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(71) Applicant: **MOTOROLA ISRAEL LIMITED**
16 Kremenetski Street
Tel Aviv 67899(IL)

(72) Inventor: **Prines, Alexander**
4 Aronson
Ramat Gan 52293(IL)

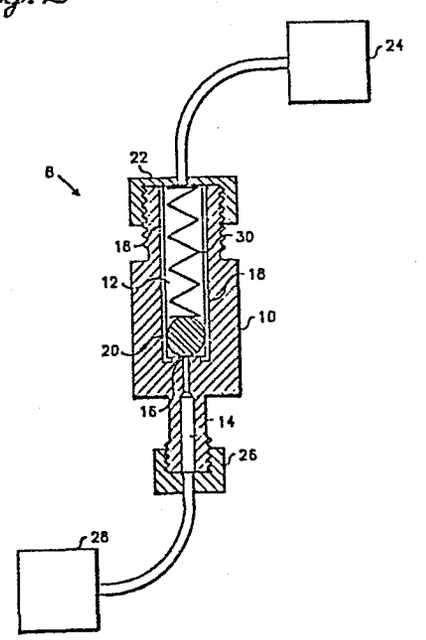
(74) Representative: **Hudson, Peter David et al,**
Motorola Inc. Patent and Licensing Operations - Europe
Jays Close Viables Industrial Estate
Basingstoke Hampshire RG22 4PD(GB)

(54) Bomb arming control arrangement.

(57) A control arrangement (8) for controlling the arming of a bomb comprises: predetermined delay means (28) for delaying the arming of the bomb for a predetermined time after an arm signal is applied to the predetermined delay means, and force sensitive delay means (10-22, 26-30) for delaying the application of an arm signal to the predetermined delay means until the forces on the bomb have reached a predetermined level.

The arming of the bomb is thus automatically delayed, in addition to the fixed hold-off time provided by the predetermined delay means, by whatever hold-off time is necessary for the bomb to enter the downward part of its trajectory.

Fig. 2



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TITLE

BOMB ARMING CONTROL ARRANGEMENT

FIELD OF INVENTION

This invention relates to arrangements for controlling the arming of bombs.

BACKGROUND OF INVENTION

Typically, in airborne bomb delivery a bomb is equipped with an impact fuze and in order to allow a safe separation between the bomb and the aircraft from which it is delivered, the bomb is equipped with a "hold-off" delay timer which delays the arming of the bomb fuze for a predetermined time after the bomb leaves the aircraft. In principle the "hold-off" time can be pre-set to any desired duration, but in practice only two different "hold-off" times are commonly used: a short "hold-off" time, typically two seconds, for "dive" or downwardly-directed deliveries, and a long "hold-off" time, typically ten seconds, for "loft" or upwardly projected deliveries.

Conventionally, the bomb "hold-off" time is set before aircraft take-off. This procedure has two disadvantages. Firstly, after the aircraft has left the ground, the pilot must adhere to his expected mode of bomb delivery; he cannot change from "dive" delivery mode to "loft" or vice versa, even if battle or terrain conditions so dictate. Secondly, if by mistake the ground crew do not set the "hold-off" time to the proper duration the bomb will either be armed too soon after delivery

(possibly exploding near the delivery aircraft) or armed too late (possibly striking its target while disarmed and failing to explode).

It is an object of this invention to provide a control arrangement for controlling the arming of a bomb wherein the above disadvantages may be overcome or at least alleviated.

BRIEF SUMMARY OF INVENTION

In accordance with the invention a control arrangement for controlling the arming of a bomb comprises predetermined delay means for delaying arming of the bomb for a predetermined time after an arm signal is applied to the predetermined delay means, and wherein the control arrangement further comprises force sensitive delay means for delaying the application of an arm signal to the pre-determined delay means until the forces on the bomb have reached a predetermined level. It will be appreciated that when a bomb is delivered in loft mode, the forces acting on the bomb in the "loft" part of its trajectory are different from those acting on the bomb during the "dive" part of its trajectory. In a control arrangement in accordance with the invention the force sensitive delay means delays the application of an arm signal, via the predetermined delay means, until the forces on the bomb indicate that the bomb is in the dive part of its trajectory. This allows the predetermined delay means to be set to a single short hold-off time, any required additional delay being automatically provided by the force sensitive delay means in dependence on the particular bomb delivery mode actually employed.

