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COUPLING AND CENTERING DEVICE FOR EXPLOSIVE CARTRIDGES

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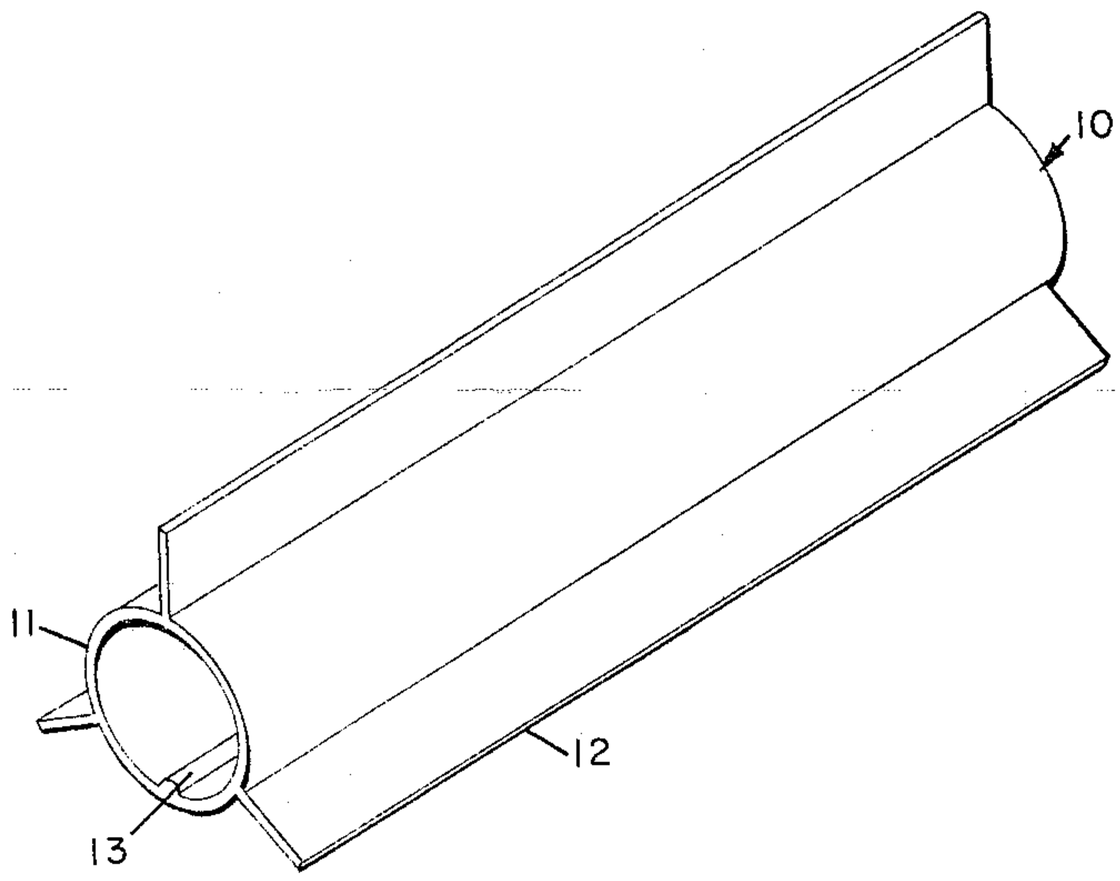

