

Feb. 16, 1971

H. RIESCHEL

3,563,094

CONTROL SYSTEMS FOR MINING EQUIPMENT

Filed Dec. 22, 1969

2 Sheets-Sheet 1

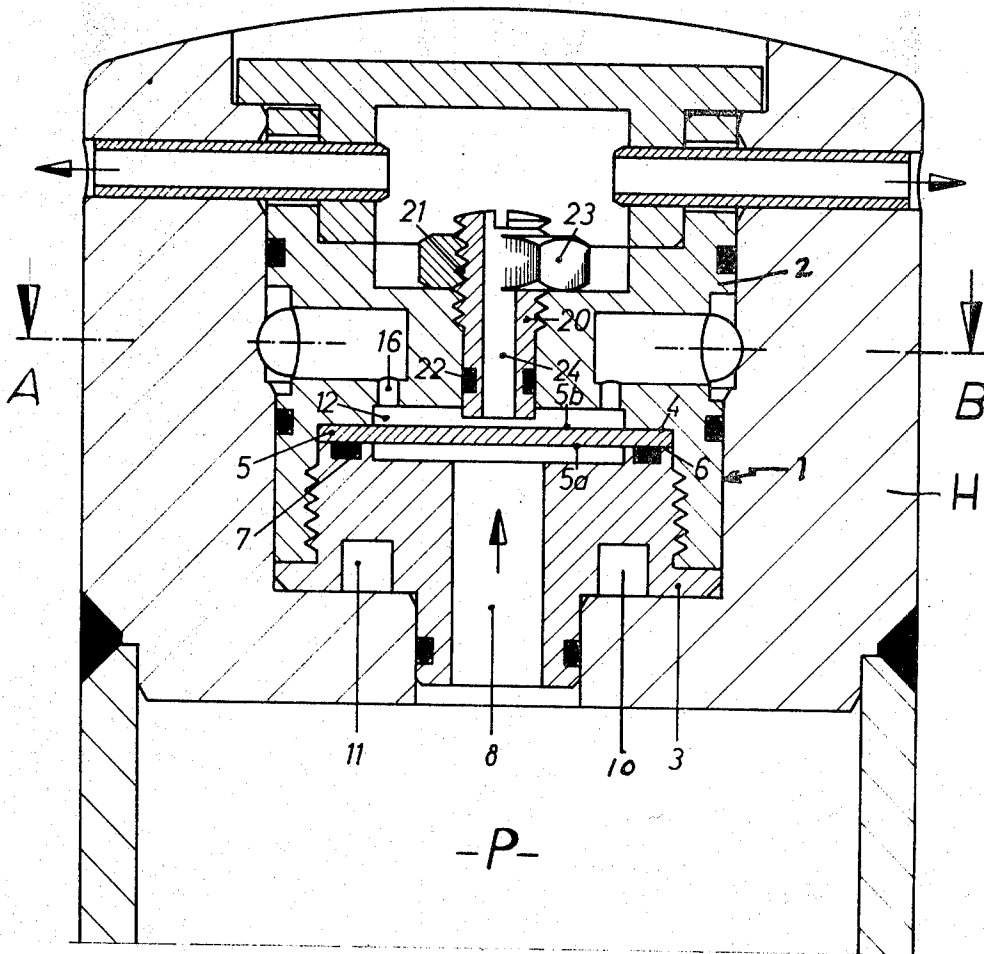


FIG. 1

INVENTOR  
*Hans Rieschel*  
by *Pauline M. Pross*  
ATTORNEY

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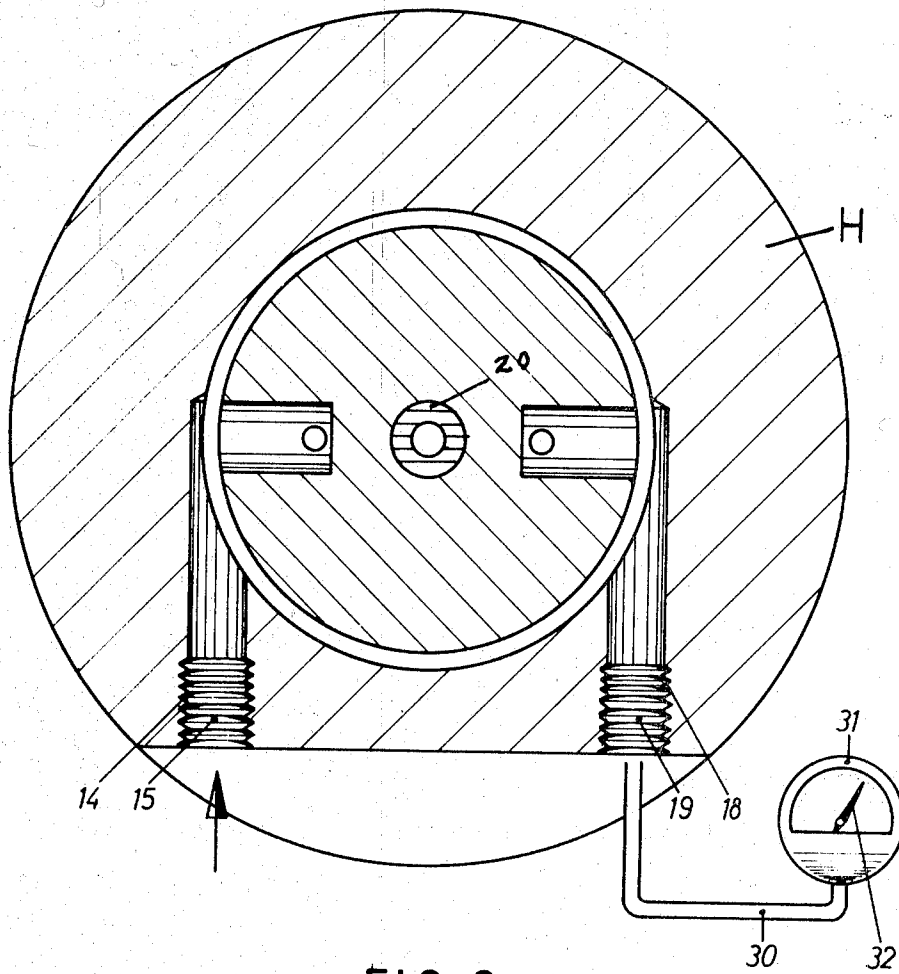


FIG. 2

INVENTOR  
*Hans Rieschel*  
by *Therese W. Prosser*  
ATTORNEY

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**CONTROL SYSTEMS FOR MINING EQUIPMENT**  
 Hans Rieschel, Miltenberg, Germany, assignor to Bergwerksverband G.m.b.H., Essen, Germany, a corporation of Germany

Continuation-in-part of application Ser. No. 716,593, Mar. 27, 1968. This application Dec. 22, 1969, Ser. No. 887,037

Claims priority, application Germany, June 1, 1967, B 92,813

Int. Cl. G011 7/00

U.S. Cl. 73-388

1 Claim

## ABSTRACT OF THE DISCLOSURE

The specification describes a hydraulic-pneumatic analog transducer for providing a pneumatic pressure indication of the hydraulic pressure existing in a hydraulic ram. The transducer makes use of a membrane of which one side is subjected to the hydraulic pressure while the other side, in accordance with the hydraulic pressure obtaining, varies in its distance from the end of a tube. Air is caused to pass between the resulting annular gap between the end of the tube and the membrane and the resulting pressure gradient is measured by means of a pneumatic pressure gauge.

## CROSS REFERENCE TO RELATED APPLICATION

This application constitutes a continuation-in-part of application, Ser. No. 716,593, filed Mar. 27, 1968, of Hans Rieschel and entitled "Control Systems for Mining Equipment" now abandoned.

