

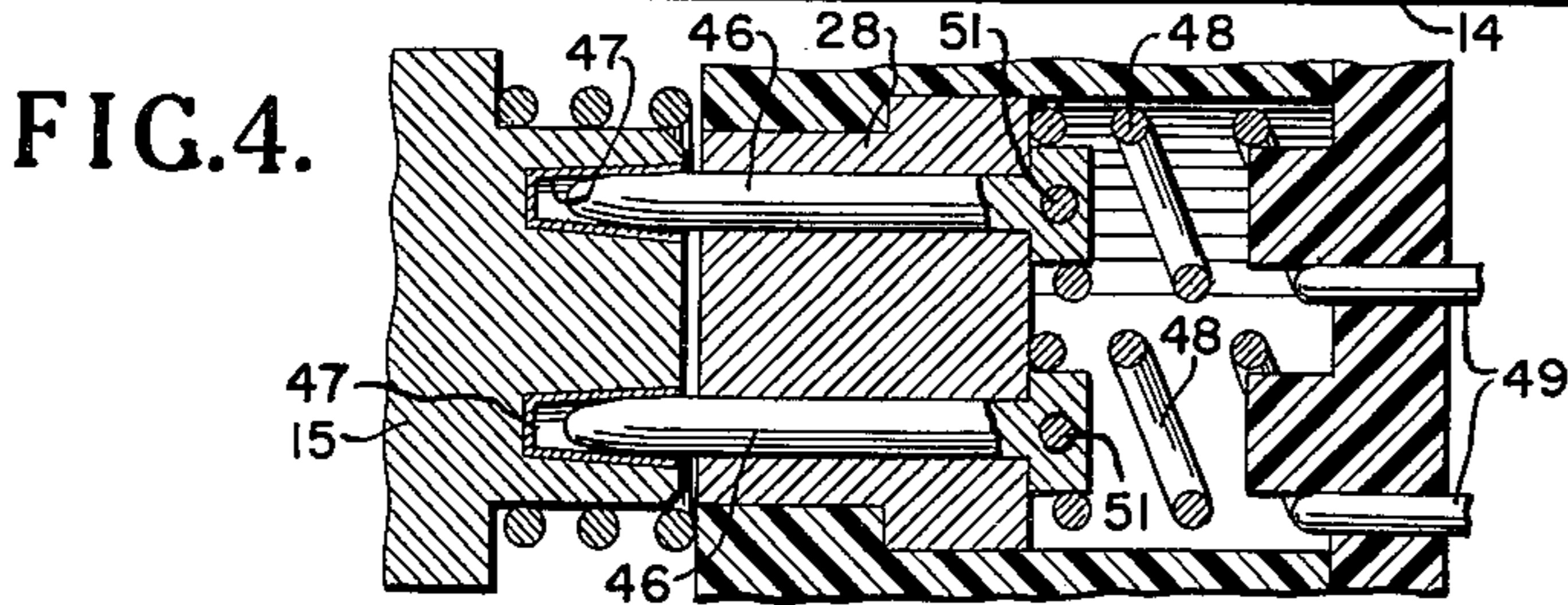
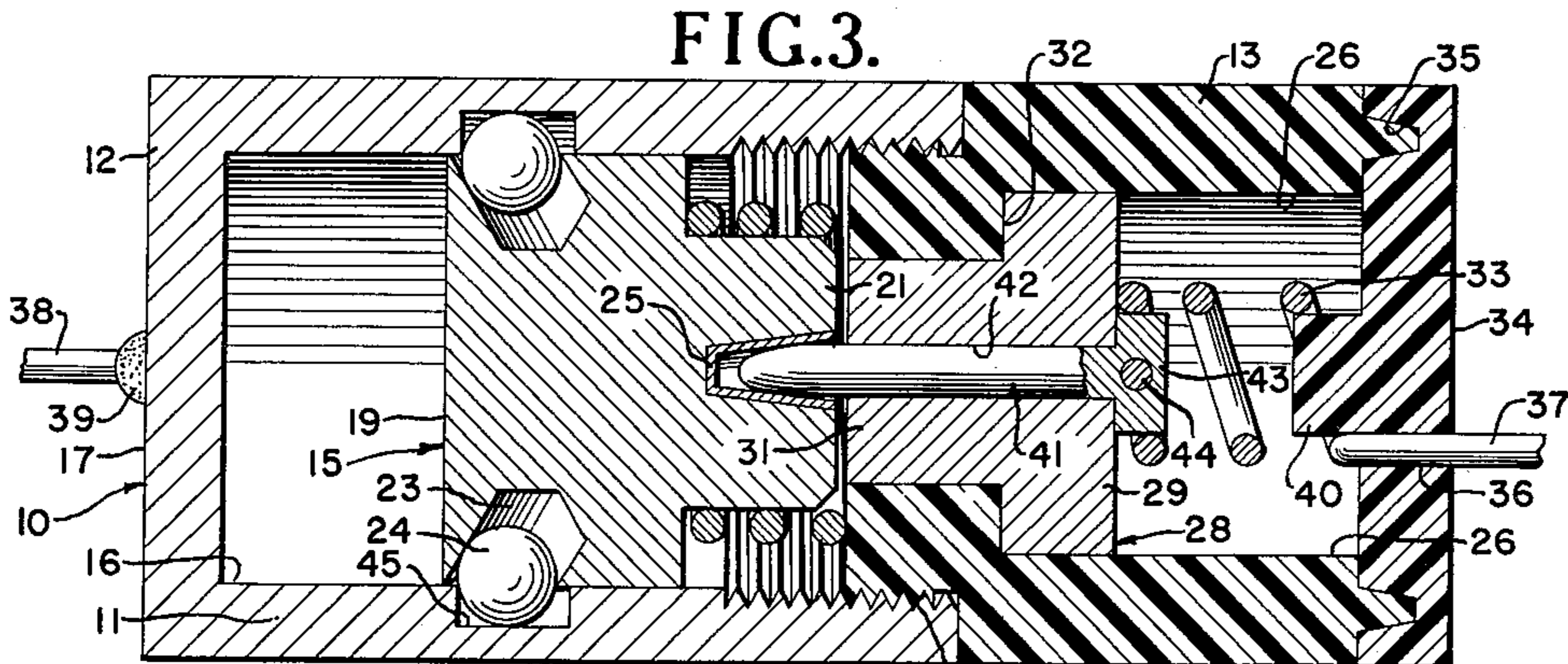
