

[54] **CONTROL ELEMENT TO BE IGNITED ELECTRICALLY FOR PIN ENTRANCE**

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[56] **References Cited**

UNITED STATES PATENTS

3,062,143 11/1962 Savitt et al.....102/28
3,541,920 11/1970 Rapp et al.....89/1 B

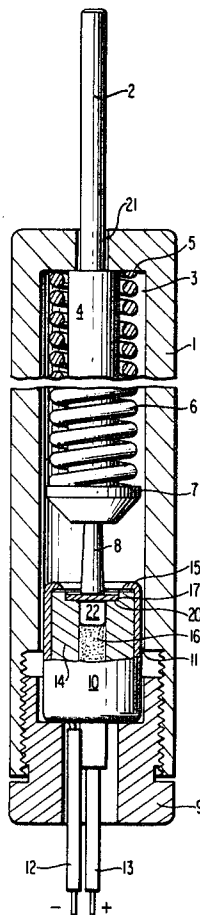
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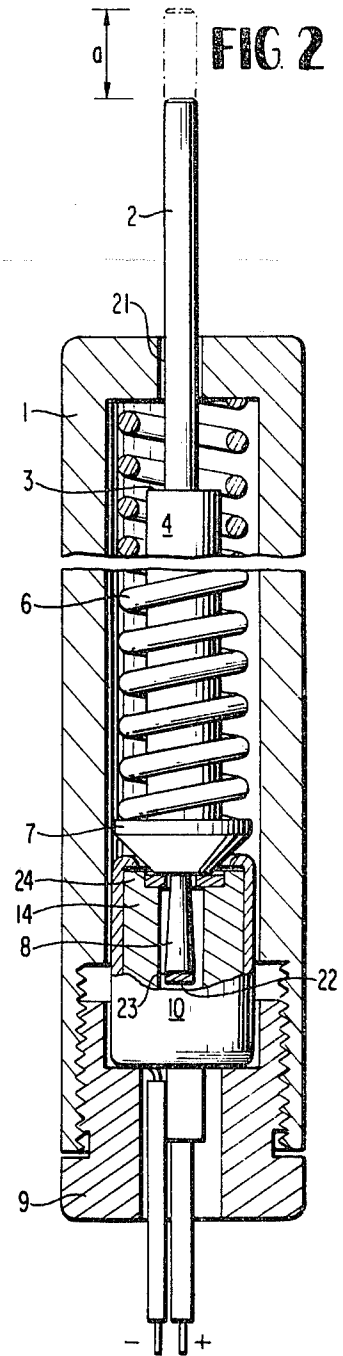
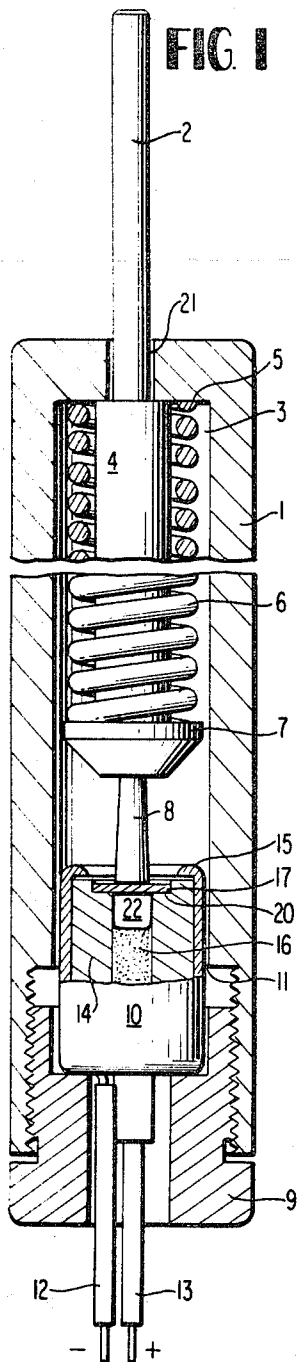
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[57] **ABSTRACT**

A control element to be electrically ignited for pin retraction, wherein the pin is guided in a housing in which the electrical primer element is accommodated and is optionally provided with a delay device. In the starting position, a compression spring presses the pin with an integrally attached piston against the primer element. The piston rests on a supporting element of the primer element. After ignition of the primer element, the compression spring presses the pin with a residual force against the remaining portion of the supporting element which has been penetrated.

