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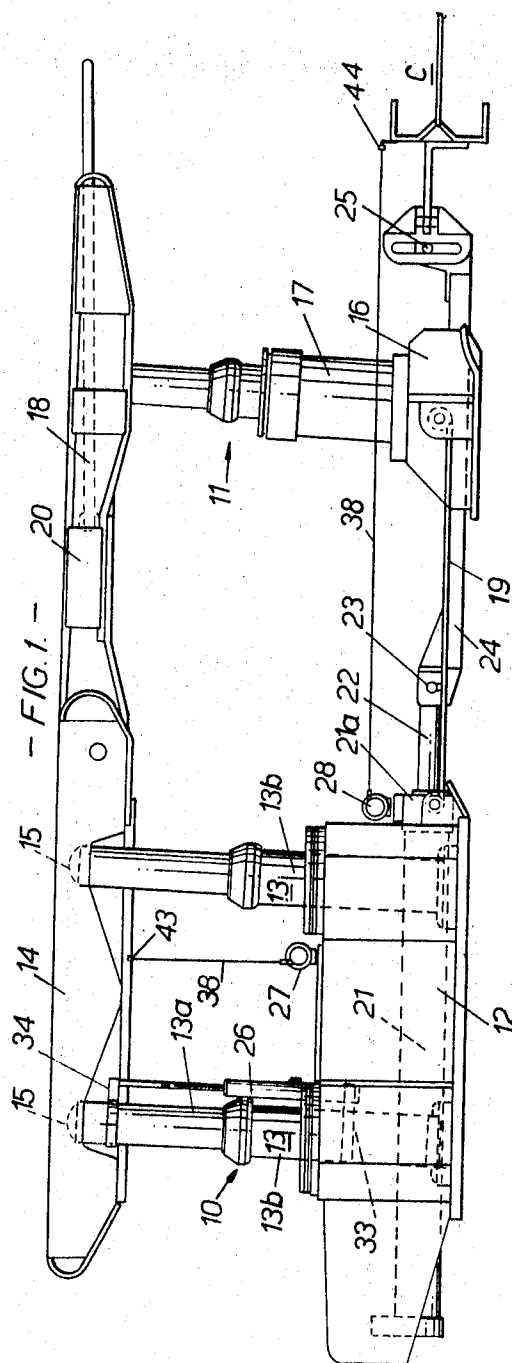
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REMOTE INDICATING SYSTEMS FOR MINE ROOF SUPPORTS

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4 Sheets-Sheet 1



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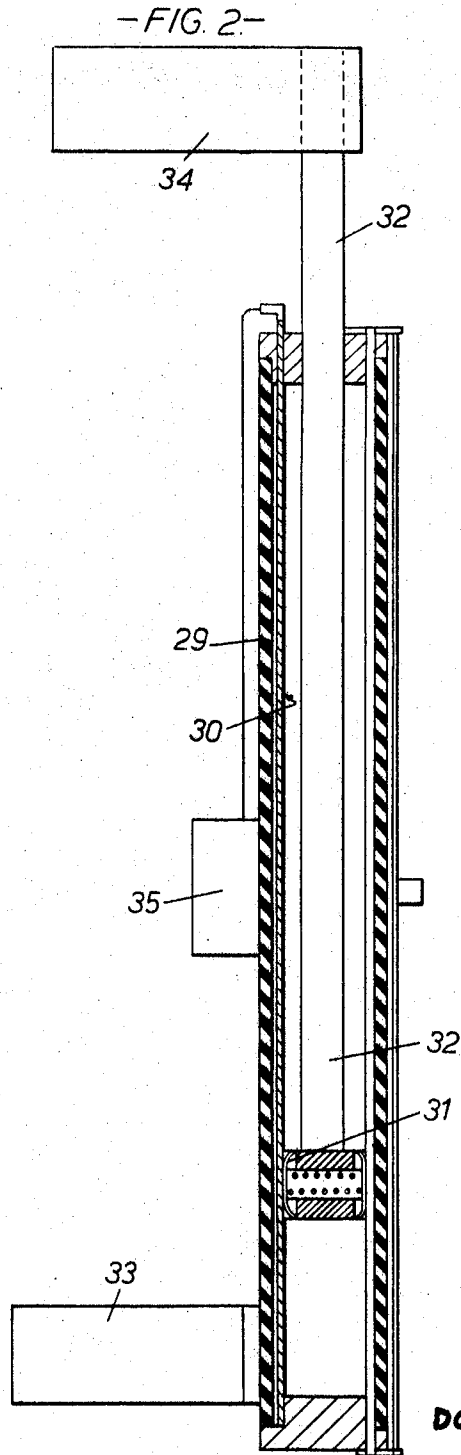
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REMOTE INDICATING SYSTEMS FOR MINE ROOF SUPPORTS