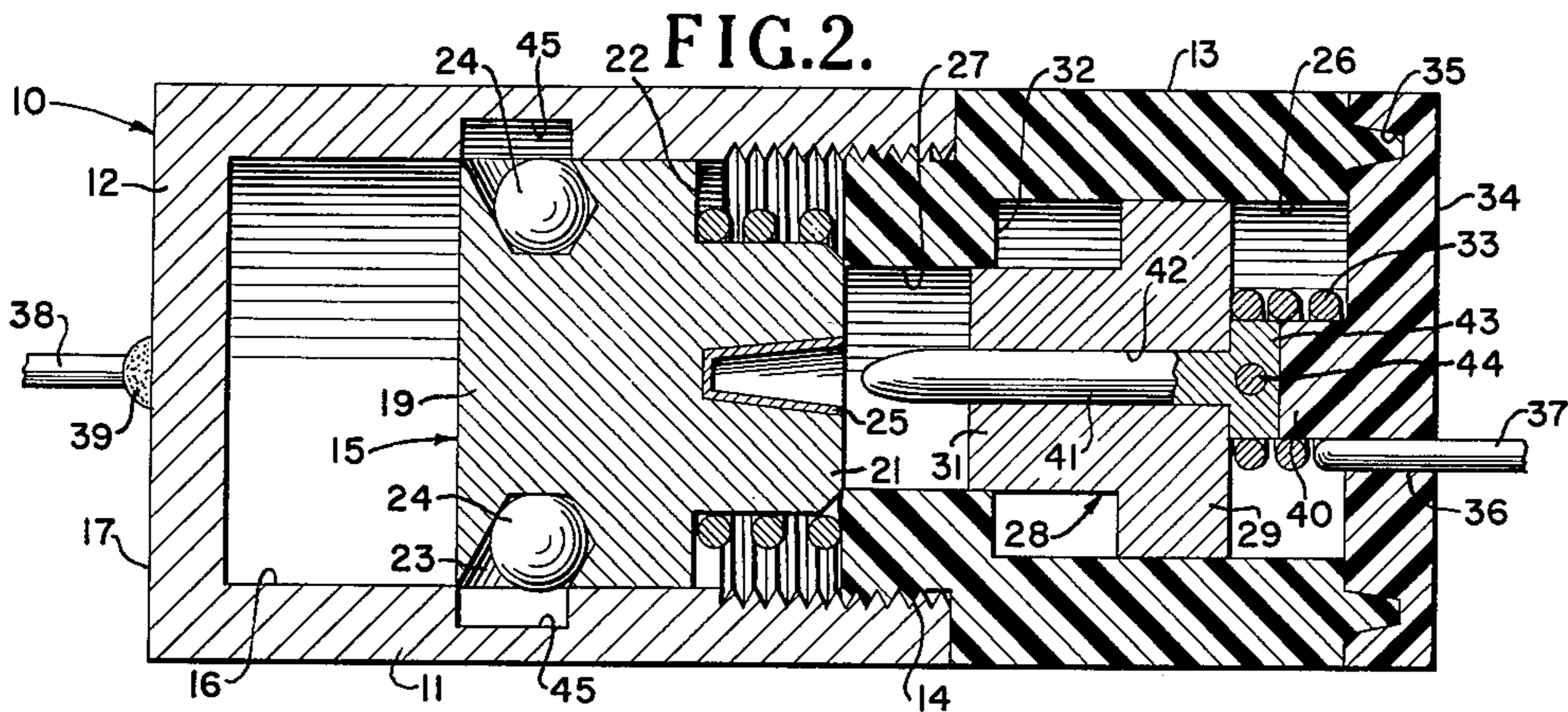
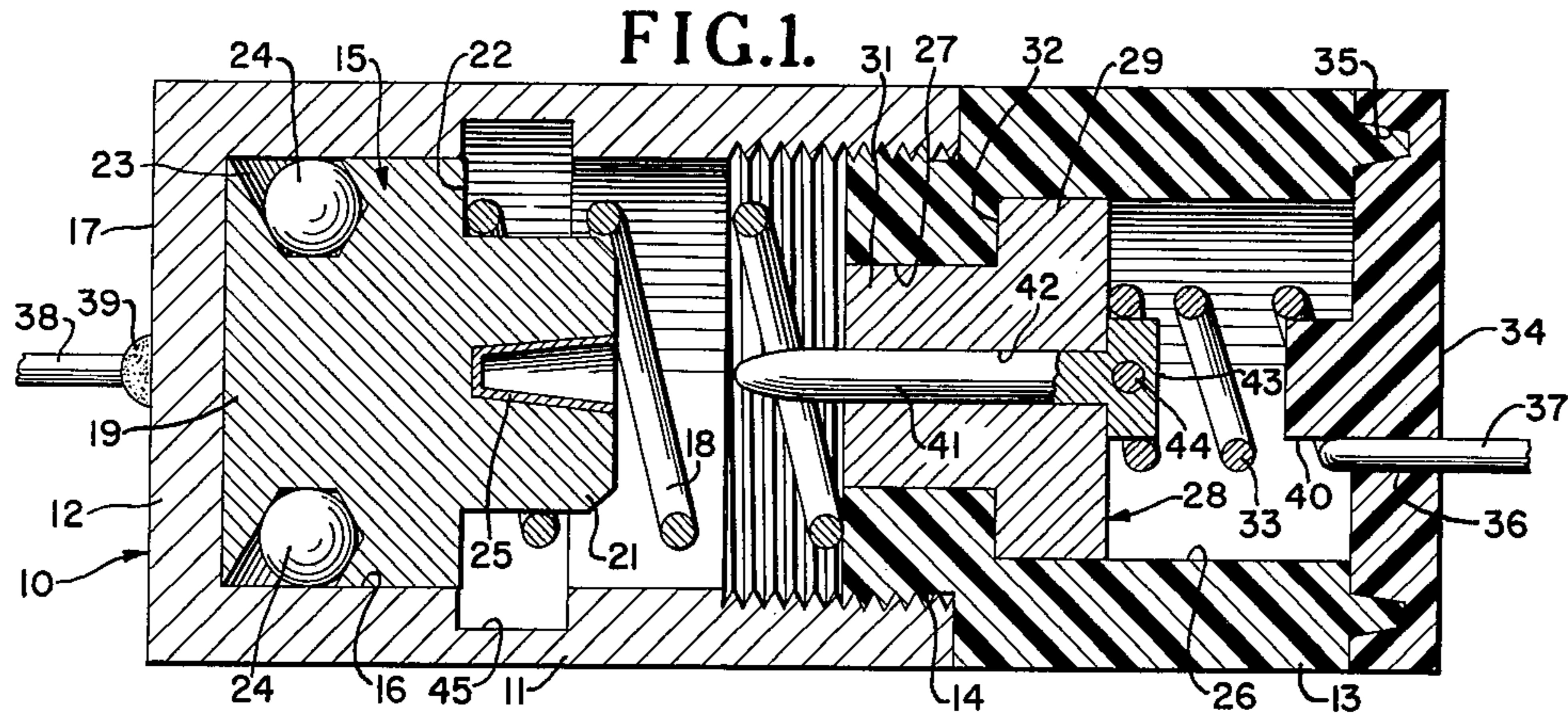
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H. E. EVANS

