one two-way valve being arranged to transmit, alternately, output pulses to the secondary control circuit, and the two-way valves being arranged to move each other via their outputs.

Also, as a preferred feature, a control system in accordance with the invention comprises two such fluid pulse delay means and two parallel-connected one-way valves, for moving the input valve in both directions alternately.

As a further optional feature the system comprises an inlet blocking valve means upstream from the input valve, and means for opening the inlet blocking valve in accordance with the advance of the roof support unit in relation to a coal front conveyer.

In accordance with a further feature of the invention the system comprises a feeler which is arranged to be extended to sense a coal face on being supplied with fluid via one of the two-way valves, and a valve which is arranged between the input valve and one of the two-way valves and is arranged to open when the feeler has reached a certain degree of extension.

Two embodiments of the invention will now be described.

FIG. 1 is a circuit diagram of a first primary fluid-operated control circuit for one of a series of self-advancing roof support units, arranged to supply control pulses to a secondary control circuit of the unit. The secondary control circuit is not shown in order to simplify the drawing.

FIG. 2 shows a further primary fluid-operated control circuit in accordance with the invention.

In the primary fluid-operated control circuit as shown in FIG. 1 and generally denoted by reference numeral **1**, of a self-advancing mine roof support unit, reference numeral **2** denotes a control duct for the supply of triggering pulses coming from the left-hand neighbouring unit. For operation the circuit is supplied with compressed air from a main **3** running along the coal face.

The output pulses of the circuit are given through ducts A and B which are responsible for controlling the two frames of a roof support unit via the secondary control circuit so as to bring about advance of the unit. As will be described below, the primary circuit provides for intervals between output pulses in the ducts A and B in order to allow one frame of the unit to be re-pressurized after advancing before the other frame of the unit is depressurized.

When a triggering impulse appears in duct **2** it pushes over an input valve **4** from the position **4***b*, as shown in the drawing, to the position **4***a* with the result that compressed air from the main **3** can flow via the branch **3***a* through the valve **4** to valve **5**. At the same time the triggering pulse is transmitted by the oneway valve **6** to the left-hand end of the input valve **5** which has two outputs. The pulse moves the valve **5** from the position **5***b* as shown in the drawing to the position **5***a*. As a result air coming through the branch duct **3***a* and the valve **4** can flow through the input valve **5** and into one of its outputs, duct **7** which leads it to the two-way valve **8** which is in the position **8***a*. As a result an output pulse for operation of the secondary control circuit is provided via duct B so that the frame of the corresponding unit is depressurized and advanced.

The pressure in the duct **7** representing one of the outputs of valve **5**, also passes through a pulse delay means generally denoted by reference numeral **9**. This means comprises a choke **9***a* leading to a pressure accumulator, and a oneway valve **9***b* connected in parallel with the choke **9***a*. As a result after pressure has been present in duct **7** for a period of time determined by the aperture of the choke **6***a* and the capacity of the accumulator **9***b*, the valve **5** is moved over into the position **5***b* from the position **5***a*. This is possible because of the comparatively short duration of the trigger pulse in duct **2** and the fact that in its position **5***a* valve **5** connects the pressure accumulator **13***b*, corresponding to pressure accumulator **9***b*

with the atmosphere via oneway valve 13*c* corresponding to oneway valve 9*b*. Once the oneway valve 5 is returned to its position 5*b* duct B is vented to atmosphere via duct 7 and branch duct 3*a* is connected with duct 10 which leads to a further two-way valve 11 with positions 11*a* and 11*b*. At the particular step in the sequence of operation under consideration this valve is in the position 11*a* illustrated with the result that the pressure signal arriving via duct 10 is transmitted to a blind duct 12.

Owing to the provision of a second pulse delay means 13, whose components have already been partly alluded to, air under pressure from duct 10 causes the valve 5 to be moved over into the position 5*a* owing to the gradual filling of accumulator 13*b* via choke 13*a*. By the time the valve 5 has been moved into position 5*a* air under pressure from duct 10 will also have moved valve 8 into position 8*b* via a duct 14, and as a result the pressure now appearing again in duct 7 following the movement of valve 5 into position 5*a* will be transmitted to duct 8 in order to cause depressurization and consequent advance of the other roof support frame in the unit via the secondary control circuit. At the same time pressure transmitted by duct 15 serves to move the valve 11 into the position 11*b*.

Since the pulse delay means is also caused to operate owing to the pressure existing in duct 7, the valve 5 is moved back into its starting position 5*b*. As a result air under pressure passes along duct 10 and leaves valve 11 which has been moved into position 11*b* by air under pressure coming from duct A through duct 15, and pressurizes duct 16. The branch duct 16*a* causes movement of the valve 8 into position 8*a* while a branch duct 18 with a choke 19 in it causes the air pressure to move valve 4 into the position 4*b* so that as a result the supply of air through branch duct 3*a* is cut off. The choke 19 is, however, so dimensioned that an air pulse exists for a sufficient time in duct 16 for the next primary control circuit to be triggered, that is to say remains on the duct connecting duct 16 with a duct corresponding to duct 2 of the next circuit.

The valve 11 is returned to the position 11*a* by air pressure in duct 17*a* branching off from duct B.

