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SYSTEMS FOR CONTROLLING SELF-ADVANCING MINE ROOF SUPPORT UNITS

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FIG. 1

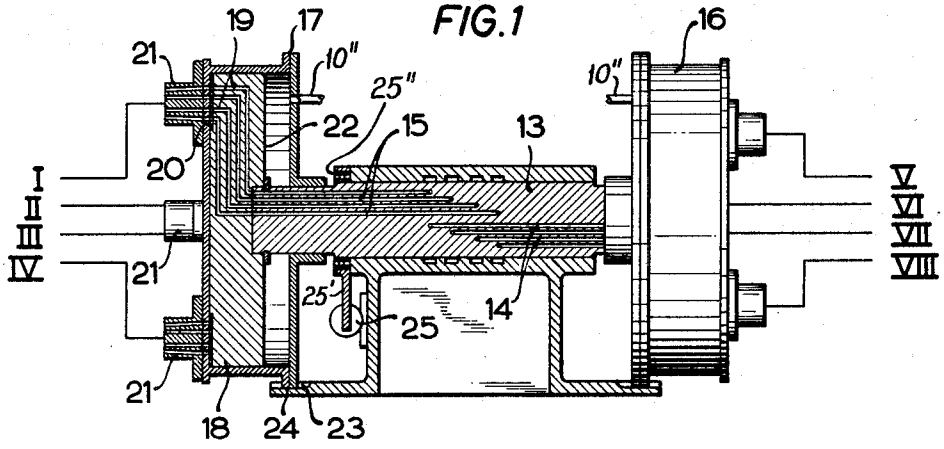


FIG. 2

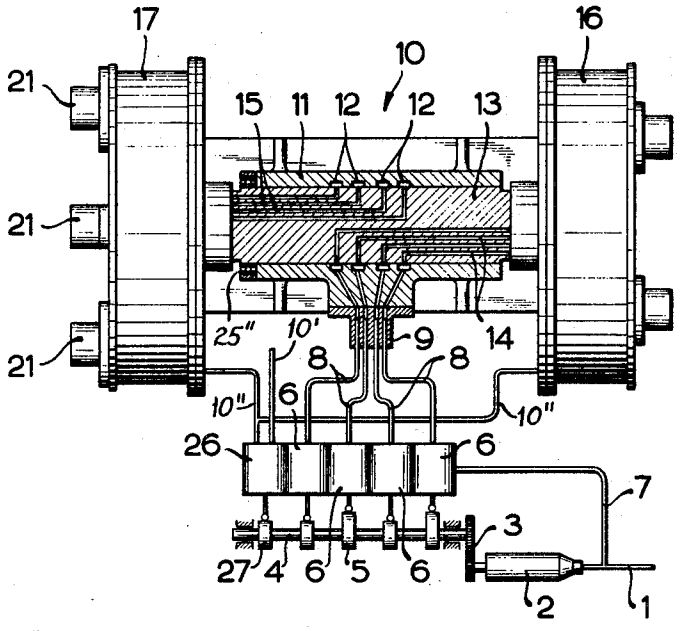
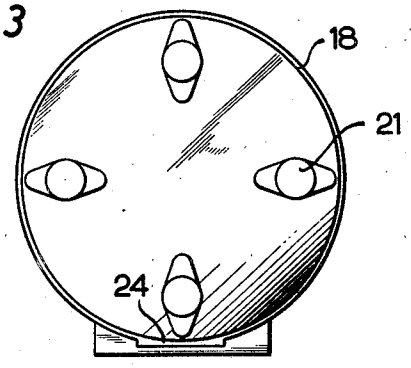


FIG. 3



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SYSTEMS FOR CONTROLLING SELF-ADVANCING MINE ROOF SUPPORT UNITS

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U.S. Cl. 91—36 7 Claims

ABSTRACT OF THE DISCLOSURE

The specification describes a control system for a series of mine roof support units of the self-advancing type. The system comprises a distributor valve with a number of output ducts which are arranged to be connected sequentially with the self-advancing mine roof support unit by means of at least one disc arranged to rotate inside a drum which can be pressurized. Multiple ducts connected with the self-advancing units are in turn connected with connecting pieces mounted on the drum and rotation of the disc in steps is arranged to bring about connection with the connecting pieces in sequence.

