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 [21] Appl. No. **54,913**
 [22] Filed **July 15, 1970**
 [45] Patented **Dec. 21, 1971**
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[54] **BIDIRECTIONAL INERTIA-RESPONSIVE GAS-
 DISPENSING APPARATUS**
 3 Claims, 1 Drawing Fig.

[52] U.S. Cl. 137/38,
 280/150 AB

[51] Int. Cl. F16k 17/36

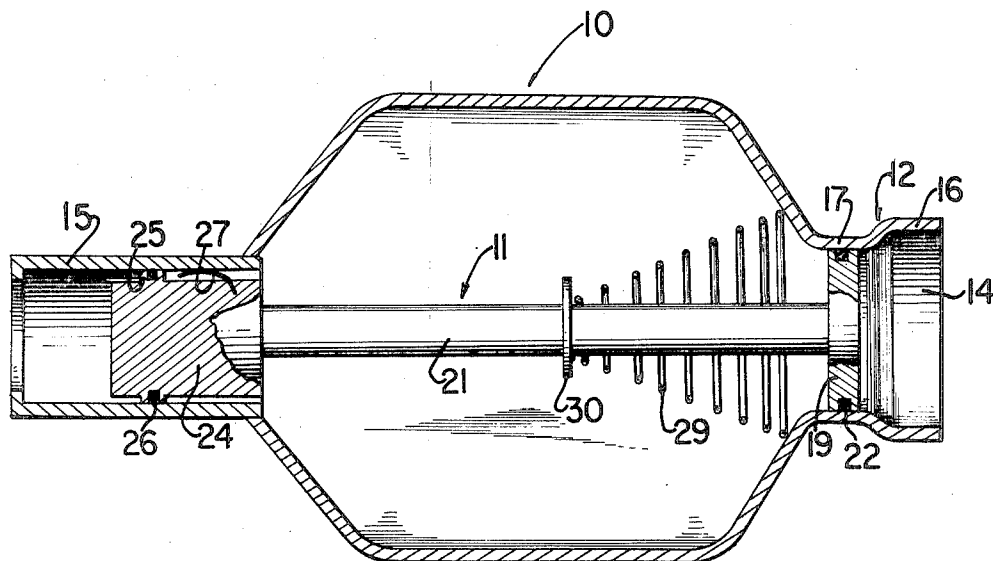
[50] Field of Search 137/38, 39,
 45, 46, 48; 296/84 K; 280/150 AB; 222/500

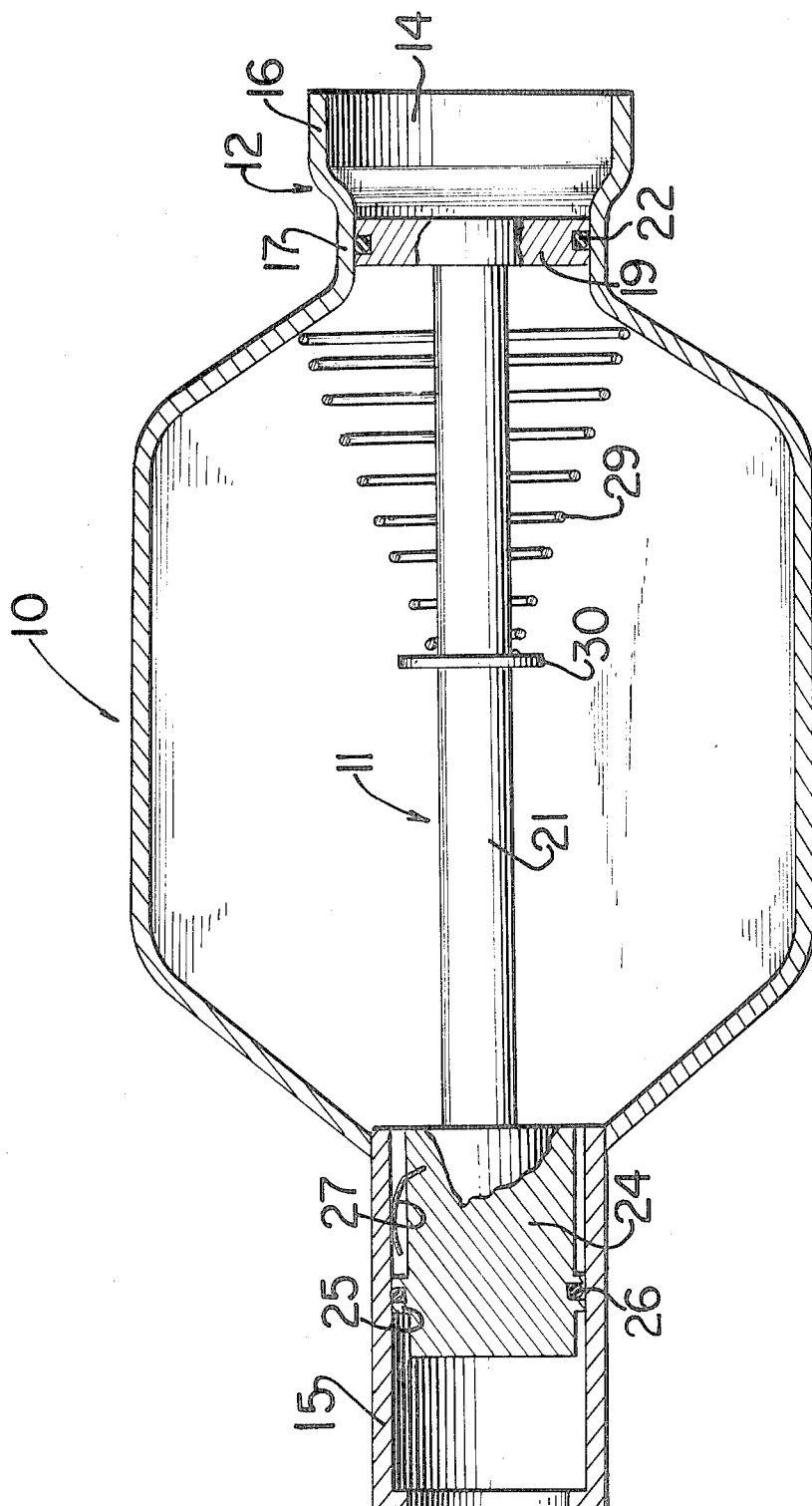
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UNITED STATES PATENTS

