

March 29, 1966

W. E. FOGG

3,242,939

EXPLOSIVE OPERATED SHUT-OFF DEVICE

Filed Sept. 26, 1962

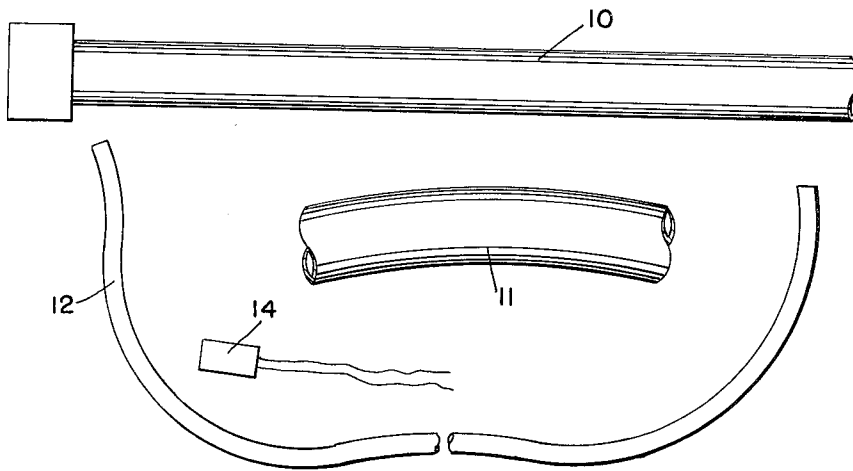


FIG. 1.

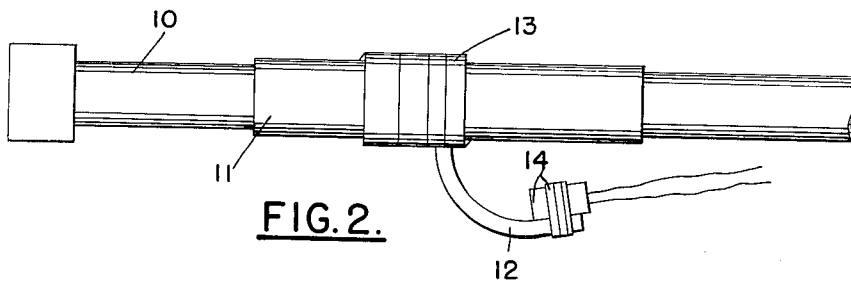


FIG. 2.

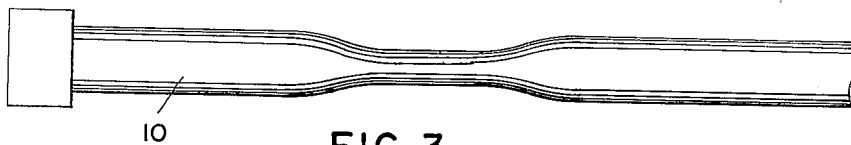


FIG. 3.

INVENTOR.
WARREN E. FOGG
BY *S. J. Rotondi,*
a. J. Dupont & S. Duboff
ATTORNEYS.

1

3,242,939

EXPLOSIVE OPERATED SHUT-OFF DEVICE

Warren E. Fogg, Philadelphia, Pa., assignor to the United States of America as represented by the Secretary of the Army

Filed Sept. 26, 1962, Ser. No. 227,640

2 Claims. (Cl. 137-67)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to an explosive operated shut off device for use in a straight through pipe of yieldable material and capable of being operated more quickly than a mechanical valve necessarily having substantial mass and inertia and requiring usually an offset or bend in the pipe. An object is to provide such a shut off device capable of being operated quickly in a straight through pipe. Another object is to provide such a device capable of closing a pipe in as short a time as about 25 microseconds.

The need for this particular shut off arose in connection with obtaining sequential samples of gas for analysis after a sample had been sealed in a tube, although the need for a quick acting shut off valve device is said to have been much older. The drawing exemplifies a preferred apparatus for attaining the above result.