## BACKGROUND OF THE INVENTION

The present invention relates more particularly to indicating apparatus for providing information concerning the pressure obtaining in hydraulic mine equipment at a distance from the equipment.

According to one previous proposal, see German specification 1,237,041, an electrical signal was to be provided varying in accordance with the working pressure of hydraulic equipment, making use of a spring-loaded double piston which short-circuited a number of electrical contacts in accordance with the displacement by the pressure. A disadvantage of this device was, however, the limited number of signals that it could provide owing to the limitation on the number of contact pairs which could be used. A further disadvantage of the device was that extensive precautions and restrictions are necessary in connection with electrical equipment in mining.

## SUMMARY OF THE INVENTION

One particular object of the present invention is to provide an apparatus for giving an indication of the hydraulic pressure existing in mine roof support units.

The present invention consists in an indicating apparatus for providing a pneumatic signal corresponding to the hydraulic pressure of a mine roof support ram, characterized in that the apparatus comprises: a body defining a chamber; a membrane extending across the chamber; duct means for applying hydraulic pressure to a first side of the membrane; a loop shaped wall having a rim adjacent to and substantially parallel to a second side of the membrane, duct means for causing gas to flow between the inside of the wall and the outside of it, this flow taking place between the wall and the membrane, and means responding to the pressure gradient existing between a space within the wall and around the wall.