22 Claims, 5 Drawing Figures

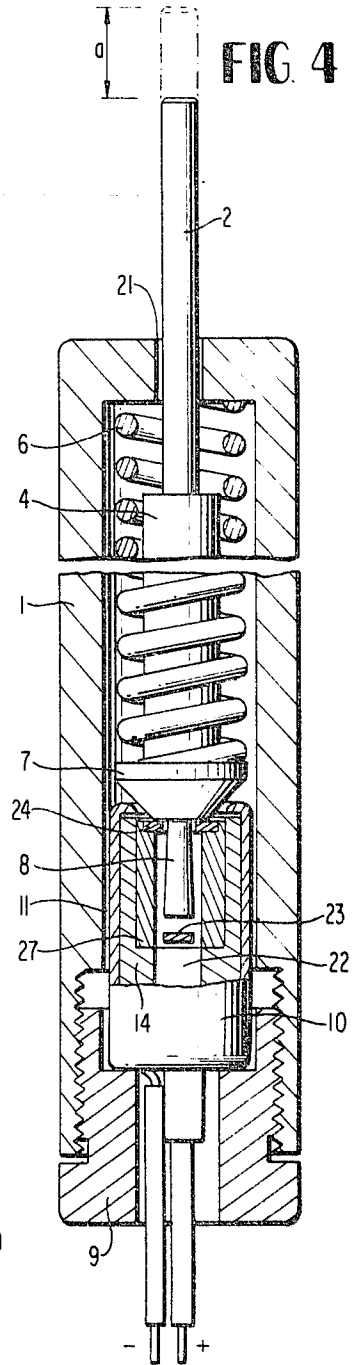
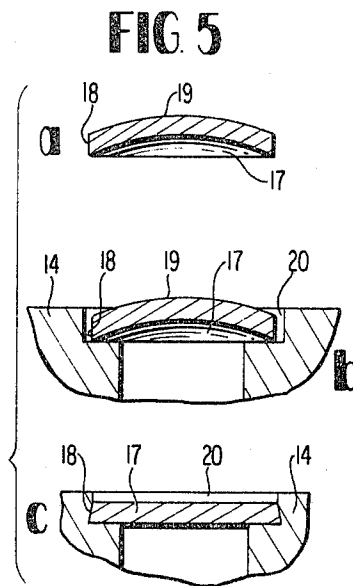
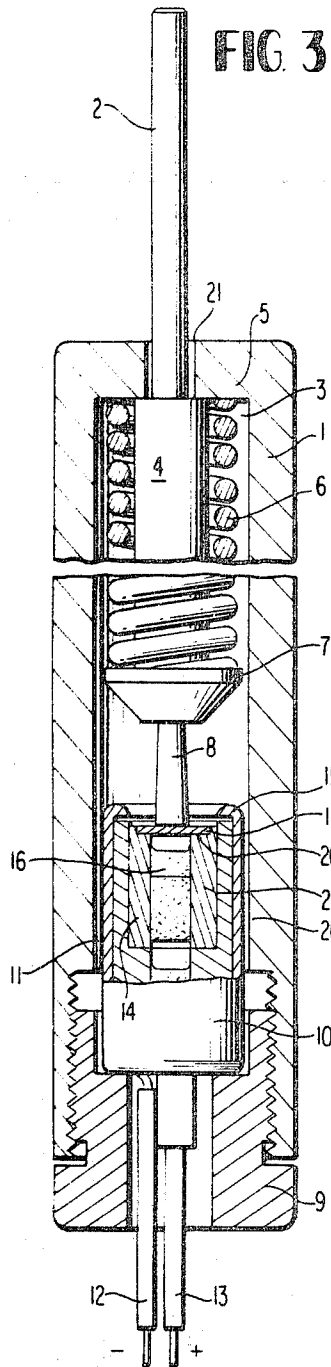




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CONTROL ELEMENT TO BE IGNITED ELECTRICALLY FOR PIN ENTRANCE

BACKGROUND OF THE INVENTION

The present invention relates to a control element to be ignited electrically for pin entrance, and more particularly, to a control element wherein the pin is guided in a housing in which the electric igniter or detonator is accommodated and is optionally provided with a delay charge.

Control elements of the aforementioned type, also known as an actuator, are intended for initiating a switching procedure upon the ignition therein of a pressure igniter charge by means of a wire or a gap fuze effected electrically by remote control.