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4 Sheets-Sheet 2



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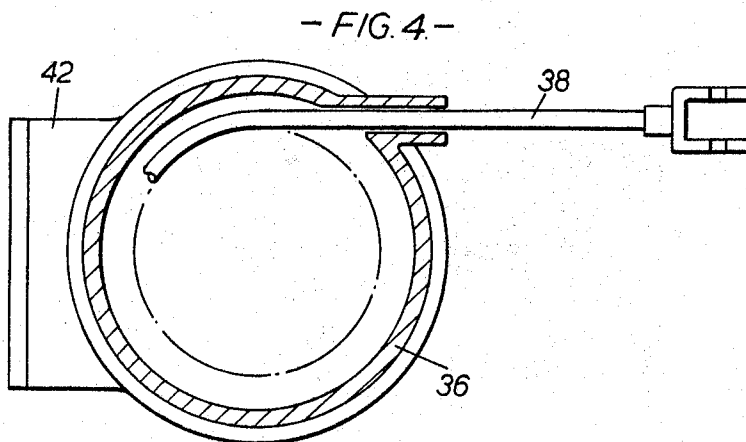
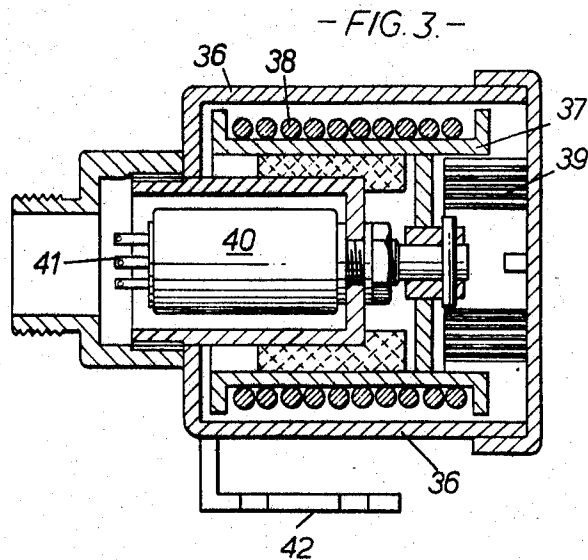
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REMOTE INDICATING SYSTEMS FOR MINE ROOF SUPPORTS

