July 28, 1959 A. VOLAND 2,896,540

CONTROL DEVICE FOR THE PERCUSSION PIN OF A PROJECTILE FUSE

Filed Nov. 29, 1955

Fig. 1.

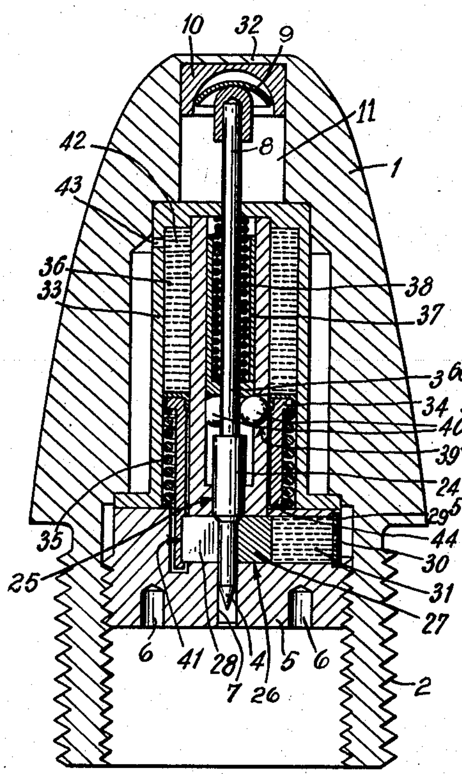
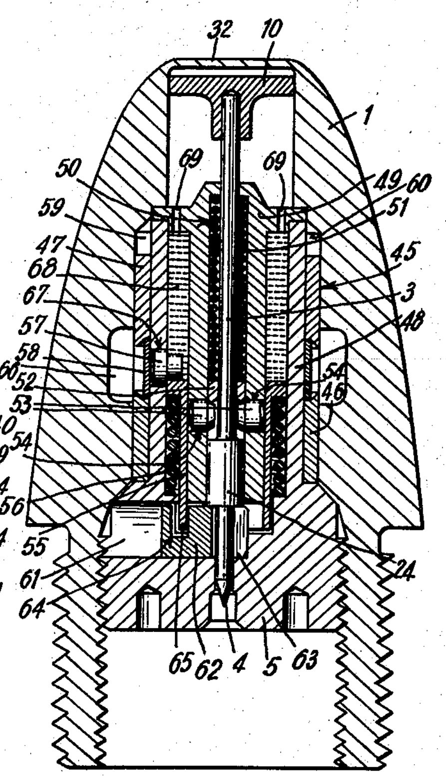


Fig. 2.



United States Patent Office

2,896,540

Patented July 28, 1959

2,896,540

CONTROL DEVICE FOR THE PERCUSSION PIN OF A PROJECTILE FUSE

André Voland, Zurich, Switzerland

Application November 29, 1955, Serial No. 549,830

Claims priority, application Switzerland December 6, 1954

1 Claim. (Cl. 102—76)

The object of the present invention is a control device for the hammer of a projectile fuse provided with muzzle safety and proximal trajectory safety devices and self-destruction devices and comprising a percussion pin and a percussion spring disposed coaxially to the hammer. The control device according to the invention is characterized in that it comprises a dash-pot regulating the motion of the percussion pin and disposed coaxially to said pin, in that the buffer fluid in this dash-pot is a silicone having a chain structure containing $Si(CH_3)_2$ groups and a viscosity which remains substantially constant within a wide range of temperatures, and in that it comprises a spring disposed coaxially to the percussion pin and actuating the mobile member of the dash-pot, which spring is fastened by locking means controlled by an acceleration which occurs at least when the projectile is moving, and locking means depending on the displacement of the mobile member of the dash-pot fastening the percussion spring.

The accompanying drawing illustrates, by way of example, two embodiments of the device which constitutes the object of the invention.

Figs. 1 and 2 respectively show axial cross-sections of these embodiments.

In the embodiment shown in Fig. 1, one may see at 1 the body of the fuse which is screwed by means of threaded portion 2 in the projectile, which is not shown. 3 is the percussion pin of the hammer the point of which is visible at 4. An inner member 5 is axially screwed into the body 1 by means of holes 6 provided in its rear face. The point 4 of the percussion pin is destined to slide in an axial hole 7 of this member 5.

The fore end 8 of the percussion pin shaft is in contact with an elastic disk 9 arranged at the bottom of a member 10 which is lodged at the upper extremity of a cylindrical hole 11 axially provided in the body 1. Member 5 maintains in its place, in the body of the fuse, a hollow cylindrical part 33, in which can slide a hollow cylindrical piston 34, which is pulled towards the point of the fuse by a compression spring 35. The piston 34 is pierced by an axial hole, inside which extends a fixed cylinder 36. The cylindrical interior of this hollow cylinder 36 constitutes a chamber in which a piston 37 can slide axially, a compression spring 38 being fitted inside this piston and resting on the one hand against the bottom of the part 33, and on the other, against the bottom of the piston 37 in order to pull the latter in the downward direction in Fig. 1. Three radial holes 39, spaced 120° apart, are provided in the lateral wall of the part 36 and in each of these a ball 40 is partially engaged. In the position of the components shown in the drawing, the three balls 40 constitute a stop preventing piston 37 from moving downwards in spite of the action of spring 38. The diameter of the balls is such that on the inside they rest against the pin 3 of the hammer, whilst on the outside they are prevented from leaving their holes 39 by the skirt of the hollow piston 34.