In order to set the range of measurement of the apparatus, the latter can comprise a tubular body which is fixed in

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a housing so as to be axially adjustable, and whose end forms the wall.

In accordance with a further, optional, feature of the invention the apparatus comprises detachable means, such as a screw-threaded ring, for holding the membrane in place against, for instance, a shoulder surface in the body, so as to allow the membrane to be replaced.

The body can be mounted in the head plate or cap of a hydraulic pit prop. The means responding to the pressure gradient can be in the form of a pressure indicator for visual inspection.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 of the drawings is a diagrammatic section of an apparatus in accordance with the invention; and FIG. 2 is a section on the line A-B of FIG. 1.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

The apparatus comprises a body 1 made up of two parts 2 and 3. The part 3 is in the form of a screw-threaded ring screwed into the part 2 so as to press a circular diaphragm or membrane 5 against a circular support shoulder face 4. The part 3 has a surface 6 opposite the face 4 and an annular seal 7 which presses the membrane 5 in a fluid-tight manner against the shoulder face 4.

The screwed-in part 3 has a central hole 8 for supplying oil of a hydraulic system to the membrane 5. The oil comes into contact with the free face of the membrane 5, denoted by reference numeral 5a. The part 3 also has sockets 10 and 11 of minor importance and it can be mounted in the head plate H of a pit prop P. The hole 8 forms the connection with the hydraulic pressure system of the pit prop P.

The part 2 has a circular hole 12 which forms part of a chamber on one side of the membrane. Compressed air is passed through a union socket or duct 15 with a female thread 14 and passes through an annular channel 16 under constant pressure into the chamber space 12. The socket 15 forms a connection for the supply of compressed air.

On the opposite side of the body there is an outlet socket 19 provided with a female thread 18, this socket serving for an output analogue signal in accordance with the hydraulic pressure above the membrane 5.

In the centre of the annular chamber space 12 there is a tube 20 whose upper end adjacent to the lower membrane face 5b forms a wall which cooperates with the membrane face in forming a variable gap. The tube 20 is provided with screw threads and is screwed into a hole 21 in the part 2 and sealed by a gasket 22. The lower end of the tube 20 is provided with a lock-nut 23. The vertical open ended passage 24 through the tube 20 leads to the outside atmosphere.

In operation the duct 15 is connected with a supply of compressed air under constant pressure. This air flows into the chamber 12 over the rim at the end of the tube 20 and thence into the inside of the tube 24 from which it emerges to the outside atmosphere. If hydraulic pressure is applied to the face 5a of the membrane, any variation in pressure leads to a bending or bulging of the membrane 5 so as to vary the width of the gap between the rim of the tube 20 and the surface 5b of the membrane 5. As a result a greater or lesser pressure gradient across the gap is created and an air pressure is produced in the chamber 12 which is passed out through duct 19.

As is schematically shown in the drawing, the analogue air pressure is passed via a conduit 30 to a pressure gauge 31 whose pointer 32 shows on a scale a value proportional to the hydraulic pressure in the pit prop. By suitable calibration of the scale, taking the cross-sectional area of the piston of the pit prop into account, the scale can be made to read directly in tons or other units of weight acting

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on the pit prop. The pressure gauge or indicator can be provided at a considerable distance from the pit prop P.

It has been found that the apparatus, particularly the body with its membrane can be made to miniature dimensions.

What I claim is:

1. A device for indicating by pneumatic signal the hydraulic pressure of a mine roof support pit prop having a head plate comprising: a body mounted in said head plate provided with a chamber, a membrane extending across said chamber for dividing same into separate sections, duct means for conveying hydraulic pressure fluid from the pit prop to one section of said chamber, an open ended tube extending into the other section of said chamber and terminating adjacent said membrane, means for adjusting said tube toward and away from said membrane, the outer end of said tube being open to the outside, means for conducting a stream of air under constant pressure

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through said other section of said chamber to pass to the inside of said tube and thence to the outside, whereby any variation in hydraulic pressure causing flexing of said membrane so as to vary the gap between the end of said tube and said membrane creates a varying pressure gradient across such gap, and gauge means connected to said body and communicating with said other section to visually indicate such pressure variations in terms of hydraulic pressure.

#### References Cited

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15 DONALD O. WOODIEL, Primary Examiner

U.S. Cl. X.R.

73—395, 406