Sept. 29, 1942. R. C. PIERCE 2,296,947

EXPANSIBLE CARTRIDGE

Filed Feb. 5, 1940

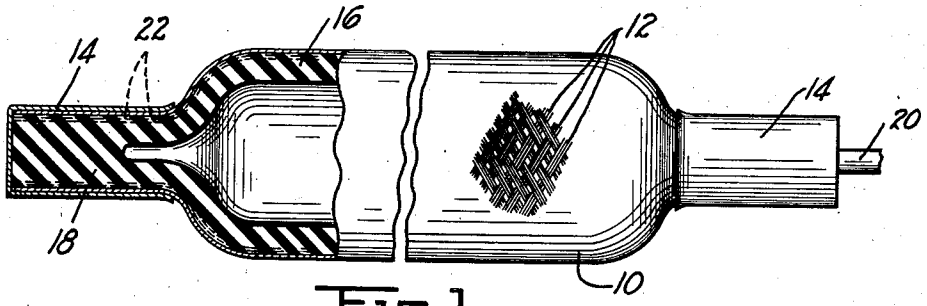


FIG. 1

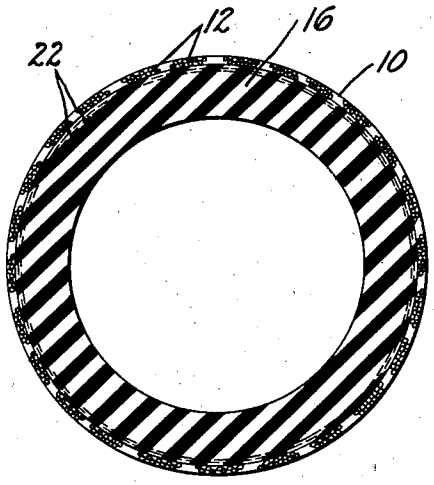


FIG. 2

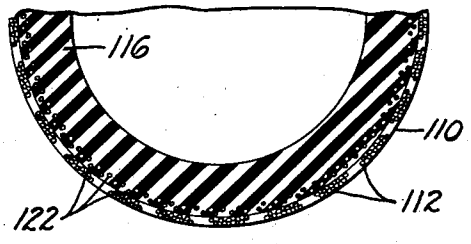


FIG. 4

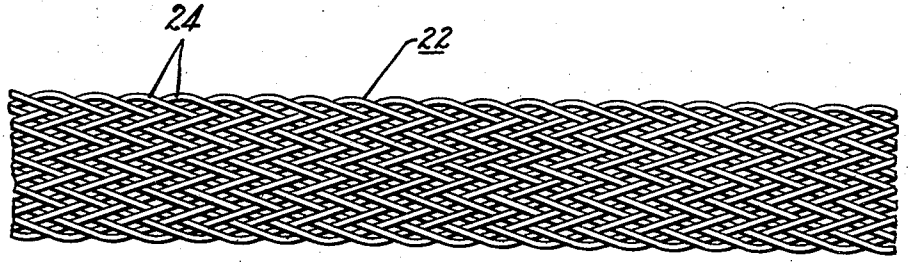


FIG. 3

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EXPANSIBLE CARTRIDGE

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Application February 5, 1940, Serial No. 317,349

2 Claims. (Cl. 262—12)

This invention relates to expansible cartridges and more particularly to cartridges including an expansible protective cover and an inflatable tube.

Expansible cartridges have been used in mining operations, particularly in coal mining, in place of explosive charges to blow down coal or the like from the vein. For this purpose extremely high pressures are required and the cartridges are made up of heavy rubber tubes inclosed in a reinforcing cover, one very satisfactory cover being fully disclosed and claimed in my Patent No. 2,041,950.

Under the extremely high pressures employed it has been found that the tube material tends to push out between the cover elements regardless of the relatively close spacing thereof. This effect is the most pronounced adjacent the ends of the cartridge where the diameter changes rapidly and where the cover elements tend to separate to a greater extent than at other points.

One of the primary objects of the present invention is to provide an expansible cartridge in which the tube is reinforced. According to one important feature the tube reinforcements are so arranged that they will not interfere with free expansion of the cartridge.

Another object of the invention relates to the provision of reinforcements which are themselves expansible so that they can expand with the tube.

The above and other objects, advantages and novel features of the invention will be apparent from the following description read in connection with the accompanying drawing, in which:

Figure 1 is a side view with parts in axial section of an expansible cartridge embodying the invention;

Figure 2 is a transverse section of the cartridge;

Figure 3 is an enlarged plan view of the reinforcing elements of Figures 1 and 2; and

Figure 4 is a view similar to Figure 2 showing another type of reinforcing element.

The illustrated cartridge comprises an expansible cover 10 shown as formed of braided tapes 12 and which may be made as disclosed and claimed in my Patent No. 2,041,950. The cover is closed at its ends by caps 14 welded or brazed to the tapes 12 and providing rigid end closures.