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INERTIAL AND CENTRIFUGALLY OPERATED SWITCH

Filed June 8, 1954



INVENTOR
H. E. EVANS

BY *W. B. Sussenberg*
ATTORNEYS

1

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INERTIAL AND CENTRIFUGALLY OPERATED SWITCH

Harold E. Evans, Greenbelt, Md., assignor to the United States of America as represented by the Secretary of the Navy

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6 Claims. (Cl. 200-80)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The present invention relates to switches and more particularly to an inertial and centrifugally actuated switch suitable for use in an electric fuzed spin projectile or the like.

The invention contemplates the provision of a new and improved switch for an electric fuzed projectile constructed and arranged to remain in an open condition until the projectile is fired from a gun and subjected to high linear and centrifugal accelerations whereupon the switch is actuated to a closed and locked position and will not be actuated to an open position should the projectile be subjected to sudden and high deceleration. Moreover, the invention provides a combination inertial and centrifugally actuated switch including a pair of inertial elements for maintaining the switch in a normally open condition and which will prevent closing of the switch in response to the setback force applied thereto as the projectile is fired from a gun. The aforesaid elements are in the form of plungers arranged within the switch casing to provide a normally open switch and which maintains the switch open for the duration of the shock period, the elements being actuated to close the switch when the setback force has decreased to a predetermined value and the centrifugal force is sufficient to actuate a plurality of locking detents to lock one of the elements to the casing and the linear acceleration is sufficient to permit the other element to be returned to the initial position whereupon the switch is closed. Thus the aforesaid switch may be advantageously used as a safety device for controlling an arming system of a VT fuze or the like whereby the fuze is maintained in a safe condition during the travel of the projectile through the bore of the gun and arming of the fuze will not occur until the projectile has traveled a substantial distance beyond the muzzle thereof.

An object of the present invention is to provide a new and improved combination inertial and centrifugally actuated switch suitable for use in an electric fuze.

Another object of the invention is the provision of a new and improved safety device which effects the arming of an electric fuze at a safe distance beyond the muzzle of the gun.

Still another object of the invention is the provision of a new and improved normally open switch structure wherein means are provided for maintaining the switch in an open position when the switch is subjected to setback force and which is locked in a closed position when the switch is subjected to high linear and centrifugal accelerations.

Other objects and many of the attendant advantages of the invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a central longitudinal sectional view of a normally open switch constructed in accordance with the present invention;

FIG. 2 is a view similar to FIG. 1 with the switch in a moved and open position;

2

FIG. 3 is a view similar to FIG. 1 with the switch in a closed position; and,

FIG. 4 is a fragmentary sectional view of an alternate arrangement of the device of FIG. 1.