The present invention relates to means for the control of self-advancing mine roof support units. In long-wall coal mining practice such self-advancing units are generally operated in sequence along the coal face, each unit performing identical movements when its turn for operation comes.

One particular object of the present invention is to provide a simple control system in which a distributor valve for controlling the movements of a roof support unit may be connected with the roof support units one after the other as their turn for operation comes so that it is not necessary to provide one such distributor valve for each of the roof support units.

The present invention consists in a self-advancing mine roof support unit control system comprising distributor valve means with control ducts leading to power rams of the support unit, and programming motor means for operating the distributor valve means, characterized in that the control system is adapted for the operation of at least two such units and for this purpose comprises a series of receiving coupling pieces of which each is connected with such control ducts leading to one of the units, an output coupling piece containing ducts coming from the distributor valve means for connection of the latter with one of the units for causing it to advance, and stepping means for bringing about relative movement between, on the one hand, the output coupling means, and, on the other hand, the receiving coupling means for sequential movement of the former in relation to the latter.

Preferably, in accordance with a further feature of the invention, the system comprises a series of valve means forming the distributor valve, one of these valve means being arranged to cause fluid power operation of the stepping means.

The system can also comprise at least one drum means with the receiving coupling pieces arranged on it in a circular formation coaxial with the axis of the drum on a radial wall of the drum, and a disc, embodying the output coupling piece, arranged inside the drum for rotation about the axis of the drum. In accordance with a still further feature of the invention a part of the drum behind the disc is fluid-tight, and the system includes duct means for pressurizing space in it for holding the disc against the end wall of the drum.

Conveniently means can be provided for pressurizing and depressurizing the drum in step with movement of the disc.

The system can comprise an axially fixed rotary shaft having ducts in it leading from annular groove means to the disc, the disc being fixed on the shaft, and non-rotary duct means connecting the groove means with the distributor valve means.

The drum is preferably arranged so that it can move axially.

One embodiment of the invention is now described with reference to the accompanying drawings.

FIG. 1 shows, partly in section, part of a control system in accordance with the invention.

FIG. 2 is a plan view and partial section of what is shown in FIG. 1 with a distributor valve.

FIG. 3 is an end view of part of the control system.

As shown more particularly in FIG. 2 the control system comprises a programming motor **2** driven by compressed air supplied by a duct **1**. The motor is connected with a gearing **3** arranged to drive a cam shaft **4** with four cams **5** for operating four valves **6**. The arrangement forms a distributing means in which during each rotation of the shaft **4** the valves **6** are each operated in a sequence which is determined by the cams **5**. The valves **6** are supplied with compressed air via a branch duct **7** from the duct **1**. The output ducts **8** of the valves **6** are conected by means of a coupling piece **9**.

From the coupling piece **9** drilled ducts connected with the ducts **8** pass through a bush **11** to annular grooves or ducts **12** corresponding in number to the number of the valves **6**. The grooves **12** serve for separate transmission of the pressure signals coming from the valves **6** to two groups of ducts **14** and **15** in shaft **13**. This shaft is arranged for rotation but cannot move axially and is surrounded by the bush **11** with a substantially air-tight fit.

One group of ducts **14** leads to the right to a drum **16** while the other group **15** leads to the left to a drum **17**. Since these drums and the means contained in them are substantially identical, only one of the drums, drum **17** is shown in detail in the drawings.

On the left-hand end of the shaft **13** there is a disc **18** fixed to the shaft for rotation with it. In the disc there are channels or ducts **19** constituting continuations of the ducts **15** in the shaft and leading to the left-hand radial side of the disc. At the position adjacent to the openings of the ducts **15** on the left-hand surface of the disc there is a sealing means **20** surrounding the group of openings of the ducts **15** serving to prevent escape of air between the left-hand radial end wall of the drum **17** and the disc **18**.

Fixed to the left-hand radial wall of the drum **17** there are four receiving coupling pieces **21** which are arranged in a circular formation coaxial with the axis of the drum and the shaft **13**.

