United States Patent

Cooke

[15] **3,661,056**

[45] **May 9, 1972**

[54] CONTROL SYSTEMS FOR SELF-ADVANCING MINE ROOF SUPPORTS

[72] Inventor: **John Cooke,** Bolton, England

[73] Assignee: **Gullick Dobson Limited,** Wigan, Lancashire, England

[22] Filed: **May 22, 1970**

[21] Appl. No.: **39,766**

[30] **Foreign Application Priority Data**

May 28, 1969 Great Britain.....26,872/69

[52] **U.S. Cl.**.....**91/413,** 251/294

[51] **Int. Cl.**.....**F15b 11/07**

[58] **Field of Search**.....251/294; 91/170 MP, 414, 411, 91/412, 413

[56] **References Cited**

UNITED STATES PATENTS

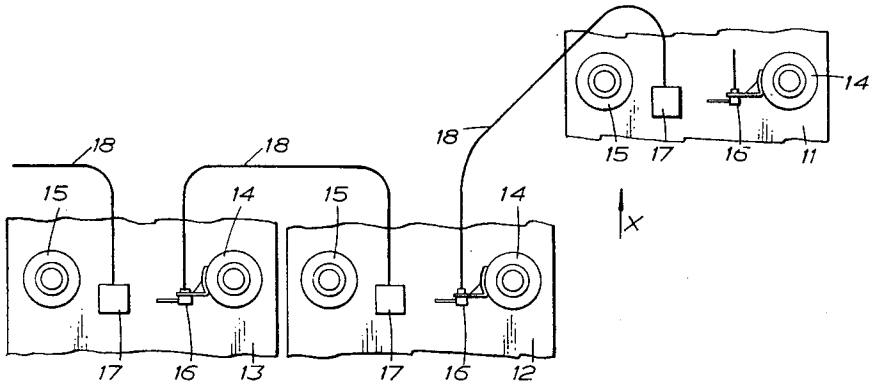
2,128,878	8/1938	Horton	251/294
2,202,422	5/1940	Hoof	251/294
3,289,625	12/1966	Grubb	251/294
3,434,389	3/1969	Grisebach	91/414

Primary Examiner—Martin P. Schwadron
Assistant Examiner—Clemens Schimikowski
Attorney—Berman, Davidson and Berman

[57] **ABSTRACT**

A control system for self-advancing mine roof supports comprising control means on a support to be controlled thereby is operated by operating means on another support by a flexible mechanical coupling. The coupling is a sheathed wire. A Dead Man's Handle arrangement can be provided by transmitting an axial force and rotation to the control means by the wire or by the wire and the sheath. The operating means is designed to fit on the control means on removal of a damaged wire as a temporary measure.