Referring now to the drawings wherein like reference characters designate like parts throughout the several views and more particularly to FIG. 1 the switch is generally indicated by the numeral 10 and comprises a casing 11. The casing is preferably formed of two sections 12 and 13 threadedly secured together as at 14, section 12 being composed of any conductive material suitable for the purpose, section 13 being composed of suitable insulating material.

An inertial mass or plunger 15 is slidably arranged within a bore 16 formed in section 12, the plunger being yieldably urged into engagement with an end wall 17 of section 12 by a spring 18. The plunger 15 is also composed of suitable conductive material and comprises a body 19 having a boss 21 formed thereon, the boss being somewhat smaller in diameter than the body 19 thereby to provide a spring engaging shoulder 22. The body 19 of the plunger is provided with an annular groove 23 having a plurality of contact locking detents or balls 24 arranged therein and normally out of engagement with the wall defining bore 16. Disposed within the boss 21 and secured thereto in any suitable manner is a conical-shaped contact 25.

The section 13 of the casing 11 is provided with a bore 26 terminating in a reduced bore 27. An inertial element generally indicated by the reference character 28 is slidably arranged with the aforesaid bores and comprises head 29 disposed within bore 26 and a boss 31 formed integrally therewith and disposed within the reduced bore 27. The head is normally urged into abutting engagement with a shoulder 32 formed on section 13 by a spring conductor 33, one end of the spring being in engagement with the head, the other end thereof being in engagement with a closure cap 34 secured to section 13 as at 35. It will be noted that one end of spring 33 extends through an opening 36 formed in cap 34 and terminates a predetermined distance beyond the outer surface thereof and thus by this arrangement an external electrical lead or conduct 37 is provided for the switch, the other external lead of the switch being indicated by the numeral 38 and secured to the end wall as at 39.

A contact pin 41 is arranged in a bore 42 formed in the element 28 having one end thereof extending beyond the boss 31 in alignment with and normally spaced from the contact or socket element 25. The pin 41 has formed on one end thereof a head 43 in abutting engagement with the flange 29, one end of the spring conductor being secured to the head as at 44.

The section 12 of the casing is provided with an annular groove or cavity 45 for receiving the locking detents 24 as the detents are actuated in response to centrifugal force thereby to lock the element 15 to the switch casing when the element is in the position as shown on FIG. 2. The cap 34 is provided with a stop 40 for arresting the movement of element 28 as the element is moved in response to setback force and the head 43 on the pin 41 engages the stop 40 as shown on FIG. 2.

In the arrangement of FIG. 4 it will be noted that the inertial element 28 is provided with a pair of contact pins 46 and the element 15 is provided with a pair of conical shaped contacts 47 in alignment with the contact pins 46 respectively. Each of the pins is provided with a spring conductor 48, one end terminating in an external lead 49, the other end thereof being secured to the pins as at 51. By the aforesaid arrangement it will be apparent that an electrical connection is established as the aforesaid contact pins 46 move into engagement with contacts 47.

As shown on FIG. 1 the element 15 is normally main-

tained in abutting engagement with wall 17 by the spring 18 and the element 28 is normally maintained in abutting engagement with shoulder 32 by spring 33 whereupon the contact pin 41 and contact 25 are held in spaced relation with respect to each other and the switch is in a normally open condition. When the switch is subject to setback force such, for example, as when the projectile is fired from a gun, the inertial elements 15 and 28 are moved selectively to a position as shown on FIG. 2 with the locking detents 24 in alignment with the cavity 45, the head 43 in engagement with the stop 40 and the element 15 in engagement with the section 13. Thus the aforesaid pin 41 and contact 25 are maintained in spaced relation with respect to each other and the switch remains in an open position for the duration of the aforesaid shock and will remain in the open position until the setback force has decreased to a predetermined value and the projectile is subject to high linear and centrifugal accelerations. It will be understood, however, that as deceleration begins, centrifugal force must be present to actuate the detents out of groove 23 and into cavity 45 thereby locking the plunger 15 to the casing 11. As the deceleration increases the inertial element 28 is returned to the initial position by spring 33 and the contact pin 41 is forcibly wedged into contact 25 whereupon the switch is closed and a circuit is established there-through. The circuit is established by way of conductor spring 33, contact pin 46, contact 25, element 15, detents 24, section 12, and thence to conductor 38. When the switch has been actuated to a closed position by the aforesaid combination of forces it will remain locked in the closed position although the projectile is subjected to a high sudden deceleration such, for example, as impact of the projectile with a target.

