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PRESSURE-OPERATED ORDNANCE DEVICE

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FIG. 1

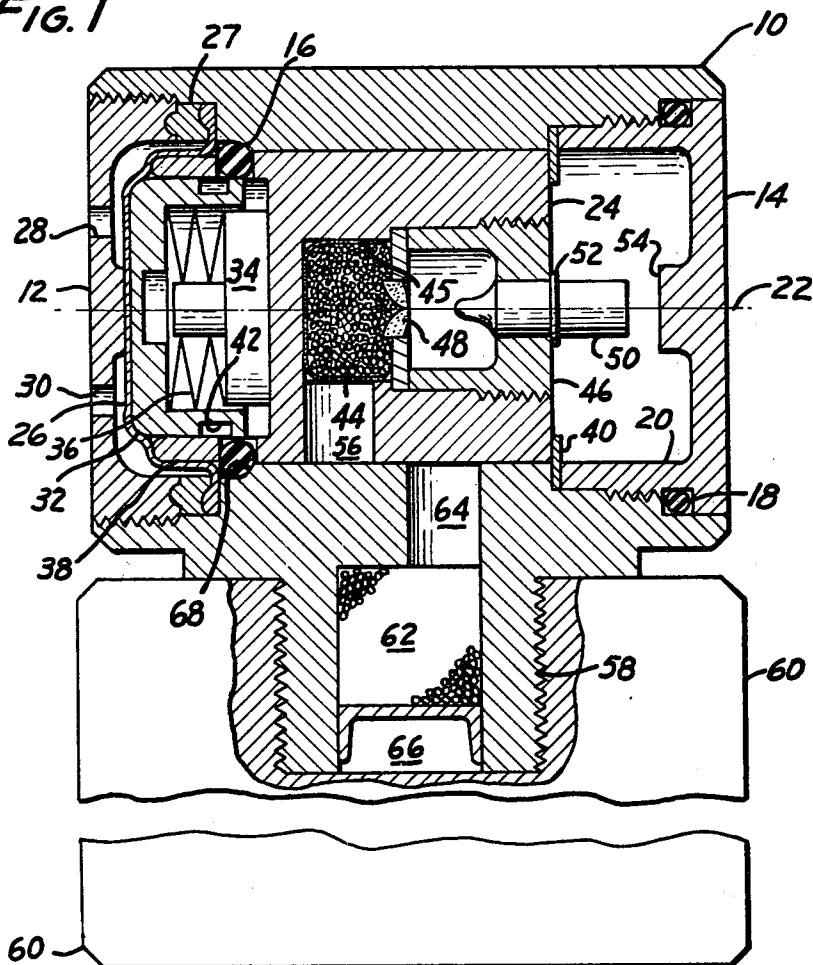
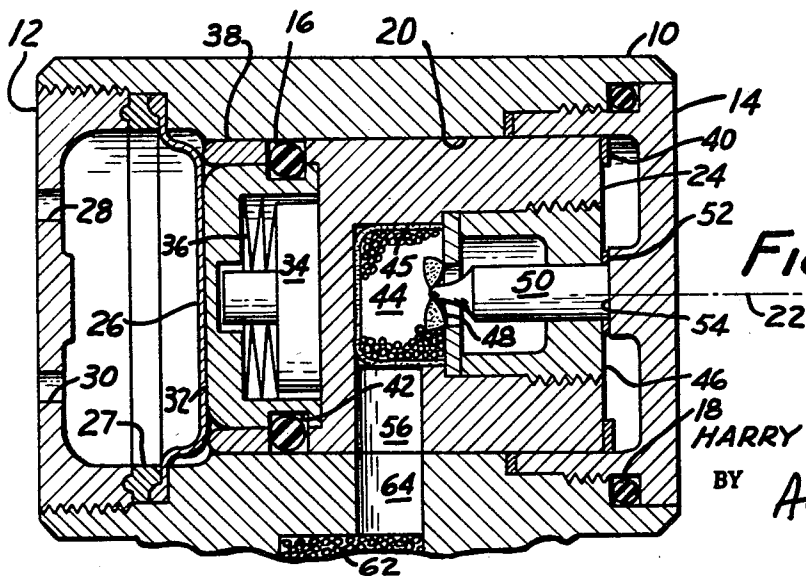


FIG. 2



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PRESSURE-OPERATED ORDNANCE DEVICE
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4 Claims. (Cl. 102-7)

ABSTRACT OF THE DISCLOSURE

This disclosure relates to pressure-operated ordnance devices. A pressure-operated ordnance device according to the present disclosure comprises a housing having a cylinder disposed therein. A piston is slidably mounted in the cylinder and supports a gas release means. Pressure-operable means operates in response to a predetermined pressure to move the piston from a first to a second position in the cylinder. Firing means is provided to actuate the gas release when the piston is moved to its second position. Passage means is provided to provide fluid communication between the gas release means and an external location when the piston is in its second position.