6 Claims, 7 Drawing Figures



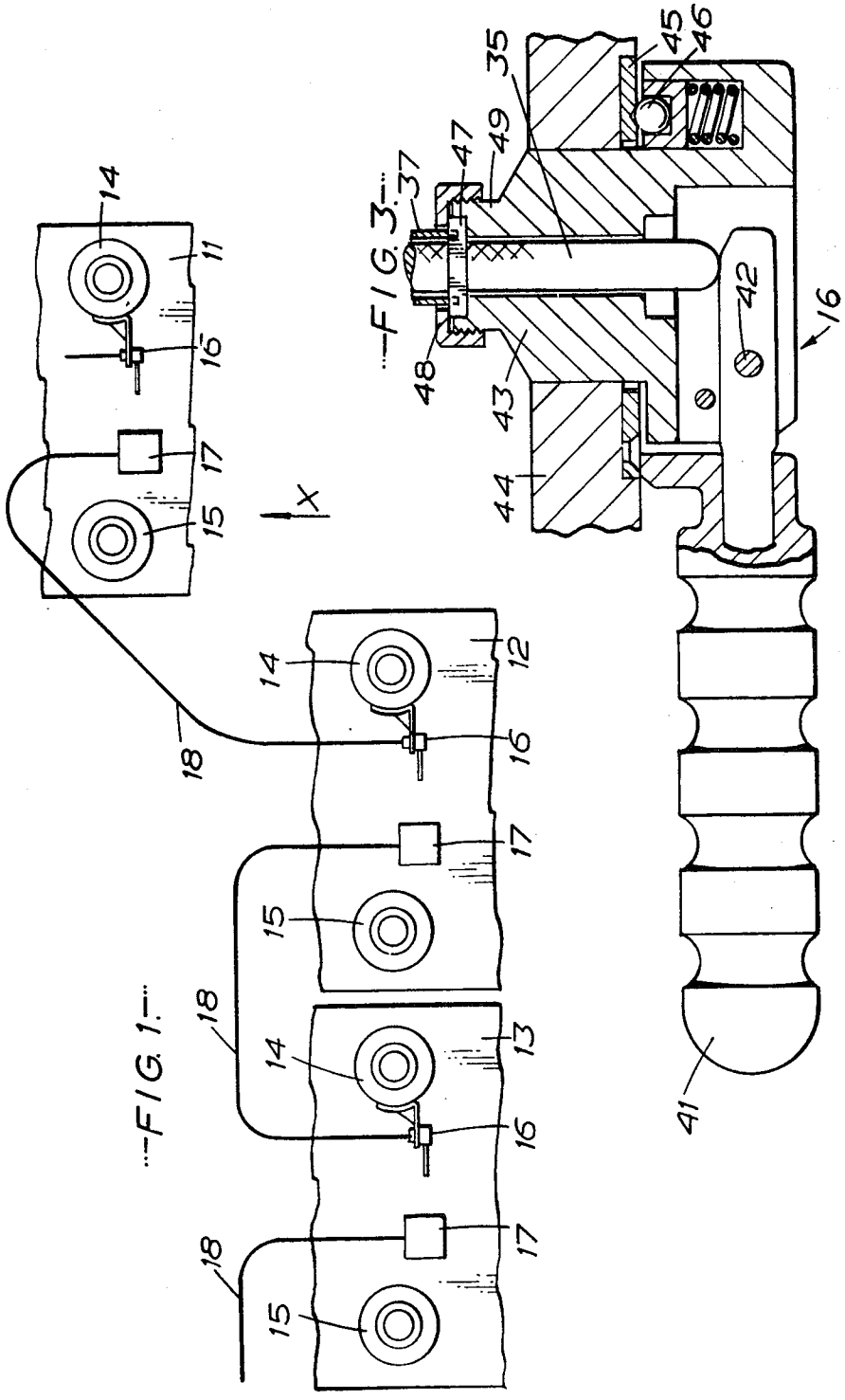
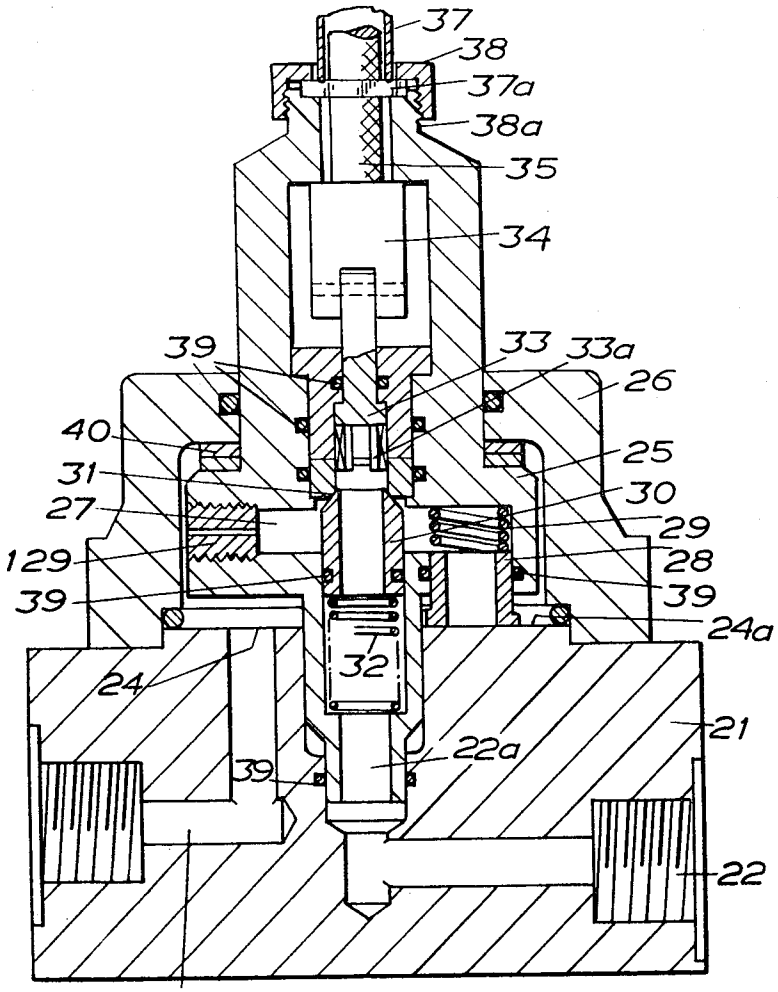