From the foregoing it will be apparent that a new and improved normally open combination inertial and centrifugally actuated switch has been devised which is suitable for use in an electric fuzed projectile for maintaining the electrical system thereof open as the projectile is fired from a gun and which is actuated to a closed position as the projectile is subjected to high linear and centrifugal accelerations thereby to close the electrical system.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A combination centrifugal and inertia actuated switch for use in a projectile comprising a pair of inertial elements movable selectively from an initial position to a moved position under setback force, means responsive to centrifugal force for locking one of the elements in said moved position, means in engagement with the other one of the elements for moving said other element from said moved position to said initial position when said setback force has decreased to a predetermined value, and means carried by said elements for establishing an electrical circuit through said switch when said other element has been returned to said initial position.

2. A combination centrifugal and inertia actuated switch for use in a spin projectile comprising a casing, a pair of inertial elements slideably disposed within said casing and movable from an initial position to a moved position in response to setback force applied thereto, detent means carried by one of said elements for locking said element in said moved position as the detent means are actuated in response to centrifugal force, resilient means in engagement with the other one of said elements for moving said other element from said moved position to said initial position as the projectile is subjected to a

sudden deceleration, a contact carried by said one element, a complementary contact carried by said other element forcibly moved into engagement with said contact by said resilient means when said other element is returned to said initial position.

3. A normally open switch of the character described for use in a spin projectile comprising a casing, a pair of inertial elements disposed within said casing and movable selectively from an initial position to a moved position in response to a setback force applied thereto, a plurality of detents carried by one of said elements and normally out of locking engagement with said casing for locking said one element to the casing as the detents are moved into locking engagement therewith by centrifugal force, resilient means in engagement with the other one of said elements for urging said other element from said moved position to said initial position when the setback force has decreased to a predetermined value, and circuit means carried by said elements, said casing, resilient means and detents for causing the switch to be closed when said other element has returned to said initial position.

4. A normally open centrifugal and inertia controlled switch for use in a spin projectile comprising an inertial plunger, an inertia mass, said plunger and mass being movable selectively from an initial position to a moved position under setback force, means including a plurality of centrifugally actuated detents for closing said switch as the plunger is locked by said detents under the centrifugal force and said mass is returned to said initial position, and means in engagement with said mass for returning the mass to said initial position as the projectile is subjected to a sudden deceleration.

5. A normally open centrifugal and inertia controlled switch for use in a spin projectile comprising a casing, an inertial mass slidably disposed within said casing, an inertial plunger disposed in spaced relation with respect to said mass and slidably arranged within said casing, resilient means in engagement with said plunger and casing for maintaining the plunger in said spaced relation with respect to said mass, said mass and plunger being movable selectively from an initial position to a moved position under setback force, means on said plunger in engagement with said casing for maintaining the plunger in spaced relation with said mass when the plunger and mass are in said moved position, detent means carried by said plunger for locking the plunger to the casing in said moved position as the detent means are actuated by centrifugal force, spring means in engagement with the mass and casing for returning the mass from said moved position to said initial position under sudden deceleration, contact means carried by said plunger, and a contact pin carried by said mass and forcibly moved into engagement with said contact means as the mass is returned to said initial position by said spring means thereby to close said switch.

6. A normally open switch of the character described comprising a casing, means including a pair of mutually spaced inertial elements slidably arranged within said casing for maintaining the switch in an open condition as the elements are moved from an initial position to a moved position in response to a sudden shock received thereby, centrifugal actuated detents for locking one of said elements in said moved position, contact means carried by said elements for closing said switch as the other one of said elements is actuated from said moved position to said initial position, and means operably engaging said other element for returning the other element to said initial position when the force of said shock has decreased a predetermined amount.