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4 Sheets-Sheet 3



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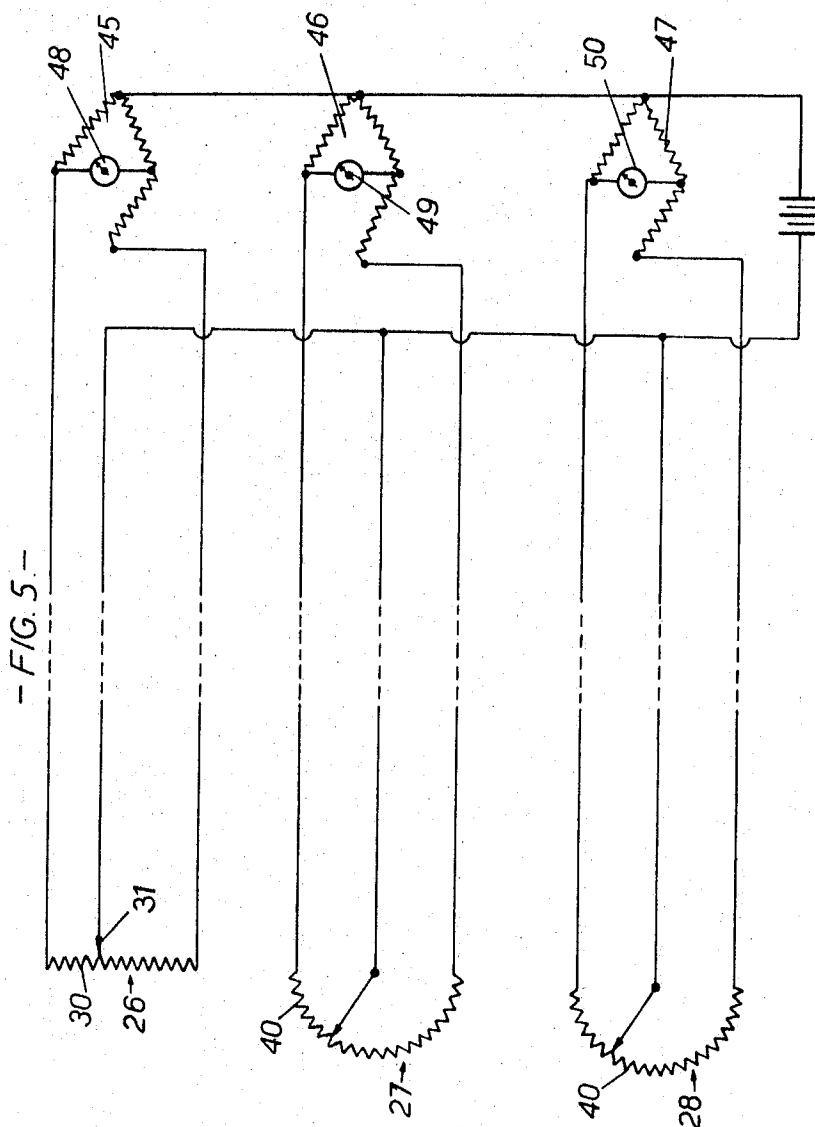
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REMOTE INDICATING SYSTEMS FOR MINE ROOF SUPPORTS

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4 Sheets-Sheet 4



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REMOTE INDICATING SYSTEMS FOR MINE ROOF SUPPORTS

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ABSTRACT OF THE DISCLOSURE

A self-advancing mine roof support includes hydraulic legs or jacks for applying a roof-engaging structure to a roof and also a hydraulic ram or jack for advancing a mineral conveyor towards the coal face and then advancing the support. The degree of extension of the hydraulic legs, which carry the roof-engaging structure, and the degree of extension of the ram which advances the conveyor and the support is indicated at a remote station by means of a galvanometer type of instrument connected in an electrical resistance bridge circuit. This bridge circuit includes a potentiometer at the roof support which is adjusted in accordance with the extension of said hydraulic legs and hydraulic ram.

This invention is for improvements in or relating to pressure-fluid-operated mine roof supports and other mining equipment.

With pressure-fluid-operated (e.g. hydraulic) mine roof supports and other hydraulically-operated mining equipment it is often desirable that an indication should be given at a remote station of the condition or position of such equipment.

For example, in the case of the hydraulic prop or chock it is advantageous if an indication can be given, at some remote distance from the prop or chock, as to whether or not it is properly extended or to what extent it is giving under roof pressure.

Similarly, in the case of a self-advancing roof support which is also adapted to push over a conveyor towards the coal face, it is advantageous if an indication can be given at a remote station as to whether the conveyor has been properly pushed over towards the coal face and/or the support advanced.

According to the present invention there is provided a system, for indicating remotely the condition of a pressure-fluid-operated device of, or associated with, a mine roof support, in which a condition sensitive device, which is adapted to transmit a signal to a remote station, is operatively connected between two elements of, or associated with, said pressure-fluid-operated device externally thereof at least one of said elements being movable relatively to the other.