FIG. 1.

FIG. 3.

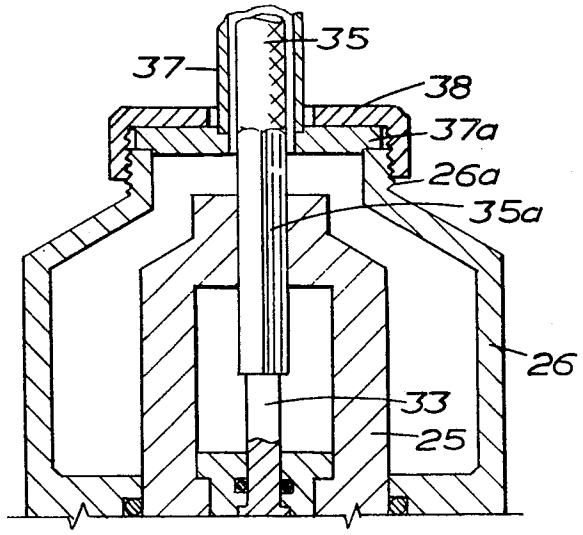
INVENTOR:
JOHN COOKE,
BY
Berman, Davidson & Berman,
ATTORNEYS.



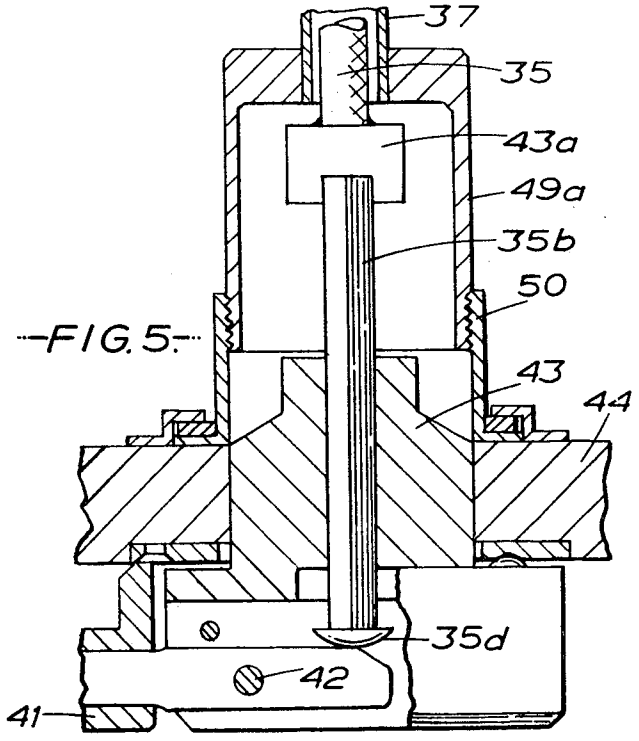
--FIG. 2--

INVENTOR:
JOHN COOKE

BY
Berman, Davidson & Berman,
ATTORNEYS.