BRIEF DESCRIPTION OF THE DRAWINGS

Two control arrangements in accordance with the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows the trajectories associated with two different modes of bomb delivery from an aircraft;

Figure 2 shows a cross-sectional view of part of a first control arrangement in accordance with the invention; and

Figure 3 shows a cross-sectional view of part of a second control arrangement in accordance with the invention.

Referring firstly to Figure 1, two bomb trajectories A and B are shown. The trajectories A and B are associated respectively with dive and loft modes of bomb delivery from an aircraft 2. In the dive mode of delivery the aircraft dives towards its target 4 and releases its bomb 6 while diving. The bomb 6 then follows the part-parabolic trajectory A to the target 4. In the loft mode of delivery the aircraft climbs as it approaches the target 4 and releases its bomb 6 while climbing. The bomb 6 then follows the fuller parabolic trajectory B to its target 4.

Before the bomb is released from the aircraft, the bomb is kept unarmed, for reasons of obvious safety, and an arm signal is applied to the bomb as it is released. However, in order to allow sufficient time for the bomb to clear the releasing aircraft 2 before it is actually armed, a time delay is introduced between the arm signal

being applied to the bomb and the bomb actually becoming armed. It will be understood that a longer time delay is required for loft delivered bombs (typically ten seconds) than for dive delivered bombs (typically two seconds).

Referring now also to Figure 2 a first control arrangement 8 for controlling the arming of a bomb includes a body 10 having a cylindrical passage 12 therein at its top and a smaller, co-axial passage 14 in its bottom. The passage 14 communicates with the passage 12 at an orifice 16. The passage 12 is provided along its length with two diametrically opposite channels 18 in its wall.

A sphere 20, of substantially the same diameter as that of the passage 12, is provided in the passage. The passage 12 is closed by a cap 22 which connects the passage to a switched source of pressurised air 24 which produces the arm signal for the bomb. The passage 14 is closed by a cap 26 which connects the passage to a pressure sensing time delay device 28. A compression spring 30 biases the sphere 20 towards the orifice 16 to close the orifice.

In use the first control arrangement 8 is fastened to the body of a bomb 6 so that the sphere 20 is sensitive to the acceleration and gravitation forces acting on the bomb.

As the bomb is released from the aircraft 2, positive air pressure (the arm signal) is applied to the passage 12 and passes through the grooves 18 around the sphere 20 towards the orifice 16. If the bomb is climbing, i.e. if the bomb was delivered in loft mode and is in the upward part of its trajectory, the acceleration and gravitation forces on the sphere 20 cause it to close the orifice 16 and prevent the arm signal from being applied through the

passage 14 to the delay device 28. However, if the bomb is falling, i.e. if the bomb was delivered in loft mode and is in the downward part of its trajectory or if the bomb was delivered in dive mode, the acceleration and gravitation forces on the sphere 20 cause it to move away the orifice 16 and open the orifice to allow the arm signal to be applied through the passage 14 to the delay device 28. When the arm signal is applied to it, the delay device 28 delays the arming of the bomb for a predetermined time equal to the minimum acceptable hold-off time, e.g. two seconds.

Referring now to Figure 3, a second control arrangement 32 for controlling the arming of a bomb includes a body 34 having a wide cylindrical chamber 36 enclosed within its top which communicates with a narrow cylindrical passage 38 at its bottom. Part-way along its length the passage 38 communicates with a narrow lateral passage 40 at an orifice 42. The passage 40 is closed by a plug 44 which connects the passage to the switched source of pressurised air 24 as in the first control arrangement, and the passage 38 is closed by a plug 46 which connects the passage to the time delay device 28 as in the first control arrangement.

A piston 48 has a disc portion 50 located wholly within the chamber 36 and an integral shaft portion 52 extending from the disc portion 50 into the passage 38. The disc portion 50 is provided with a hole 54 therethrough to allow air to pass from one side of the disc to the other, and the shaft portion 54 is provided with a number of longitudinally spaced annular lands 56 which seal the passage 38.

In use the second control arrangement 32 is fastened to the body of a bomb 6 so that the piston 48 is sensitive

to the acceleration and gravitation forces acting on the bomb.