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ABSTRACT: Apparatus for dispensing pressurized gas in response to a front or rear end collision including a container having an outlet opening and an open ended tubular member aligned with the outlet providing a second opening. A valve member extending between the openings has a large diameter piston normally sealing the outlet and a smaller diameter piston sealing the second opening. Movement of the valve member in either axial direction moves the large diameter piston out of the outlet to discharge the container. A spring is provided to hold the valve member in the closed position against the differential pressure force acting on the large diameter piston. When the container is rapidly decelerated or accelerated along the axis of the valve member, the inertia of the valve member causes it to be displaced opening the outlet to permit discharge of the container.





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BIDIRECTIONAL INERTIA-RESPONSIVE GAS-DISPENSING APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to apparatus for supplying fluid medium under pressure in response to a sudden change in velocity of the apparatus.

In recent years a great deal of attention has been devoted to safety systems and devices for protecting the occupants of passenger vehicles, particularly automobiles. One type of system which is currently being given serious consideration employs an inflatable bag or envelope which is stored in a deflated condition, usually in front of the occupant (for example under the dashboard of an automobile). When the vehicle experiences very rapid deceleration such that the occupant would be thrown forward (for example against the dash or windshield), gas stored under pressure is automatically released and the bag is inflated to restrain and cushion the occupant.

The majority of the systems which have been previously proposed have employed electrically detonated explosive charges for rapidly releasing the stored gas. The explosive charge is connected to an electrical circuit which includes an inertia responsive electrical switch that closes in response to a predetermined rate of deceleration.

In my copending application Ser. No. 862,687, filed Oct. 1, 1969, and assigned to the assignee of the present application, there is disclosed apparatus for inflating such bags which does not require an explosive charge or an inertia responsive electrical switch. Instead, the container of pressurized gas is provided with an inertia-responsive valve. The container is provided with an outlet opening connected to the inflatable bag and a second opening defined by a tubular formation aligned with the outlet. A valve member is positioned in the container to seal both openings. One end of the valve member is provided with a large area piston which fits into the outlet opening and the other end is provided with a piston of lesser area which fits into the tubular formation. A stop member is provided at the outlet opening. The valve member is held in the closed position against the stop member by the pressure within the container. When the vehicle experiences a dangerously rapid deceleration, the inertia of the valve member overcomes the pressure imbalance on the valve member and the valve member moves with respect to the container away from the outlet opening. The large piston moves out of the outlet and the container discharges inflating the bag in front of the occupant.

It is also desirable to protect the passenger in case of a rear end collision resulting in a dangerously rapid acceleration. Immediately following a serious rear end collision, the passenger would be driven against the seat back rest and would then rebound and be propelled forward toward the dashboard. Inflation of the air bag under these conditions would protect the passenger against injury as a result of this rebound.

SUMMARY

Accordingly, it is an object of the present invention to provide apparatus for supplying fluid medium under pressure in response to both a decrease and an increase in velocity.