The coupling pieces **21** are each connected by multiple ducts I–IV leading to four self-advancing mine roof support units. Pressure signals transmitted along these multiple ducts serve for causing advancing of the units in turn. Similarly corresponding coupling pieces **21** on the right-hand radial wall of the drum **16** are connected by means of multiple ducts V–VIII with further mine roof supporting units.

The drum **17** is air-tight so that fluid pressurization of the right-hand part of the interior of the drum **17**, that is to say lying between the right-hand radial face of the disc **18** and the right-hand radial wall of the drum will press the drum **17** against the left-hand radial face of the disc **18**. Such pressurization is brought about via duct means **10″** as shown in FIG. 2. In order to prevent ro-

tation of the drum **17** about the axis of the shaft, a projection **24** on the periphery of the drum fits into a groove **23** which extends in a direction parallel to the axis of the shaft **13** sufficiently to allow movement of the drum to a certain extent in the axial direction.

The shaft **13** is rotated in steps by a stepping means in the form of a ram **25** which is connected with an arm **25'** which is connected by means of a free wheel **25''** with the shaft **13** so that extension of the ram **25** causes rotation of the shaft **13** and the disc **18** sufficiently to bring the part of the disc with the outlets of the ducts in it, which constitutes an output coupling piece, from one of the receiving coupling parts **21** to the next one. When the ram **25** is retracted the shaft **13** does not rotate owing to the action of the free wheel **25''**.

The receiving coupling pieces **21** on the two drums **16** and **17**, and the openings of the ducts in the discs in the drums, are so arranged that the valves **6** are connected with two ducts I and V simultaneously.

In operation, rotation of the cam shaft **4** operates the valves **6** in sequence so that corresponding air-transmitted signals are fed to the two multiple ducts I and V, for example, which happen to be connected by means of the discs in the drums **16** and **17**. When the sequence of operation of the valves **6** has been completed, a further cam **27**, similar to the cams **5**, operates a further valve **26**, similar to the valves **6**, which transmits air under pressure via a duct **10'** to the ram **25** so as to cause a rotational movement of the shaft **13**, and therefore of the discs such as **18** in the drums **16** and **17** so as to move the parts of the discs such as **18** which carry the openings from the ducts in the discs from one of the receiving connecting pieces **21** to the next one. When the rotational movement, that is to say the stepping movement, of the shaft **13** and the discs has been completed, the spaces inside the drums are pressurized by means of the valve **26** which is connected with the spaces by ducts **10''**. For a further stepping movement of the shaft **13** and the discs by means of the ram **25** the spaces are depressurized.

What I claim is:

1. In a self-advancing mine roof support unit control system comprising distributor valve means with control ducts leading to power rams of the support unit, and programming motor means for operating the distributor valve means, the invention which consists in that the control system is adapted for the operation of at least two

such units and for this purpose comprises a series of receiving coupling pieces of which each is connected with such control ducts leading to one of the units, an output coupling piece containing ducts coming from the distributor valve means for connection of the latter with one of the units for causing it to advance, and stepping means for bringing about relative movement between, on the one hand, the output coupling means, and, on the other hand, the receiving coupling means for sequential movement of the former in relation to the latter.

2. A system in accordance with claim **1**, including a series of valve means forming the distributor valve, one of these valve means being arranged to cause fluid power operation of the stepping means.

3. A system in accordance with claim **2**, comprising at least one drum means with the receiving coupling pieces arranged on it in a circular formation coaxial with the axis of the drum on a radial wall of the drum, and a disc, embodying the output coupling piece, arranged inside the drum for rotation about the axis of the drum.

4. A system in accordance with claim **3**, in which a part of the drum behind the disc is fluid-tifiht, and the system includes duct means for pressurizing the space for holding the disc against the end wall of the drum.

5. A system in accordance with claim **1**, comprising means for pressurizing and depressurizing the drum in step with movement of the disc.

6. A system in accordance with claim **5**, further comprising an axially fixed rotary shaft having ducts in it leading from annular groove means to the disc, the disc being fixed on the shaft, and non-rotary duct means connecting the groove means with the distributor valve means.

7. A system in accordance with claim **6**, in which the drum can move axially in relation to the shaft.

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U.S. Cl. X.R.

60—57, 97; 61—45; 91—413; 137—624.14