--FIG. 4.--



--FIG. 5.--

INVENTOR:
JOHN COOKE,
BY
Berman, Davidson & Berman,
ATTORNEYS.

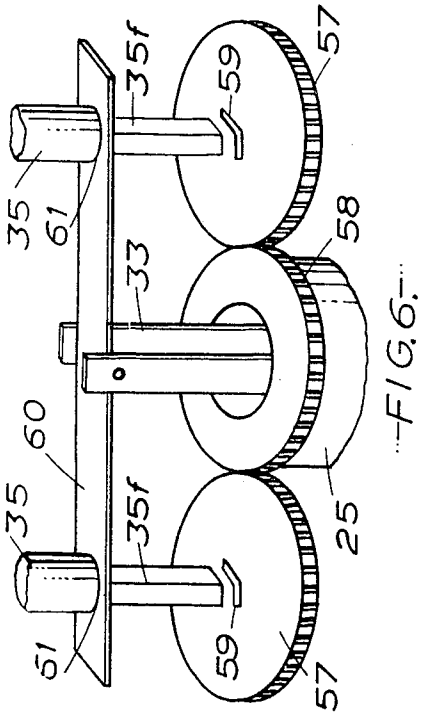
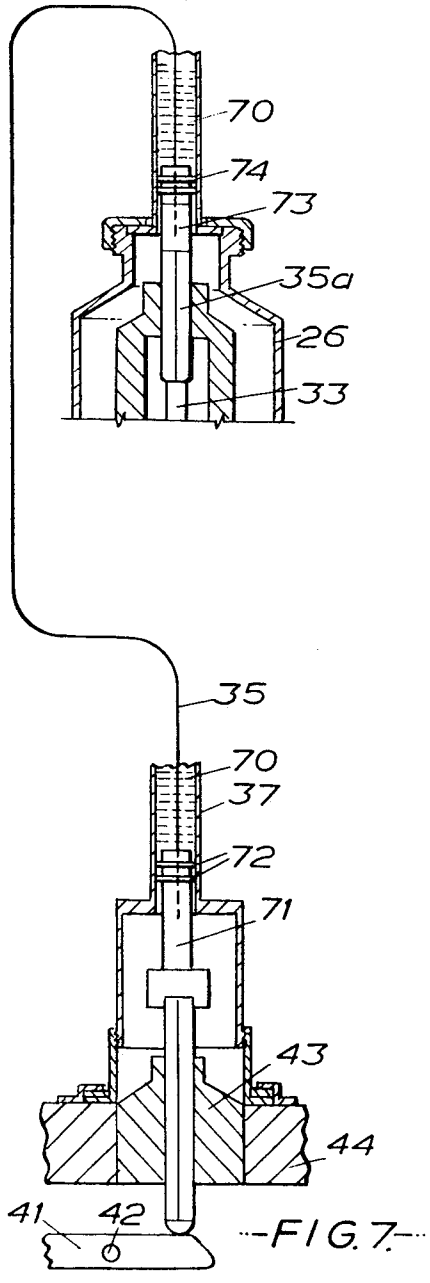


FIG. 6.

INVENTOR:
JOHN COOKE,
BY
Berman, Davidson & Berman,
ATTORNEYS.



-FIG. 7-

INVENTOR:
JOHN COOKE,
BY
Berman, Davidson & Berman,
ATTORNEYS.

CONTROL SYSTEMS FOR SELF-ADVANCING MINE ROOF SUPPORTS

The present invention concerns a remote control system especially for mine roof supports of the self-advancing type.

These supports operate by means of, for example, hydraulically extensible members which are operated to brace the support or part of the support between the floor and roof of a mine working, to push or pull another part of the support or an anchorage to another position wherein it will remain and then on release of the support or the first mentioned part to move it relative to said other part or anchorage. Various types are known but there are a minimum of two hydraulically extensible members incorporated in a support and usually many more.