It is known to provide a control element which has a piston, wherein a guide tube, which is disposed in an outer sleeve and associated with the piston, is provided with surfaces on its outside. The propellant gases developing after the ignition of a propellant charge pass between the guide tube and the outer sleeve from the ignition side, which is located on one side of the piston, to the opposite side of the piston and, thereby, press the piston into the tube so that the piston exerts a pulling action, by way of a pin, on an element connected with the piston and disposed outside of the control element which is to be switched or controlled.

The disadvantage of this construction, however, resides in that a very exact fitting is required between the pin and the outer sleeve as well as between the bore of the inner tube and the piston. In order to maintain the pin in its position after initiation for a longer period of time, it is necessary to provide additional seals or gaskets in the fitted parts or to fix the piston in the inner tube in its end position by means of an additional holding device.

Furthermore, a control element is conventional which draws in a pin having a disk-like stem within the housing on which a compression spring rests with the opposite side of this spring being supported in the bottom of the housing. The compression force of the spring presses the pin, by means of a piston stem attached to the disk-like stem of the pin, onto a firmly compressed pyrotechnical supporting or delay charge. After the ignition, the pyrotechnical charge is converted into liquid slag, so that the piston stem of the pin can penetrate into the fuze tube and, accordingly, the pin executes a movement toward the inside.

The disadvantages of this type of control element reside in that the supporting or delay compositions are sensitive to outside influences, especially moisture. In order to keep outside influences away, complicated sealing problems must be solved either in connection with the passage of the pin through the housing or on the surface of the supporting or delay charge. The provision of sealing means at the housing causes additional friction and thus a reduction in the draw-in or entrance force of the pin.

SUMMARY OF THE INVENTION

It is an aim of the present invention to overcome the problems and disadvantages encountered in the prior art devices by providing a control or switching element which is simple in construction, requires no additional sealing elements, ensures a safe functioning, and is also suitable for delayed-action detonators.

The foregoing problems have been solved, in accordance with the present invention, by providing that, in the starting position, a compression spring presses the pin with its integrally attached piston against the detonator or primer element with this piston resting on a supporting element of the primer element; the compression spring presses the pin, after the ignition of the detonator element and the thus-produced penetration through the supporting element, with a residual force against the remaining portion of the supporting element of the primer element. The detonating or primer element consists preferably of a capsule, wherein a fuze tube containing a pressure igniter charge is disposed.

BRIEF DESCRIPTION OF THE DRAWING

These and further aims, features and advantages will become more apparent from the following description when taken in conjunction with the accompanying drawing which shows, for purposes of illustration only, several embodiments in accordance with the present invention and wherein:

FIG. 1 is a partial cross-sectional view of a control element with a pyrotechnical pressure igniter charge prior to ignition or detonation;

FIG. 2 is a view of the control element according to FIG. 1 after ignition;

FIG. 3 and 4 are partial cross-sectional views of a control element corresponding to the element of FIGS. 1 and 2 but with an additional delay charge; and

FIG. 5 shows the steps of installing a supporting disk in a fuze or powder train tube.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawing and, in particular, to FIG. 1, the control element consists of a housing 1 from which a pin 2 extends for executing the switching or control function, i.e. it is drawn into the housing after a trigger pulse or impulse. The pin 2 rests, in its armed or extended position, with the shoulder 3 of the guide portion 4 abutting against the bottom 5 of the housing and can be moved toward the inside by means of a compression spring 6 disposed between the bottom 5 of the housing and a mounting disk 7 following the guide portion 4 of the pin. The lower end of the pin forms a piston 8 which tapers conically in the direction of the mounting disk 7. The pin 2 is cocked or armed by way of a primer element 10 disposed in a locking screw or threaded cap 9, i.e. the pin is pushed out of the housing against the force of the spring to such an extent that the shoulder 3 contacts the bottom 5 of the housing.

For igniting the primer element 10, conventional means (not shown) can be employed such as, for example, gap or wire primers. From the capsule 11 of the primer element 10, the two electric connections of the primer charge with the negative pole 12 and the positive pole 13 are extended toward the outside through the locking cap or screw 9. Within the capsule 11, a fuze tube 14 is disposed above the primer charge and is held in the capsule by means of a flange or bead 15.