FIG. 1 shows the materials before assembly for their intended use.

FIG. 2 illustrates the materials of FIG. 1 in position for the quick closure of the pipe but without the tape for holding such materials in their set position.

FIG. 3 represents the pipe after it has been closed.

FIG. 1 illustrates a tube 10 of aluminum having a half inch outside diameter with a wall thickness of .065 inch, the particular pipe being known as 3003 with a hardness of H14 having a tensile strength of 15,000 pounds per square inch. A rubber tube 11 having a half inch inside diameter with a wall thickness of an eighth of an inch and about 4 inches in length is slid over the tube 10 to the place where closure by substantially uniform collapse of the tube is desired. A detonating cord 12 known as Primacord about 18 inches long and containing 30 grains per foot of a detonator known as PETN (pentaerythritol tetranitrate) enclosed in a protective covering is wound in about 5 tight helical turns 13 with its convolutions substantially contiguous one another over the rubber sleeve 11 as shown in FIG. 2. Over this is wound enough of any friction or adhesive tape to hold the foregoing parts in their intended position, such tape being unnecessary to show inasmuch as the quantity or kind of tape is not important so long as it holds the above mentioned elements in place. About 2 inches of the Primacord is left uncovered by the tape as a suitable length for attachment of a detonator 14 or primer either electrical or percussion type, for firing the Primacord in ways known to the detonating cord art.

The exact occurrence on firing the detonating cord is uncertain. It is believed a shock or pressure wave of

2

high velocity moves radially inward (as well as outward) from the helical detonating cord compressing the rubber sleeve and the deformable aluminum tube walls substantially uniformly and under enough pressure to tightly compact the tube walls so that there is no longer any opening within or through them. This is so not only to appearance but also to test when air under pressure is supplied to the pipe immersed in water. No leakage through the pipe or its walls has been found. A hermetic seal has been formed quickly and in about 25 microseconds by the explosive. The high speed with which this closure has been formed is thought to be a distinguishing characteristic of the apparatus disclosed.

When less easily deformable material such as stainless steel and mild steel have been sought to be closed in tubular form cracks have appeared which are thought to be the result of the impact of the very high velocity pressure wave. It seems safe to believe that the rubber sleeve functions to absorb much of the shock of the pressure wave, because without such sleeve results are less desirable and more likely to form cracks. Other cushioning materials than rubber are suitable and one such is neoprene. No other tubular materials have been satisfactorily tried but it is believed soft copper, lead, suitable plastic pipes, and other readily deformable materials should be capable of being closed in the same manner. The detonator 14 may abut the end of Primacord 12 or may overlap some of it as in FIG. 2 when attached by tape or other known ways.

I claim:

1. An explosive operated shut-off device for a straight through pipe of yieldable material comprising a yieldable sleeve slidable over said pipe a detonation cord helically wound around said sleeve with the convolutions of said cord substantially contiguous one another, and a primer for firing said detonation cord, said detonation cord containing an effective amount of explosive to completely shut off the pipe when the detonation cord is fired.

2. A combination according to claim 1 in which said pipe is of aluminum known as 3003 H14 having an ultimate tensile strength of about 15,000 pounds per square inch, said pipe having an outside diameter of about half an inch with a wall thickness of about 0.065 inch, said sleeve being of rubber having a wall thickness of about 1/8 of an inch and a length to extend beyond the convolutions of said cord, said detonation cord containing 30 grains of PETN (pentaerythritol tetranitrate) per foot with about 5 convolutions of said cord wrapped around, said PETN being present in an effective amount to completely shut off said pipe on firing.

References Cited by the Examiner

UNITED STATES PATENTS

2,367,206 1/1945 Davis ----- 113-44 X

ISADOR WEIL, *Primary Examiner.*

J. DEATON, *Assistant Examiner.*