FIG. 1

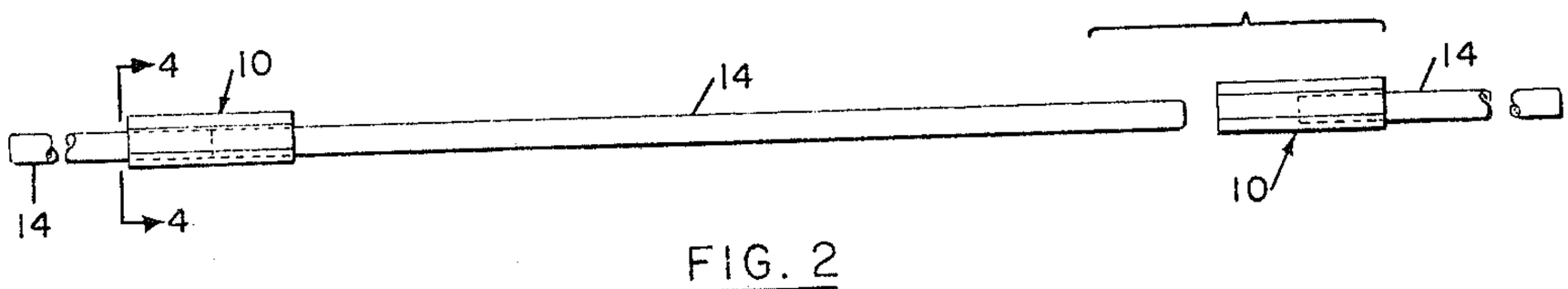

FIG. 2

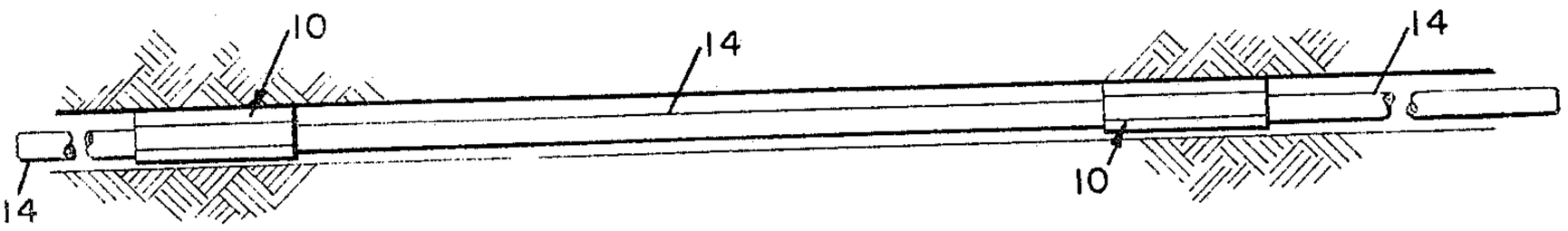

FIG. 3

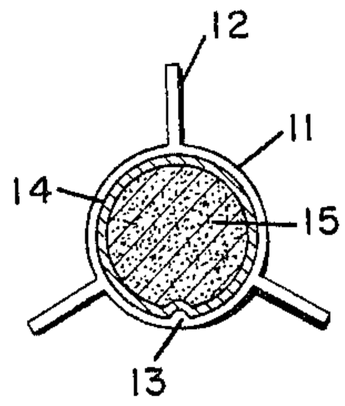

FIG. 4

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COUPLING AND CENTERING DEVICE FOR EXPLOSIVE CARTRIDGES

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This invention relates to a coupling device for explosive charges and more particularly to a device for coupling small diameter explosive charges and for centering the charges as an assembly in a somewhat larger diameter borehole for purposes of smooth contour blasting.

One object of the present invention is to provide a coupling device for the aforesaid service which is positive in its action of connecting small diameter explosive containers in end-to-end abutting relationship and which serves also to center the containers in larger diameter boreholes.

Other objects of the invention are to provide a coupling device that is simple in construction, economical to manufacture and uniformly reliable.

In accordance with the present invention, there is provided a coupling device which is designed to frictionally couple small diameter explosive charges packaged in resilient containers in end-to-end abutting relationship and to center the containers in a larger diameter borehole, the coupling device comprising as a unitary structure of thermoplastic material a tubular body member of considerably less length than the length of a container to be coupled, a plurality of equispaced radial fins extending equidistant from the tubular body member throughout its length, and inwardly projecting bead-like means within the tubular body member extending throughout its length, said bead-like means being adapted to maintain the end portion of a coupled resilient container in tight frictional contact within said body member.

For a more complete understanding of the present invention and for further objects and advantages thereof, reference is now made to the accompanying drawing wherein reference symbols refer to like parts wherever they occur:

FIGURE 1 is an isometric view of a coupling device in accordance with the present invention;

FIGURE 2 is an elevational view of the coupling device showing two containers coupled with a third container in position for coupling;

FIGURE 3 is an elevational view showing the coupling device and coupled containers in place in a borehole; and

FIGURE 4 is a sectional view taken along line **4—4** of FIGURE 2.

Referring now to FIGURE 1, there is illustrated a coupling device **10** having a tubular body member **11** with three equally spaced radial fins **12** extending from the body member. The fins **12** extend equidistant from the body member **11** and are of the same length as the body member. An inwardly projecting bead **13** is provided within the tubular body member **11** and extends throughout its length. The coupling device is now further described with particular reference to FIGURES 2 and 3 which depict a plurality of paper containers, represented by **14**, being assembled to form an explosive column and a plurality of containers as assembled in a borehole, respectively.

In making up an explosive column assembly, the coupling device **10** is forced midway on one end of a first paper container **14**. Then a second paper container **14** is forced into the coupling device **10** until the ends of the two containers abut each other. This procedure is repeated until an assembly of the desired number of containers is obtained. The containers may be completely

assembled outside the borehole and pushed therein or may be incrementally pushed therein as additional units are added. In either event, the assembled column of containers is centered in the borehole in end-to-end abutting relationship as shown in FIGURE 3.