This invention relates to pressure-operated ordnance devices.

It is an object of the present invention to provide a pressure-operated ordnance device which may be initiated by environmental pressure. An ordnance device according to the present invention is particularly useful in situations where environmental pressure changes in accordance with some physical factor and the ordnance device is intended to be operated when the physical factor is at a preselected level. For example, depth charges and other marine bombs are intended to be actuated at certain specific depths. Since fluid pressure increases in relation to depth in fluid, the ordnance device according to the present invention is useful for actuating marine bombs at some preselected depth.

A pressure-operated ordnance device according to the present invention comprises a housing having a cylinder disposed therein. A piston is slidably mounted within the cylinder and pressure-operable means operates in response to a predetermined pressure to move the piston through the cylinder to a second position. Gas-release means is supported by the piston, and a passage provides fluid communication between the gas-release means and an external location when the piston has moved to its second position. Upon application of the predetermined pressure to said pressure-operable means, the piston moves to its second position, thereby bringing the gas release means into communication with the external location. Firing means is provided to actuate the gas release means, thereby permitting the gas release to release gas through the said passage. An external detonator or other utility device may be actuated by the released gas in the passage.

The above and other features of this invention will be fully understood from the following detailed description and the accompanying drawings, in which:

FIG. 1 is a side elevation partly in cutaway cross-section of the preferred form of an ordnance device according to the present invention; and

FIG. 2 is a side elevation as in FIG. 1 with the ordnance device illustrated in another position.

In the drawings there is illustrated an ordnance device having a housing 10 into which caps 12 and 14 are threaded at each end and sealed by seals 16 and 18, respectively. Axial cylinder 20 is formed about axis 22

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within housing 10 and cap 14. Piston 24 is slidably mounted within cylinder 20.

Resilient disk 26, which may be formed from rubber, is mounted within housing 10, spaced from cap 12 by spacer 27, and is in fluid communication with the environmental pressure through apertures 28 and 30. A plunger arrangement comprising housing 32, plunger 34, spring bias 36 and slidable ring 38 is mounted within housing 10 adjacent disk 26. When in the position illustrated in FIG. 1, plunger housing 32 is to the left, and spring bias means 36 urges plunger 34 to the right, thereby urging piston 24 to the right. Shear ring 40 is mounted within cylinder 20 and between housing 10 and plug 14 to position piston 24. Seal ring 16 provides a fluid seal between housing 10, plunger housing 32 and ring 38. Annular recess 42 is provided within plunger housing 32 for purposes to be hereinafter explained.

An explosive squib or other gas release means 44 is mounted within chamber 45 in piston 24 and is held in place by plug 46. Firing cap 48 is mounted to piston 24 adjacent the gas release means and is adapted to actuate the gas release means. Firing pin 50 is slidably mounted within plug 46 and held away from the piston cap by integral shear ring 52. Shoulder 54 is provided on cap 14 and is adapted to contact and move firing pin 50 through plug 46 to actuate firing cap 48 when piston 24 and plug 46 move to the right, as shown in the drawings.

Passage 56 is formed through one wall of piston 24 to gas release means 44. Housing 10 is provided with a threaded neck 58 for attachment to a suitable utility device such as depth charge 60. Detonator device 62 is mounted within neck 58 and communicates with cylinder 20 by passage 64. Detonator 62 is in communication with depth charge 60 through channel 66.

When the ordnance device is in the position illustrated in FIG. 1 and the environmental pressure surrounding housing 10 is insufficient to operate it, spring bias means 36 biases plunger housing 32 and piston 24 apart. The movement of housing 32 to the left is restricted by cap 12, and the movement of plunger 34 to the right is restricted by piston 24. Shear ring 40 retains piston 24 in position. Seal ring 16 is sandwiched between shoulder 68 in housing 10 and ring 38, thereby preventing movement of the ring. Passages 56 and 64 are occluded in such a manner that the wall of cylinder 20 acts as a valving wall between them.