Within the cover 10 there is arranged an expansible tube 16 of rubber or the like and which has relatively heavy walls. The ends of the tube 16 extend into the caps 14, one end being closed as shown at 18 and the other having a conduit 20 connected thereto and extending out through a cap 14.

In use the cartridge, in unexpanded condition, is placed in a hole in a vein of coal or the like and fluid under pressure is forced in through the conduit 20. As the cartridge expands to the form shown in Figure 1 it forces out the coal or other material. The cover 10 serves to protect the tube from damage from contact with the coal and also prevents the tube from bursting when the coal is forced down and its pressure against the cartridge is relieved.

It has been found that covers of the type disclosed in my Patent No. 2,041,950 maintain a relatively close spacing between the braids 12 during all stages of expansion so that the tube 16 is adequately supported throughout. However, the braids have a tendency to separate to a greater extent adjacent the caps 14 where there is a rapid change of diameter than at other places and other types of covers may separate to a greater extent throughout. Under some circumstances the tube 16 may tend to press out between the cover elements, thereby damaging the tube or the cover or both.

In order to eliminate this there are provided, according to the present invention, a series of reinforcements for the tube which hold it against pressing out between the cover elements without interfering with its free expansion. As shown, the reinforcing elements comprise elongated flexible members 22 arranged in parallel in annular layers adjacent the outer portion of the tube 16. While two such annular layers are shown in the drawing it will be apparent that more or less could be used, as desired. The members 22 preferably extend axially of the tube although they may, if desired, be given a slight twist so as to lie in a long spiral. Since the tendency for the tube to press out between the cover elements is more pronounced adjacent the ends of the cover than in its center portion, the reinforcing elements 22 may extend from the ends past the point of maximum curvature longitudinally and may terminate short of the center of the cartridge as shown in Figure 1.

The reinforcing elements of Figures 1 and 2 are shown in detail in Figure 3 as comprising a flat braid formed of elongated strands 24. In the form of braid shown the strands 24 cross alternately over and under two other strands back and forth across the braid although other types of braids could be used satisfactorily.

The strands 24 may be formed of fibrous ma-

terial such as cotton, hemp, jute, wool or the like but I prefer to use metal wires plated or coated so as to bond to the rubber of the tube **16**. The braids **22** are imbedded in the tube and during curing thereof the rubber of the tube bonds to the strands **24** and to itself through the interstices of the braid so that the braid is securely anchored in place in the tube.

One important advantage of a braid of the type shown in Figure 3 is that during expansion of the tube the braid itself will expand widthwise. This enables the braids to be placed relatively close together in the layers to provide a uniform support for the tube without interfering with its free expansion.

Figure 4 illustrates an alternative form, parts therein corresponding to like parts in Figures 1 to 3 being designated by the same reference numerals plus **100**. In this form the reinforcing elements are made up of substantially round cords which may be formed of fibrous material or which may be wire cables made up with relatively fine wires. The cords, as in Figures 1 to 3, are preferably coated or treated to adhere to the rubber of the tube so that a good bond is secured.

In either case the reinforcing elements lying adjacent the outer portion of the tube **16** reinforce and stiffen it so that it will not press out between the cover elements even though they separate to a considerable extent. Since the reinforcing elements are flexible they will readily follow the longitudinal curve of the tube adjacent its ends and will not interfere with its proper expansion.

In forming the tube the uncured rubber is molded or otherwise formed to the desired shape with the reinforcing elements in place in accordance with known manufacturing methods. The rubber is then cured to form the completed article with the reinforcing elements bonded in place and held together by the rubber.

While the invention has been described in detail in connection with two particular embodiments it will be understood that this description and the accompanying drawing are for purposes of illustration only and are not to be taken as a definition of the scope of the invention, reference being had for this purpose to the appended claims.

What is claimed is:

1. An expansible cartridge comprising a tubular braid formed of elongated metallic elements crossing over and under each other diagonally around the braid and adapted to expand radially, an inflatable tube in said braid, means for conducting fluid under pressure into the tube to expand it, means closing the ends of the braid whereby its expansion is limited to the portion between the ends, and elongated reinforcing elements imbedded in the walls of the tube and lying substantially parallel to each other in layers and extending substantially axially thereof throughout the portion thereof from said end closing means to an expanded part of the tube to reinforce the tube against pressing out between said metallic elements when the tube is expanded.

2. An expansible cartridge comprising a tubular braid formed of elongated metallic elements crossing over and under each other diagonally around the braid and adapted to expand radially, an inflatable tube in said braid, means for conducting fluid under pressure into the tube to expand it, means closing the ends of the braid whereby its expansion is limited to the portion between its ends, and elongated reinforcing elements imbedded in the tube walls and lying substantially parallel to each other in layers and extending substantially axially of the tube throughout the portion thereof from said end closing means to an expanded part of the tube to reinforce it against pressing out between the metallic elements, said reinforcing elements comprising flat braids of wires crossing over and under each other diagonally across the braid and adapted to expand widthwise when the tube is inflated.

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