These extensible members are normally operated by a control means such as a valve which regulates the flow of operating fluid to the hydraulically extensible members possibly by means of pilot valves. The valve is usually directly manually controlled and used to be provided on the support being controlled but there is now a tendency to put the manually controlled valve on an adjacent support. The fluid interconnections between the control valve and the hydraulically extensible members or the pilot valves have thus to cater for the relative advancing movement of the two supports and are numerous and susceptible to damage.

According to the present invention there is provided a remote control system comprising control means, an operating means for the control means for disposing remotely from the control means, and a rotary flexible mechanical coupling from the operating means to the control means.

There are a number of possible mechanical couplings which are suitable. However bearing in mind that the control system of a mine roof support preferably has a "Dead Man's Handle" provision, it is suggested that a sheathed torque transmitting wire or a torque transmitting sheath is probably best. The sheath can be filled with a plastic medium or grease and act as a pressure transmitting pipe to actuate the "Dead Man's Handle" provision, or a push-pull movement of the wire can be superimposed for this provision on top of a torque-transmitting rotary movement. Alternatively two or more wires can be used possibly within a common sheath.

The invention is particularly applicable for use with the low torque manually controlled valve available from Gullick Dobson Limited as the control means.

This could be modified so that the operating handle would be supplied in a separate handle assembly that preferably could be secured to the body of a separate valve assembly for a reason that will be explained later or on an adjacent support to be connected by a Bowden-type or other sheathed wire to the valve assembly. The valve assembly and the handle assembly could have fittings to secure the sheath to them and a handle and at least one movable valve member would be connected to or abut the internal wire so that axial and rotary movement would be transmitted from the handle to the movable member of the valve. The connections at the end of the internal wire could be square section pins fitting into complementary sockets with the length of the wire selected so as to transfer any axial movement by abutment between the wire and the handle at one wire end and the wire and the movable valve member at the other wire end.

It has been stated above that the handle assembly is preferably securable to the body of the valve assembly. This allows fitting a handle assembly directly to a valve assembly on failure of the wire so that the support can be kept in service. This fitted handle assembly can be that normally used to control the valve through the intermediary to the failed wire. Alternatively a special key could be provided for operation of the valve assembly.

Compared to the prior control fluid hydraulic coupling, the flexible mechanical coupling is neater and less prone to damage and if it is damaged, the mine roof support can very easily be kept in service without waiting for permanent repairs as would be the case with a control fluid hydraulic coupling.

It is possible to control a support from more than one other support for example from the supports on both sides thereof. The supports on both sides would each have a handle assembly connected by a flexible mechanical coupling to the valve assembly. The handle assemblies can be positively coupled together through the medium of the flexible coupling so that operation of one handle assembly causes the other handle assembly to repeat the motion or a lost motion device or clutch could be incorporated in both flexible couplings so that the valve assembly could be operated by one handle assembly at a time and on change over between handle assemblies the second handle assembly has initially to move into a correct relationship with the valve assembly.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings.

THE DRAWINGS ARE

FIG. 1, a schematic plan view of a line of mine roof supports,

FIG. 2, a valve assembly in plan section,

FIG. 3, a handle assembly in plan cross-section,

FIG. 4, a modified valve assembly in partial plan section,

FIG. 5, a modified handle assembly in partial plan section,

FIG. 6, a view of a further modification of a valve assembly in simplified perspective view, and

FIG. 7, a schematic section of another control system.

DETAILED DESCRIPTION OF THE EMBODIMENTS

In FIG. 1, there are shown parts of three mine roof supports **11**, **12** and **13** which have hydraulically extensible members **14** and **15** and which are to be advanced in the direction of arrow X under the control of a valve assembly **17** operated by a handle assembly **16**. The support **11** is shown as having been advanced (by means of a handle assembly **16** on the support **12**) and the operator will now move to the support **13** to advance the support **12**.