Such an arrangement has the advantage, over arrangements in which the condition sensitive device is incorporated within the ram or prop means, that the condition sensitive device is readily accessible. Furthermore where the ram or prop means is initially designed for manual operation and is subsequently modified for remote control it is a simple matter also to include the remote indicating equipment. Conveniently the condition sensitive device is adapted to alter the electrical resistance, inductance or capacitance, or a combination thereof, of an electric circuit so that an electrical indicating instrument in said circuit will indicate the relative positions of the members of the prop or ram means.

For example, in the case of a hydraulic prop or ram the movable member could be arranged to adjust a linear potentiometer or resistance forming an arm of a Wheatstone bridge circuit which includes a power source

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which could be an electric battery, and an electrical measuring instrument which would, for the purpose of the present invention, be calibrated directly in units of length so as to indicate extension or retraction of the pressure fluid ram or prop means.

A particular compact and convenient form of variable resistance would be a resistance wire or tape wound onto a spring-spool, the construction being somewhat like that of a spring-reel tape measure. The casing of the device would be connected externally to one member (say the cylinder) of the ram or prop whilst the free end of the tape would be connected externally to the other member (e.g. the ram proper). The arrangement will be such that the amount of the resistance wire or tape drawn out of the casing varies the resistance of the circuit in which it is connected and thereby causes movement of the indicating instrument in that circuit in accordance with such variation of resistance and, of course, the degree of extension or retraction of the ram or prop.

In a modification of this arrangement the potentiometer or rheostat is circular and is traversed by an angularly movable brush. This assembly is located in the "tape measure" casing and movement of the brush is caused by pulling out or retraction of the "tape" which could be a cord or chain.

A still further alternative is a telescopic unit the resistance of which varies with changes in its length.

One particular embodiment of the invention will now be described, by way of example, with reference to the accompanying drawing in which:

FIGURE 1 is a side elevation of a self-advancing roof support which is also adapted to push over a conveyor as cutting of the coal face proceeds. In this figure the invention is shown as applied to a system for indicating extension and retraction of a hydraulic prop of the roof support, the position of a roof-bar structure of the support and the position of the conveyor relatively to the support,

FIGURE 2 is a detail sectional view showing a form of linear potentiometer incorporated in the support shown in FIGURE 1,

FIGURE 3 is a sectional view of a helical form of potentiometer incorporated in the support shown in FIGURE 1,

FIGURE 4 is a cross-sectional view of the potentiometer shown in FIGURE 3, and

FIGURE 5 is a diagram of a suitable electric wiring system for the devices incorporated in the embodiment of the invention shown in FIGURES 1 and 4 whereby the required remote indication can be obtained.

Referring first to FIGURE 1, the roof support comprises a rear unit 10 and a forward unit 11.

The rear unit 10 comprises a base 12, hydraulically-extensible legs or props 13 and a roof-bar structure 14 supported on said legs or props. There are concave-convex seatings 15 where the roof-bar structure 14 rests on the props so as to allow for a degree of adjustment to suit irregularities in the roof.

The forward unit comprises a base 16, at least one hydraulically-extensible prop or leg 17 and a roof-bar structure 18.

The bases 12 and 16 and the roof-bar structure 14 and 18 of the rear and forward units are articulated together by members 19 and 20 respectively.

A hydraulic ram 21 is incorporated in the base 12 of the rear unit. The piston rod or ram proper 22 of this hydraulic ram is coupled at 23 to one end of a ram relay or extension bar 24, the opposite end of which is connected at 25 to the conveyor C.

For the purpose of the present invention a linear potentiometer 26 is provided as part of a system for

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indicating movement of the ram 13a of one of the legs 13 with respect to its cylinder 13b.

A circular or helical potentiometer 27 is provided as part of a system for indicating any movement of the roof-bar structure 14 and a similar potentiometer 28 is provided for indicating the position of the conveyor C with respect to the support 10, 11.