When employing a wire fuze, a pyrotechnical pressure igniter charge 16 is pressed into the fuze tube 14. In case a gap fuze is employed, the gas produced by the electrical primer charge is completely sufficient, so that the pressure igniter charge 16 can be replaced by adjusting or appropriately apportioning the electrical

primer charged into the gap detonator. The pressure igniter charge or the electrical primer charge can be covered in the fuze tube 14 with, for example, a varnished or lacquered lead-tin foil and provided with a cover coating of varnish.

A disk 17 serves as a cover for the fuze tube 14 and simultaneously constitutes the supporting element for the tensioned or armed pin, thereby exerting a sealing function. This function is attained by providing that the disk 17, prior to its installation, has a different geometrical shape than in the mounted condition. The disk is, as shown in FIG. 5, curved in the center with the peripheral area 18 being parallel to the line of symmetry. During installation, the disk is inserted with its curvature 19 pointing upwardly into the recess or aperture 20 of the fuze tube 14. By pressing the disk flat, an enlargement of the outer diameter is obtained which is dependent on the size of the curvature 19 of the disk. As shown in FIG. 5c, the flattened disk assumes the configuration of a truncated cone with the lower peripheral portion of the disk deforming the recess 20 such that the recess assumes a corresponding shape. This results in a flush sealing at the diameter of the recess 20 in the fuze tube 14. This type of sealing withstands high pressures, so that the pyrotechnical compositions compressed thereunder are completely protected from environmental influences.

Consequently, it is not necessary any more to provide a seal in the pin passage 21 of the housing 1. This constitutes an advantage, since a seal between the housing 1 and the pin 2 would be very expensive and complicated. Besides, power losses would occur due to such a seal because of friction on the moving pin.

The mode of operation of the control element in accordance with the present invention is as follows: Upon the application of a specific electrical energy to the electric poles 12 and 13, the pulse is conducted to the initiating charge (not shown). Upon the ignition of such an initiating means, the pressure igniter charge or the electrical charge spontaneously builds up a pressure in the fuze tube 14. The pressure is directed against the disk 17, which advantageously consists of a material having a low elongation at rupture such as, for example, copper or a copper alloy such as brass which exhibits these properties after special treatment. This material can be, for example, one having the DIN (German Industrial Standard) designation E-Cu F 37 or Ms 58 F 51.

If the disk 17 were made of a soft material, the material would be pressed upwardly at the piston 8 on the outside by the gas pressure, and the gas could escape into the space between the primer element and the mounting disk 7. Entrance of the pin 2 by the spring 6 could not be ensured thereby, since the piston 8 is only a little smaller than the receiving bore 22 for the pyrotechnical pressure igniter charge 16 in the fuze tube 14.

In case of a material having a low elongation at rupture or ductile yield, the disk 17 is ruptured along the diameter of the piston 8 of pin 2 when slightly lifted by the gas pressure, whereby the latter is moved and is accelerated by the spring 6 into the presently empty space of the fuze tube 14. The disk 23 punched out of the disk 17 likewise falls into the receiving bore 22 of the fuze tube 14, as seen in FIG. 2. The gas which is under pres-

sure thereby reaches the space between the primer element and the receiving disk only when the disk 17 has been punched.

Due to the above-mentioned conicity of the piston 8, a friction between the latter and the remaining annular section 24 of the disk 17 is prevented also in this case. Consequently, the full spring force of the compression spring 6 is available for the movement of the pin. The pin 2 rests in a defined manner after triggering with the underside of the mounting disk 7 on the remaining annular section 24, whereby an exact stroke length a of the pin results. By the change in position of the pin 2, another structural element can be switched, armed, or released.

In FIGS. 3 and 4, the construction of the fuze 10 employed in FIGS. 1 and 2 is different. The control element in FIGS. 1 and 2 switches without a delay time, whereas the element of FIGS. 3 and 4 has a pyrotechnical delay unit incorporated therein. The difference in the primer element 10 resides in that a pyrotechnical delay charge 26 is connected with the primer charge 25 and the pressure igniter charge 16. The delay charge 26 and the pressure igniter charge 16 are pressed into the fuze tube 27 and converted with, for example, a lead-tin foil and provided with a cover layer of varnish. This combined element is inserted into the primer element 10 as a prefabricated unit with this primer element, in turn, being embedded in the capsule 11.

This subdivision of the primer element with installed delay is suitable because the primer element can be manufactured in large numbers as a unit, wherein the primer composition can be covered with, for example, a lead-tin foil and provided with a cover coating of varnish. The same procedure can be followed with respect to the delay component, the unit being producible with varying delay times. Thereby, it is possible to couple the same primer elements with varying delay components. This measure simplifies the manufacture and storage of fuzes having an incorporated delay time element.