A valve assembly **17** is connected to a respective handle assembly by a sheathed wire or other flexible mechanical coupling **18** such as a Bowden Cable.

Each valve assembly **17** comprises a base plate **21** having a pressure-fluid inlet **22** and having a plurality of outlets **23** terminating at ports **24** in a valve face **24***a* of the plate **21**. A member **25** rotatable in a casing **26** attached to the base plate **21** has inside it an inlet chamber **27** and incorporates a hollow insert **28** forming a single port which is urged by a spring **29** to make a face seal with the valve face and arranged (when the insert is in line with a port **24**) to communicate between the inlet chamber **27** and the port. A pressure balancing orifice plug **129** is fitted to equalize the static pressure between the inlet chamber **27** and the outlet ports. The rotatable member **25** forms a rotating seal in the inlet **22** and an inlet duct **22***a* in the member connects the inlet and the chamber **27** under the control of a stop valve.

An insert **30** sealed but slidable in the fluid inlet acts as this stop valve (in cooperation with a valve seat **31** on the rotatable member **25** and under the closing bias exerted by a spring **32**). A plunger **33** is slidable axially in the rotatable member by an end fitting **34** of a flexible wire and **35** and has fingers **33***a* to lift the insert **30** from its seat **31** when an axial compression force is transmitted by the wire.

The wire is enclosed in a sheath **37** which has a non-circular end fitting into a non-circular recess in the end of the rotatable member and which has a collar **37***a* clamped by means of a screw ring **38** to a threaded end fitting **38***a* of the rotatable member **25**.

O-ring seals **39** are provided where necessary and a thrust bearing **40** is provided between the casing **26** and the member **25**.

Each handle assembly **16** comprises a handle **41** mounted for pivotal movement about a pin **42** carried by a member **43** rotatable in a base member **44**. An indented annular insert **45** in the base member **44** cooperates with a spring loaded ball **46**

to provide position indication or feel to the rotatable member. The sheath **37** has a non-circular end fitting into a non-circular recess in the end of the rotatable member **43** and has a collar **47** clamped by means of a screw ring **48** to an end fitting **49** of the rotatable member **43**. The wire **35** is disposed at the axis of rotation of member **43** and the pivot pin **42** is disposed so that when the handle is pivotted from the position shown it applies an axial compression force to the wire. When the handle is released the spring **32** acts on the wire to return the handle to the illustrated position in a "Dead Man's Handle" mode of operation.

As has been stated earlier it is possible to modify the arrangement to enable the wire to be dispensed with in case the wire is damaged. One such modification is illustrated in FIGS. **4** and **5**.

In FIG. **4**, the wire **35** has a square end **35***a* which fits into a square recess in the rotatable member and which is journalled for sliding movement therein. The end of the wire bears on the plunger **33** directly. The sheath **37** terminates at the collar **37***a* and is secured to an end fitting **26***a* of the casing **26** in a dust tight manner by a screw-ring **38**.

In FIG. **5**, the wire **35** terminates in an end fitting **43***a* with a square recess into which fits a square pin **35***b* which extends through a square bore in the rotatable member **43** to abut the handle **41**. This pin **35***b* is rendered captive by a suitable head **35***d*. The sheath **37** of the cable terminates in a male threaded end fitting **49***a* of considerable axial extent. This end fitting is screwed into an end fitting or collar **50** freely rotatable on the rotatable member **43** or on the base plate **44**.

If the wire **35** breaks, the base plate **44** which can be held onto a support by stout spring clips (not shown) can be removed from the support, the sheath can be uncoupled at each end, and the handle assembly mounted directly on the valve assembly with the square pin **35***b* taking the place of the square end of the wire. If desired spring clips can be associated with the valve assembly to steady the base plate **44** when used in this mode.