It is another object to provide such apparatus which is simple and inexpensive.

The foregoing objects are accomplished by providing apparatus which comprises a container of fluid medium under pressure having an outlet opening and an open ended tubular member aligned with the outlet to provide a second opening, valve means including a valve member having a first end portion normally positioned to seal the outlet and a second end portion within the tubular member to seal the second opening, the valve member having a predetermined mass and being movable toward the tubular member to an operated position in response to a change in velocity in one direction and being movable toward the outlet to a second operated position in response to a change in velocity in the opposite direction, the first end portion being positioned to open the outlet when the

valve member is in the operated positions, the valve means including means for normally holding the first end portion in its normal position.

DESCRIPTION OF THE DRAWING

A preferred embodiment of the invention has been shown for the purposes of illustration and description forming a part of the specification, wherein:

The single FIGURE of the drawing is a longitudinal sectional view of apparatus according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, there is shown apparatus for supplying fluid medium under pressure which includes a container 10 and an inertia-actuated valve member 11 positioned within the container.

The container 10 is generally cylindrical and is provided with a neck 12 at one end defining an outlet opening 14 and an open-ended tubular extension 15 at the other end. The tubular extension 15 is in alignment with the outlet opening 14 and provides a second opening in the container. The neck 12 has a wide mouth portion 16 and an inner smaller diameter portion 17 for cooperating with the valve member to seal the outlet.

The valve member 11 includes a piston 19 normally positioned within the neck portion 17, a piston 20 positioned within the tubular extension 15, and a rod 21 connecting the pistons 19 and 20. The piston 19 is of a larger diameter than the piston 20 so that the valve member 11 is pressure biased to the right as viewed in the drawing. An "O" ring 22 is positioned in an annular recess formed around the outer periphery of the piston 19 to provide a seal between the piston and the neck portion 17. The piston 20 has a body portion 24 having a diameter significantly less than the inner diameter of the tubular extension 15 and a radially extending annular formation 25 carrying an "O" ring 26 for sealing between the piston 20 and the extension 15. A spring 27 is embedded in the body portion 24 and normally is flexed to extend along the inner surface of the extension 15.

A conical spring 29 surrounding the rod 21 is seated against that end of the container 10 containing the outlet 14 and engages a flange 30 provided on the rod 21.

For use in the protection of a vehicle passenger, the container 10 would be normally mounted in front of the passenger with the tubular formation 15 pointing toward the front of the vehicle. An inflatable bag would be attached to the neck 12 to be deployed toward the passenger upon inflation.

When the container is pressurized, either through the outlet 14 or through a separate fill port not shown, the pressure imbalance urging the valve member 11 toward the right is resisted by the spring 29 to hold the piston 19 in sealing relationship with the neck portion 17.

As described below, the apparatus will operate to discharge the container when either of two conditions exist. When the velocity of the container 10 (in the direction in which the extension 15 is pointing) is decreased at a dangerous rate, the inertia of the valve member overcomes the differential pressure acting on the piston 19 and the valve member moves toward the left (as viewed in the drawing) opening the outlet to discharge the container. When the velocity of the container, in this same direction, is increased at a dangerous rate, as would be the case in the event of a rear end collision, the valve member 11 moves toward the right against the force of the spring until the piston 19 is positioned within the mouth 16. The spring strip 27 is then moved out of the extension 15 and snaps outwardly to engage the wall of the container and hold the valve member 11 in this position as the container discharges.

It will be seen from the foregoing that the present invention provides simple and inexpensive apparatus for supplying fluid medium in response to both a decrease and an increase in velocity.

I claim:

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1. Apparatus for supplying fluid medium under pressure in response to either an increase or a decrease in velocity comprising in combination a container of fluid medium under pressure having an outlet opening and an open ended tubular member aligned with said outlet opening to provide a second opening, and valve means including a valve member having a first end portion normally positioned in said outlet for sealing said outlet and a second end portion within said tubular member for sealing said second opening, said valve member having a predetermined mass and being movable in the direction of said tubular member to a first operated position in response to a change in velocity in one direction and being movable in the direction of said outlet to a second operated position in response to a change in velocity in the opposite

direction, said first end portion being positioned to open said outlet when said valve member is in said first and second operated positions, said valve means including means for normally holding said first end portion in said normal position.

2. Apparatus according to claim 1 wherein said last-mentioned means includes piston means carried by said valve member to bias said valve member in one direction and spring means for balancing the action of said piston means.

3. Apparatus according to claim 2 wherein said first end portion of said valve member includes a piston member and said outlet has a portion into which said piston fits in sliding and sealing relationship.

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