An important feature of the invention, however, resides in the inwardly projecting longitudinal bead **13**. This bead serves to maintain the end portion of a coupled container **14** in tight frictional contact within the body member **11**. It will be appreciated that in the manufacture of explosive charges packaged in paper containers, it is practically impossible to hold close tolerances in respect to external diameter and particularly in respect to the external diameter of small diameter cartridges. Consequently, a tight frictional fit as desired by attempting to hold the external diameter of a container and the internal diameter of a connecting sleeve within tolerances close enough to achieve the desired effect is a practical impossibility. Superimposed upon the aforementioned condition is that of temperature variation including moisture causing expansion and contraction relative to diameter of the containers. Referring now particularly to FIGURE 4, it will be seen that the bead **13** imparts a wedge-like force to the coupled resilient paper container **14** which is filled with an explosive charge **15**. This wedge-like force imparted by the bead **13** distorts the resilient paper container **14** from its constant radius whereby it is maintained under a spring-like outwardly urged stress in contact with the interior of the body member **11** substantially throughout the entire periphery of its end portion. Thus, in addition to maintaining the end portion of a coupled container in tight frictional contact within the body member, variations in tolerances and in expansion and in contraction are compensated since the spring-like outwardly urged stress is ever present to adjust to these factors.

From the foregoing, it will be appreciated that although a plurality of fins and beads may be used, no additional beneficial purpose is served in having more than three fins or in having more than one inwardly projecting bead or bead-like means such as a wedge or other configuration, since such surplusage detracts from the economy of the device. Accordingly, as an example of a commercially sized preferred embodiment of the invention, the coupling device depicted in FIGURE 1 was formed as a unitary structure by extruding high-density polyethylene characterized by a melt index of 0.2 to 0.7 (I_2 at 190° C.) and then cutting the extruded piece into lengths about 4.25 inches long. The inside diameter of the body member was 0.68 inch (±.005) with a 25 mil wall thickness, and the outside diameter of the fins was 1.50 inches with a 20 mil thickness for the fins. The inwardly projecting bead was semicircular and had a radius of 1/32 inch.

A conventional blasting explosive was packaged in small diameter paper containers and sealed therein using fluted end crimps. The containers were spirally wound kraft or manila paper and were spray coated with paraffin wax. The outside diameter of the containers was 0.680 inch, held as nearly as possible, and the finished packed length was 24 inches.

Coupling devices and the explosive containers hereinbefore described were field tested and found to give exceptional results for smooth contour blasting and particularly for the arch section of rock formations where blasting is carried out in horizontal planes and where heretofore radial fracture damage to the rock was a common occurrence.

Furthermore, it will be appreciated that although high-density polyethylene is preferred for the coupling device, other thermoplastic materials may be used such as polyolefins generally, and copolymers and alloys thereof and other materials such as plasticized vinyl chloride, plasti-

cized vinyl chloride-vinyl acetate copolymer and the like. Similarly, although kraft or manila paper is preferred in accordance with conventional manufacturing practice for small diameter tubes, tubular extrusions, for example, of any of the aforementioned plastics may be used as the container body providing suitable resiliency is maintained as hereinbefore set forth. Ordinarily, container diameters for smooth contour blasting will not exceed about one inch, and the coupling device and size of borehole will be proportionately increased to accommodate any such other sizes.

It will be seen, therefore, that this invention may be carried out by the use of various modifications and changes without departing from its spirit and scope, with only such limitations placed thereon as are imposed by the appended claims.

What we claim and desire to protect by Letters Patent is:

1. A coupling device which is designed to frictionally couple small diameter explosive charges packaged in resilient containers in end-to-end abutting relationship and to center the containers in a larger diameter borehole, the coupling device comprising as a unitary structure of thermoplastic material:

(a) a tubular body member of considerably less length than the length of a container to be coupled,

(b) a plurality of equispaced radial fins extending equidistant from the tubular body member throughout its length, and

(c) inwardly projecting bead-like means within the tubular body member extending throughout its length, said bead-like means being adapted to maintain the end portion of a coupled resilient container

in tight frictional contact within said body member.

2. A coupling device which is designed to frictionally couple small diameter explosive charges packaged in resilient paper containers in end-to-end abutting relationship and to center the containers in a larger diameter borehole, the coupling device comprising as a unitary structure of thermoplastic material:

(a) a tubular body member of considerably less length than the length of a container to be coupled;

(b) three equispaced radial fins extending equidistant from the tubular body member throughout its length, and

(c) an inwardly projecting bead within the tubular body member extending throughout its length, said bead being adapted to maintain the end portion of a coupled resilient container in tight frictional contact within said body member.

3. The coupling device according to claim 2 wherein the radial fins are thin in cross section and flexible so that the fins are yieldable to accommodate minor irregularities and obstructions encountered in the borehole.

4. The coupling device according to claim 2 wherein the thermoplastic material is high density polyethylene.

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