If, as described above, electrical energy is applied to the poles 12 and 13, the primer composition 25 is first ignited and then ignites the pyrotechnical delay charge 26 which, in turn, ignites the pressure igniter charge 16 after the lapse of a certain delay period. Thereafter, as in the control element of FIGS. 1 and 2, the disk 17 is punched through and the pin 2 is retracted into the housing 1.

The present invention ensures that the pin 2 is securely fixed in its terminal position. This is important when, for example, the control elements are employed in a rocket in order to prevent an unintended actuation. The length of the entrance or draw-in path a of the pin 2 can be modified as desired by effecting simple constructional measures at the pin 2 and/or at the primer element 10. Thus, it is possible to adapt the control element to the respective desired purpose.

While we have shown and described several embodiments in accordance with the present invention, it is to be clearly understood that the same is susceptible of numerous changes and modifications as are encompassed within the spirit of the invention. We, therefore, do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications as are encompassed by the scope of the present invention.

We claim:

1. Control element adapted to be ignited electrically, comprising a housing, pin means having a piston operatively guided in the housing, electrical detonator means arranged in the housing, said electrical detonator means include a capsule having fuze tube means, said fuze tube means being provided with recess means at the end thereof directed toward the outside, means for pressing the pin means against the detonator means to retract the pin; and supporting means in the form of a disk being mounted in a flush manner in said recess means such that the pin means rests against said disk, said disk having a curvature adapted to be pressed flat to form an enlarged outer disk diameter for peripheral flush engagement with said recess means to effect a seal between said disk and said recess means of said fuze tube means, wherein the pressing means presses the pin means against the detonator means in the starting position and, after ignition of the detonator means and penetration of the supporting means, presses the pin means with a residual force against the remaining portion of the supporting means.

2. Control element according to claim 1, wherein the pressing means comprises a compression spring.

3. Control means according to claim 2, wherein a delay charge is provided in the detonator means.

4. Control element according to claim 1, wherein said fuze tube means includes a pressure igniter charge disposed therein.

5. Control element according to claim 4, wherein the pressing means comprises a compression spring.

6. Control element according to claim 5, wherein a delay charge is provided in the detonator means.

7. Control element according to claim 6, wherein said fuze tube means includes a first fuze tube with a primer charge arranged in the capsule, and a second fuze tube containing the pressure igniter charge and a delay charge arranged in said first fuze tube.

8. Control element according to claim 7, wherein the fuze tubes are provided with recess means at the end thereof directed toward the outside, and the supporting means being mounted in the recess means.

9. Control element according to claim 2, wherein fuze tube means includes a pressure igniter charge disposed therein.

10. Control element according to claim 9 wherein

said fuze tube means includes a first fuze tube with a primer charge arranged in the capsule, and a second fuze tube containing the pressure igniter charge and a delay charge arranged in said first fuze tube.

11. Control element according to claim 1, wherein the disk comprises a material having low elongation at rupture.

12. Control element according to claim 11, wherein a delay charge is provided in the detonator means.

13. Control element according to claim 12, wherein fuze tube means includes a pressure igniter charge disposed therein.

14. Control element according to claim 13, wherein said fuze tube means includes a first fuze tube with a primer charge arranged in the capsule, and a second fuze tube containing the pressure igniter charge and a delay charge arranged in said first fuze tube.

15. Control element according to claim 11, wherein the material is from the group consisting of copper and copper alloy.

16. Control element according to claim 1, wherein the remaining portion of the supporting means is an annular section which is punched out of the disk by gas pressure with the piston serving as an abutment.

17. Control element according to claim 2, wherein the compression spring is mounted on a guide portion of the pin means.

18. Control element according to claim 17, wherein the compression spring is tensioned between the housing bottom and a receiving disk following the guide portion.

19. Control element according to claim 18, wherein the piston tapers in a direction toward the receiving disk.

20. Control element according to claim 1, wherein a threaded cap means is provided as a centering device and abutment for the detonator means.

21. Control element according to claim 1, wherein said supporting disk has a configuration of a truncated cone in the flattened condition.

22. Control element according to claim 1, wherein said supporting disk effects a flush mounting and sealing of said supporting disk and said recess means by deforming the walls of said recess means to correspond to the enlarged outer diameter of said disk in the flattened condition.

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