As the bomb is released from the aircraft 2, positive air pressure (the arm signal) is applied to the passage 40. If the bomb is climbing the acceleration and gravitation forces on the piston 48 cause it to move downwards so that at least one of the lands 56 seals the orifice 42 from the lower part of the passage 38 and the arm signal is prevented from being applied through the lower part of the passage 38 to the delay device 28. However, if the bomb is falling the acceleration and gravitational forces on the piston 48 cause it to move upwards and open the orifice 42 to the lower part of the passage 38 to allow the arm signal to be applied through the lower part of the passage 38 to the delay device 28.

It will be appreciated that in both of the above described control arrangements the arming of the bomb is automatically delayed, in addition to the minimum delay of approximately two seconds, by whatever hold-off time is necessary for the bomb to enter the downward part of its trajectory. Hence, because there is no need to determine the required hold-off time before aircraft take-off, flexibility in the choice of bomb delivery mode is provided and the risk of error in wrongly pre-setting the hold-off time is avoided.

CLAIMS

1. A control arrangement (8; 32) for controlling the arming of a bomb (6), comprising:

predetermined delay means (28) for delaying arming of the bomb for a predetermined time after an arm signal is applied to the predetermined delay means,

and characterised in that the control arrangement further comprises force sensitive delay means (10-22, 26-30; 34-56) for delaying the application of an arm signal to the predetermined delay means until the forces on the bomb have reached a predetermined level.

2. A control arrangement according to claim 1 wherein the arm signal is a pneumatic signal and the force sensitive delay means comprises:

a body (10; 34) having a first passage (12; 40) for receiving the arm signal, a second passage (14; 38) for communicating the arm signal to the predetermined delay means, and an orifice (16; 42) joining the first and second passages; and

a sealing member (20; 48) which is normally in a first position where the sealing member seals the orifice and which moves when the forces on the bomb reach the predetermined level to a second position where the sealing member opens the orifice.

3. A control arrangement according to claim 2 wherein the sealing member (20) is substantially spherical.

4. A control arrangement according to claim 3 wherein the force sensitive delay means further comprises spring biasing means (30) for biasing the sealing member towards

the first position.

5. A control arrangement according to claim 2 wherein the sealing member (48) comprises:

a first portion (50) located in and movable within a chamber (36) in the body; and an integral second portion (52) extending from the first portion to the orifice (42), the second portion being provided with sealing means (56) for sealing the orifice when the sealing member is in the first position and for opening the orifice when the sealing member is in the second position.

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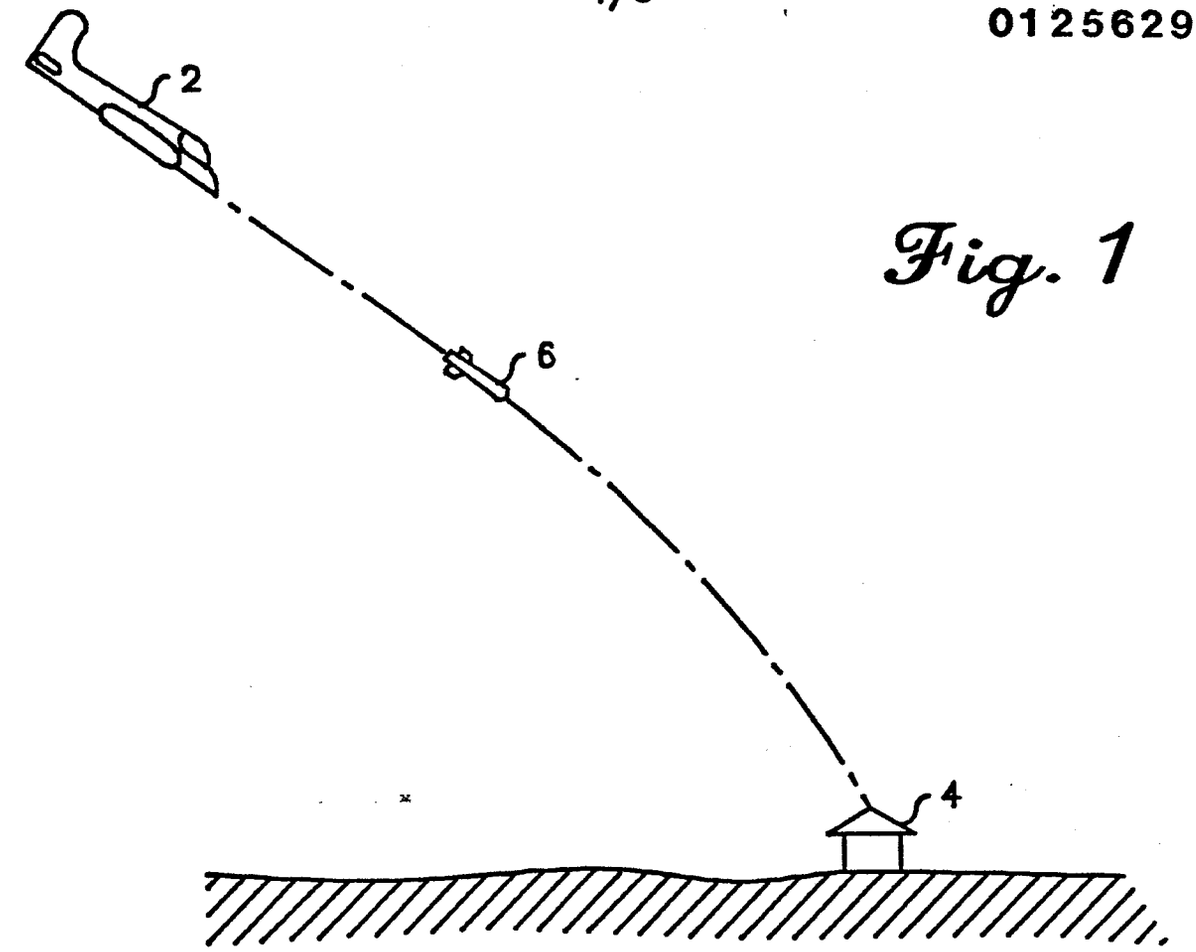