When sufficient environmental pressure is imparted to resilient disk 26 through apertures 28 and 30, the force imposed by the pressure on housing 32, which equals the product of the environmental pressure and the surface area of plunger housing 32 adjacent disk 26, overcomes the spring bias provided by spring 36 so as to move plunger housing 32 to the right, as shown in the drawings, into abutment with piston 24. Annular recess 42 is moved adjacent to seal ring 16, which contracts into the recess and free of shoulder 68 of housing 10. Since the force available to move piston 24 equals the product of the pressure on disk 26 and the surface area of housing 32 and ring 38 adjacent disk 26, it can be readily understood that for the same operating environmental pressure, more force is available to move piston 24 than is used to move housing 32. Seal ring 16 and annular recess 42 act as a detent release means to provide the additional operating area for the environmental pressure. Shear ring 40 is adapted to fracture when subjected to a force less than the force derived from the environmental pressure on both housing 32 and ring 38.

When piston 24 is moved sufficiently to the right, firing

pin 50 is brought into contact with shoulder 54 and shear ring 52, which is provided for retention of pin 50, fractures. Piston 24 and plug 46 slide over firing pin 50 until the pin pierces firing cap 48, thereby actuating gas discharge means 44. At the same time, passage 56 is brought into alignment with passage 64 so that the gas released from the gas release means is expelled through the passages to detonator 62. The detonator then operates to actuate the depth charge 60.

The present invention thus provides a pressure-operated ordnance device which is safe to use and easily manufactured. The device operates with a positive action due to the release of the detent release means provided by ring 16. When the device is subjected to a predetermined pressure, the ring releases to increase the force on the piston, thereby moving the piston to fire the ordnance device.

This invention is not to be limited by the embodiment shown in the drawings and described in the description, which is given by way of example and not of limitation, but only in accordance with the scope of the appended claims.

I claim:

1. A pressure-operated ordnance device comprising: a first housing having an axis; a cylinder axially disposed in said first housing; piston means slidably mounted in said cylinder; pressure-operable means mounted in said first housing adapted to move said piston from a first to a second position in said cylinder when said pressure-operable means is subjected to a predetermined external pressure, said pressure-operable means comprising disk means mounted in said first housing; means providing fluid communication between environmental fluid and said disk means, said disk means being movable from a first to a second position upon application of a predetermined environmental pressure, thereby to move said piston from its first to its second position; a plunger in said first housing adjacent to said piston; a plunger housing in said first housing adjacent to said disk means; seal means providing a fluid seal between said cylinder and said plunger housing when said piston is in its said first position, an annular recess on said plunger housing; ring means adjacent said disk means and substantially surrounding said plunger housing, said annular recess being positioned adjacent said seal means when said disk means is in its second position; a shoulder on said first housing contacting said seal means when the disk means is in its first position, said seal means restraining movement of said ring means when the seal means is contacting said shoulder, whereby when said disk means moves from its first to its second position, said seal means moves from

contact with said shoulder and into said recess, thereby releasing said ring means to increase force on the piston to thereby move the piston to its second position; gas release means in said first housing and carried by said piston; passage means through the first housing providing fluid communication between said gas release means and a location external from said cylinder when said piston is in its second position; and firing means adapted to actuate said gas release means when said piston is moved to its second position, said gas release means thereby releasing gas through said passage, whereby upon application of said predetermined pressure on said pressure-operable means, said pressure-operable means moves said piston from its first to its second position thereby actuating the gas release means, and said gas release means releases gas through said passage to said location external from said cylinder.

2. A pressure-operated ordnance device according to claim 1 wherein said pressure-operable means further includes bias means for biasing said disk means against the environmental fluid, whereby said predetermined environmental pressure produces a force to overcome the bias provided by said bias means to move said disk means from its first to its second position.

3. A pressure-operated ordnance device according to claim 2 wherein said passage means comprises a first passage communicating between said gas release means and a wall of said cylinder, and a second passage communicating between a wall of said cylinder and said location external from said cylinder, said first and second passages being occultated when the piston is in its first position and being in communication when said piston is in its second position.

4. A pressure-operated ordnance device according to claim 3 wherein said firing means comprising a firing cap mounted in said piston adjacent to said gas release means, and a firing pin mounted adjacent said firing cap, said firing pin being adapted to actuate said firing cap when the piston moves to its second position.

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