The potentiometer shown in FIGURE 2 comprises an elongated casing or tube 29 of insulating material which houses an elongated resistance wire 30. A spring-loaded wiper 31, connected to a movable arm or rod 32, is slidably positioned in the tube 29 and is adapted to traverse the resistance wire 30 in electrical contact therewith. The tube 29 is attached by means of a bracket 33 to a fixed member of the support, in this case the cylinder 13b of one of the rams 13. The movable rod or arm 32 is attached by means of a bracket 34 to the extensible and retractable ram proper 13a of the support 13. Electrical connections are made from the ends of the potentiometer wire 30 and the wiper 31 to a three pin plug attachment device 35, by which the potentiometer is connected in the remote indicating system as shown in FIGURE 5.

The circular or helical potentiometer 27 (see FIGURES 3 and 4) comprises a casing 36 within which there is rotatably supported a drum 37 on which is wound a wire or cord 38. The wire or cord 38 is adapted to be drawn out of the casing 36 so as to rotate the drum 37 against the action of a clock type torsion spring 39. The arrangement is somewhat like that of a spring-reel tape measure. Rotation of the drum 37 is adapted to adjust a helical or circular potentiometer 40 to which the drum is operatively connected. The potentiometer is provided with a three pin plug attachment 41 by which it is adapted to be connected in the indicating system as indicated in FIGURE 5. The casing 36 is provided with a bracket 42 by which it is mounted on the stationary base 12 of the support unit 10. The free end of the cord or wire 38 is attached to the roof-bar structure 14 as indicated at 43 in FIGURE 1. Thus, any movement of the roof-bar structure 14 relatively to the base 12 will cause or allow rotation of the drum 37 and result in an appropriate adjustment of the potentiometer 40.

The potentiometer 28 is similar in construction to that just described with reference to FIGURE 3. In this case, however, the casing 36 is mounted on the stationary part or cylinder 21a of the ram 21 by means of the bracket 42 and the free end of the wire 38 is connected to the conveyor C as indicated at 44.

Referring now to FIGURE 5, it will be noted that the potentiometers 26, 27 and 28 each form one arm of a Wheatstone bridge circuit indicated at 45, 46 and 47 respectively.

The Wheatstone bridge circuit 45 includes a galvanometer type of instrument 48 responsive to adjustment of the potentiometer 26 and thereby adapted to indicate any extension or retraction of the leg 13 with which the potentiometer 26 is associated.

The bridge circuit 46 includes a similar indicating instrument 49 adapted to indicate any movement of the roof-bar structure 14 relatively to the base 12 of the support unit 10.

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Similarly, the bridge circuit 47 includes an indicating instrument 50 adapted to indicate the relative positions of the conveyor C and the roof support and thereby whether or not the conveyor has been properly advanced and the support drawn up to it in the well-known way. It will be appreciated that the instruments 48, 49 and 50 may be calibrated so as to indicate directly in units of length or other convenient units. These instruments can, of course, be positioned at a station quite remote from the support.

It will be appreciated that in some cases the signal obtained by extension or retraction of the ram or prop, particularly if this is small, may be insufficient in itself to operate satisfactorily the indicating instrument in which case the signal may be amplified before being passed on to the indicating instrument.

I claim:

1. A mine roof support including hydraulic jack means and a member movable by said hydraulic jack means relatively to a stationary part of the support, a casing fixed on said stationary part of the roof support at a position outside said jack means, an adjustable electrical potentiometer unit housed in said casing, means operative to adjusting said potentiometer including an extensible and retractable part which extends out of said casing, means on said extensible and retractable part connecting it to said member whereby said part of the potentiometer adjusting means is extended or retracted simultaneously with movement of said member, an electrical resistance bridge circuit which includes said potentiometer, whereby the electrical potential across the bridge circuit varies with the adjustment of said potentiometer, and a galvanometer instrument, at a remote station relatively to the support, connected across said bridge circuit so as to respond to said electrical potential and thereby indicate at said remote station the position of said member relatively to the stationary part of the support.

2. A self-advancing mine roof support as claimed in claim 1 wherein within the potentiometer casing there is a drum rotatable against the action of a spring, a cord wound on said drum and constituting said extensible and retractable part of the potentiometer adjusting means, and means operatively connecting said drum to the potentiometer for the adjustment thereof.

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