Fig. 1

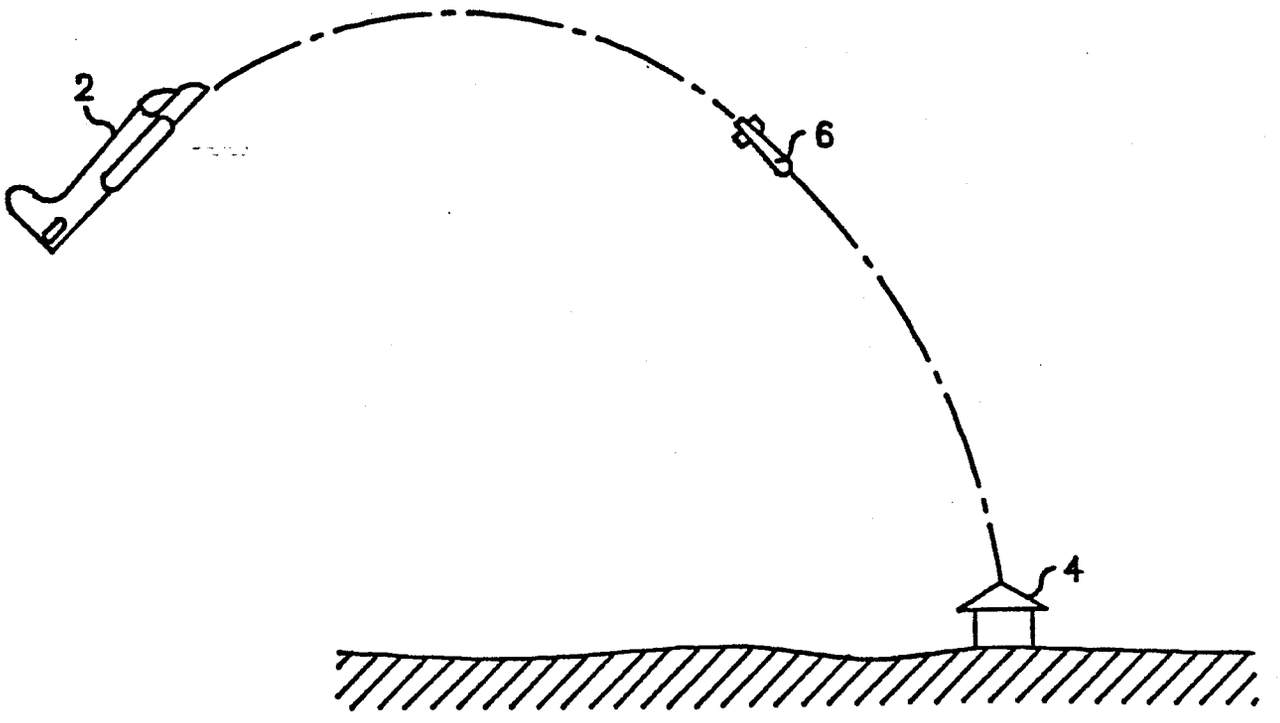

Fig. 2

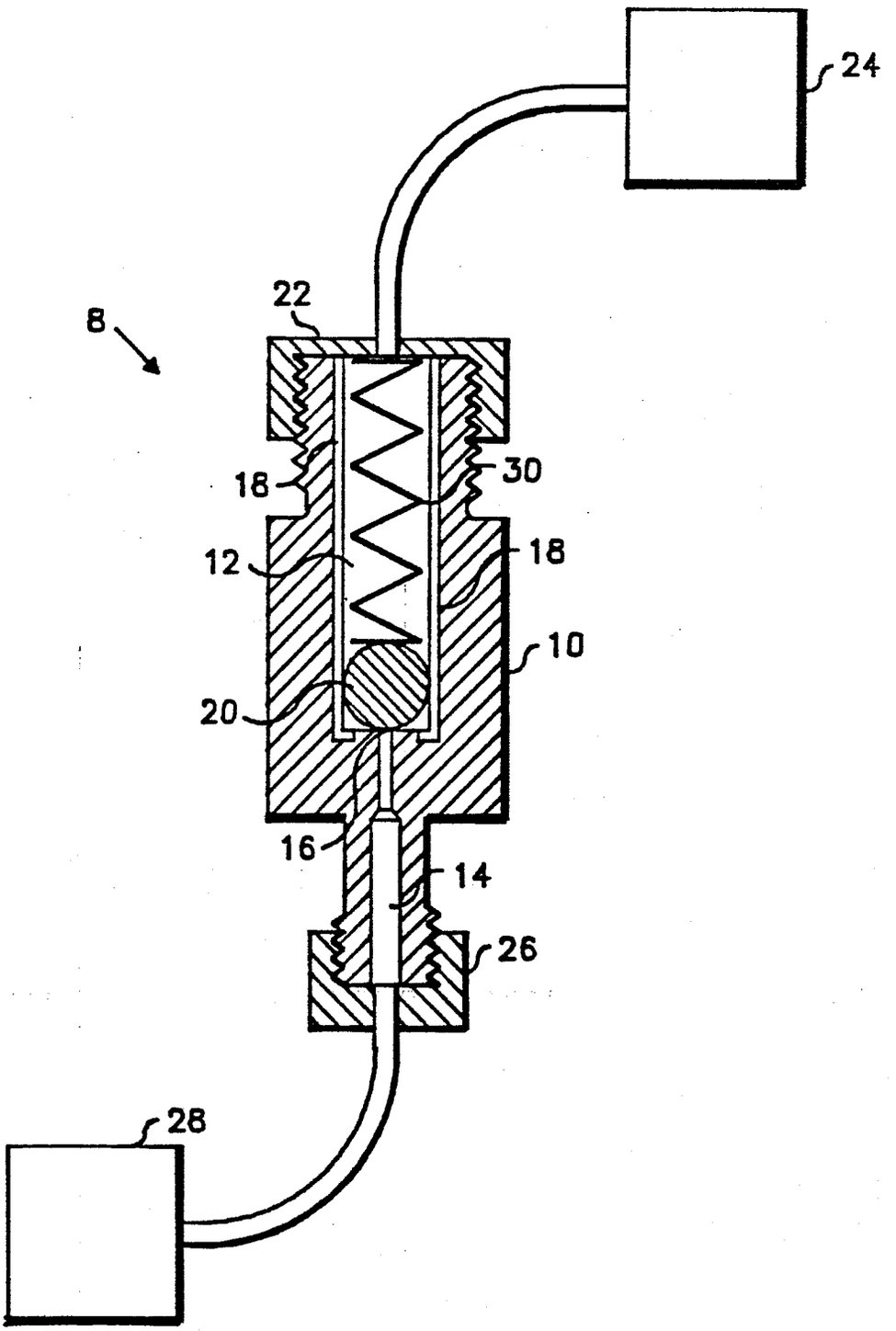

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Fig. 3