In an alternative modification for use when control of a valve assembly is desired selectively from both of the adjacent supports, each of the adjacent supports has a handle assembly and the valve assembly has associated with it two gear wheels **57** (FIG. **6**) for rotating a gear wheel **58** formed on the outside of the rotatable member **25**. The valve assembly ends **35***f* of the two wires **35** are of angle section so they can each engage in a complementary axial angled slot **59** in a respective gear wheel **57** only in a unique angular relationship between the wire and the gear wheel. Each wire projects through these slots (when the respective handle is pivotted). Each wire passes through a hole in a double end lever **60** pivotted on the plunger member **33** and has a stop **61** which abuts the periphery of the hole so that axial force exerted on the wire causes the stop to push on the lever **60** to operate the stop valve and to allow the end to engage in the respective slot. The valve assembly would be encased in a housing to which the sheaths of the wires would be attached. On pivotting the handle, the stop **61** would push on the lever **60** but the handle could not be fully pivotted until the handle was in the correct position for the end of the wire to enter the slot **59**.

FIG. **7** illustrates another version of the control system. As well as the wire **35** the sheath contains a plastic medium **70** such as grease or a thick paste. A plunger **71** with sealing rings **72** is slidable in the handle end of the sheath **37**. This plunger can be integral with the wire **35** or the wire can be non-rotationally but axially movable in the plunger **71**. At the valve end of the sheath, the wire **35** is axially movable but non-rotational in a piston **73** with sealing rings **74**. Preferably the wire fits into blind holes in the plunger **71** and piston **73** so as to avoid the need for sealing the wire to the plunger **71** and piston **73**. On pivotting the handle, the plunger forces the medium **70** along the sheath and extends the piston **73**. This is arranged to push on the plunger **33** while the wire as in the embodiment of FIGS. **4** and **5** transmits torque. It would be possible to transmit the torque by the sheath **37** as in the embodiment of FIGS. **2** and **3** with a saving in complexity.

I claim:

1. In a line of self-advancing mine roof supports, each of which includes a plurality of rams, a control system comprising an hydraulic valve assembly including an hydraulic valve mounted on one of the mine roof supports for selectively, supplying hydraulic fluid to an hydraulic ram or combination of rams forming part of the mine roof support, said valve comprising a multi-ported member for selective communication with the rams, a single ported member capable of movement relative to the multi-ported member in a mode such as to put its single port in sealed communication with a selected one of the plurality of ports in the multi-ported member, a closure member arranged selectively to prevent and allow flow of pressure-fluid through the selected one of the plurality of ports by movement of said closure member in another mode, one of said modes being rotational and the other linear, and a bias means urging said closure member to prevent said flow, an operating assembly adapted to be disposed remotely from the valve assembly and including a handle mounted therein for rotational and tilting movement, a flexible sheath means connecting the operating assembly and the valve assembly and at least one flexible further means disposed within the sheath means and connecting the operating assembly and the valve assembly, one of said means being coupled both to the handle and to the valve assembly for transmission of the rotational movement of the handle to cause said rotational mode of movement of the single-ported member relative to the multi-ported member and one of said means abutting the handle so that tilting movement thereof causes linear movement of this one of the means and being connected to the valve assembly for the transmission of said linear movement.

2. A control system according to claim **1** wherein the first mentioned one of said means is the sheath means which has end fitting whereby it can be secured non-rotationally to the handle and to the valve assembly.

3. A control system according to claim **1** wherein the first mentioned one of the means is the further means which also is the second mentioned one of said means, the operating assembly having a member rotatable with the handle and the further means having an end fitting which slidably but non-rotationally cooperates with the said rotatable member and an end fitting which is slidably but non-rotationally secured to one of the ported members.

4. A control system according to claim **1** wherein the operating assembly and the valve assembly are adapted to fit together so that the operating assembly can be used to control the valve assembly if there is a failure necessitating removal of said means.

5. A control system according to claim **1** wherein two operating assemblies are associated with the valve assembly, the valve assembly incorporating two selectively engageable gear wheels for causing the rotational mode.

6. A control system according to claim **1** wherein said further means is a flexible wire.

* * * * *