In the second embodiment of the invention shown in FIG. 2 the parts corresponding to the parts shown in FIG. 1 are given like reference numerals.

An important difference between the two embodiments of the invention is that pulses are only emitted via ducts A and B if the relative advancing movement of the corresponding unit is sufficient with regard to the coal face and coal face conveyor.

Compressed air from compressed air main 3 passes along branch duct 3*a* and also along branch duct 3*b* which drives a motor 20 which in turn drives a cam shaft 22 via gearing 21 so as to rotate cams 23. The left-hand cam 23 operates valve 4*a* which is provided with a return spring 4*c*.

As soon as the valve 4 has been moved against the force of spring 4*c* by means of the cam 23 so as to be in the position 4*a*, fluid under pressure is admitted to duct 24 and arrives at an on-off valve 25 having positions 25*a* and 25*b*. The valve is moved into the open position 25*a* by movement of the respective self-advancing unit in relation to a part 26 mounted on a coal face conveyor, the part 26 being provided with a suitable cam face for engaging the feeler on valve 25. If the valve 25 is closed then the air pressure in duct 24 will not be further transmitted and no advancing of the unit will occur. If, however, the valve 25 is open the air will pressurize duct 27 and flow through input valve 5 to valve 8 which is in position 8*a*. However, instead of then flowing along duct B as was the case for the first embodiment of the invention, the air under pressure flows through duct 28 which is connected with a space between the larger piston surface and the cylinder end wall of a ram 30 which carries a feeler 31 for prodding the coal face in order to sense its position. The ram 30 is mounted near the roof over the coal face. If the coal face has been sufficiently cut away since the self-advancing unit was last advanced for a further advancing movement to be appropriate, the corresponding movement of the feeler 31 is such that a cam face, not shown, pushes a valve 33 from the position 33*b* indicated into the position 33*a* in which it is open.

Owing to the operation of the pulse delay means the valve 5 is moved into the position 5*a* against the action of spring 5*c*. Air under pressure is now able to flow along duct 10, through valve 33 in position 33*b* and duct 34, and then, via valve 11 in position 11*a*, into duct B. At the same time air passes along duct 10*b* to push the valve 8 into the position 8*b*.

Duct B remains pressurized until valve 4 is closed by cam 23. When valve 4 is closed valve 5 is moved back into position 5*a* by spring 5*c*, since since air can escape from the accumulator 9*b* via the oneway valve, duct 27, valve 25 in position 25*a*, duct 24, and valve 4 in position 4*a*. On further rotation of the cam 23 a raised part of it opens valve 4 again and duct 27 is re-pressurized and air flows through the valve 5 in position 5*a* into duct 7. However, since valve 8 has been moved into position 8*b*, air only flows into duct 41 in order to move valve 11 into position 11*b*. As a result when the delay means 9 has switched valve 5 into position 5*b* the air pressure passing along duct 10, duct 32, and duct 34 passes into duct A instead of duct B. The system is then depressurized when cam 23 allows spring 4*c* to move the valve 4 into position 4*b*.

After this closing of valve 4 valve 45 is opened by a further cam and the air pressure passing through the valve returns valves 25 and 33 into the position shown in the drawing. A duct 24' can be provided to serve for providing a trigger pulse to the next unit along the coal face. The unit can for example have a control system as shown in FIG. 1. The timing of the return of valves 25 and 33 into the position as shown in FIG. 2 is not critical and can occur any time after depressurization of duct A and pressurization of duct B.

What I claim is:

1. In a fluid control system for causing the sequential advance of self-advancing mine roof support units, comprising

(a) for each unit, a primary fluid-operated control circuit having a plurality of ducts therein, fluid pulse means for triggering said circuit to provide two successive output pulses in different ducts, and

(b) for each unit, a secondary control circuit for causing advancement of the respective unit in response to the output pulses from the primary fluid-operated circuit,

the improvement in that the primary control circuit comprises

(i) an input valve, with two outputs, for receiving the trigger pulses and transmitting corresponding pulses through its outputs, and

(ii) at least one fluid pulse delay means having a parallel-connected oneway valve, to be pressurized by the trigger pulse, and to move the input valve so as to change over the output to different ducts.

2. A control system according to claim 1, further comprising two two-way valves connected respectively with the two outputs of the input valve, two outputs of one two-way valve being arranged to transmit, alternately, output pulses to the secondary control circuit, and the two-way valves being arranged to move each other via their outputs.

3. A control system according to claim 1, comprising two such fluid pulse delay means and two parallel-connected oneway valves, for moving the input valve in both directions alternately.

4. A control system according to claim 2, comprising an inlet blocking valve means upstream from the input

valve, and means for opening the inlet blocking valve in accordance with the advance of the roof support unit in relation to a coal front conveyer.

5. A control system according to claim 2, comprising a feeler which is arranged to be extended to sense a coal face on being supplied with fluid via one of the two-way valves, and a valve which is arranged between the input valve and one of the two-way valves and is arranged to open when the feeler has reached a certain degree of extension.

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JACOB SHAPIRO, Primary Examiner

U.S. Cl. X.R.

251—89, 170; 91—1