The space circumscribed by member 33, cylinder 36 and piston 37 forms a chamber the axis of which is that of the fuse, and which is filled with a mass 42 made of a silicone grease or oil having a linear or cyclic chain structure containing the groups $Si(CH_3)_2$. Each terminal point of the chain is effected by three methyl groups united to the silicon atom. The viscosity of silicones of this type is an exponential function of the number of groups. It is thus possible to obtain the desired viscosity by judicious choice of the number of groups. It is also possible to obtain a silicone oil or grease having a given viscosity, by mixing silicones of different viscosities.

The pin 3 of the hammer is provided in its lower portion, with a part of larger diameter 24 which is capable of sliding in an axial hole 25 of the cylinder 36. The upper part of member 5 is provided with a radial cylindrical hole 26, in which is fitted a piston 27, provided with a slot 28 over part of its length. The extremity of the percussion pin 3, comprised between the part of larger diameter and the point 4, passes through this slot 28, the width of which is such that the piston 27 prevents the percussion pin from moving further down than the position shown in Fig. 1 as long as this percussion pin is engaged in the slot 28.

The open end of the cylindrical hole 26 is provided with a stopping plug 29, pierced by a calibrated hole 30. The part of this cylindrical hole 26 which is comprised between the piston 27 and the plug, forms a chamber which is filled with a mass 31, of the same nature as the mass 42.

The upper part of the chamber containing the mass 42 is provided with a calibrated hole 43 passing through member 33 and through which this chamber can communicate with a hollow space comprised between 33 and 1.

The operation of the device according to Fig. 1 is as follows:

The components are shown in the position they occupy before the shot is fired. The left-hand extremity of the piston 27, on the slotted side, is engaged in a notch 41, provided in the wall of the piston 34, which prevents this piston from following the pull of the spring 35. At the moment of the firing of the shot, the projectile is made to rotate by the rifling of the barrel of the weapon, and, owing to the effect of this rotation, the piston 27 which is arranged eccentrically in relation to the axis of the fuse, is urged away from this axis by the centrifugal force. Owing to this, it compresses the mass 31 which slowly escapes through the calibrated hole 30. The calibration of this hole 30 is chosen in such a manner that the piston 27 ceases to block the percussion pin (by cooperation of the edges of the slot 28 with the lower extremity of the enlarged part of the pin 3) after a lapse of time which is such that the muzzle safety as well as the proximal or immediate trajectory safety is assured. Any premature ignition of the discharge is thus precluded. As soon as the piston 27 has moved sufficiently to the right in Fig. 1 to release the percussion pin, the fuse is ready to operate by percussion against any kind of obstacle so as to produce the ignition of the charge by means of the point 4 of the percussion pin. In case of percussion of the fuse against an obstacle, the thin bottom 32 of the hole 11, which constitutes the fore end of the fuse is driven in and forced axially in the downward direction on the drawing, taking the part 10 and the fore end 8 of the percussion pin with it. The action of the point 4 of the percussion pin takes place immediately.

If within a certain time interval, which is determined in advance, the fuse has encountered no obstacle, it must ensure the self-destruction of the projectile as is well known. This is effected in the following manner:

In the course of this movement, the piston 27 begins by releasing the piston 34, owing to the fact that it leaves the notch 41. From that moment the piston 34 rises under the action of the spring 35 and drives the material 42 through the calibrated hole 43 in the part 33. The quantity of the material 42, the force of the spring 35 and the dimensions of the calibrated orifice 43 are calculated in such a manner that the lower part 44 of the piston 34 only uncovers the orifices 39 at the moment when self-destruction is to take place.

From the moment when piston 34 uncovers orifices 39, the balls 40, under the action of the centrifugal force exerted on them as the result of the rotation of the projectile, escape through these orifices towards the outside, into the space comprised between parts 33 and 36, whence they free piston 37. Spring 38 then drives piston 37 towards the bottom and the ignition occurs to effect the self-destruction of the projectile.

It may be seen from the above that the described device enables the self-destruction of the projectile and the muzzle and proximal or immediate trajectory safety to be obtained in a simple and pure manner. The adjustment of the time intervals for these two functions may be made easily and with precision by giving to the calibrated hole 30 the appropriate dimensions. The consistency of the silicone greases prevents any leakage through the calibrated holes 21 and 30 whilst the devices are kept in stock. The chemical composition of these masses protects the device from any undesirable chemical action. The quasi constancy of their viscosity, within a range of temperatures of plus or minus 50 in relation to the normal, greatly contributes towards ensuring a sure operation.

It will be remarked that the piston 34, with its calibrated hole 43 and the material 42, constitutes a dash-pot. As for the muzzle and proximal trajectory safety it is ensured by means of the dash-pot constituted by the piston 27, the calibrated hole 30 and the material 31.

In the second embodiment according to Fig. 2, there is only one dash-pot ensuring the two functions of the muzzle and proximal trajectory safety and of self-destruction. The parts which are identical with those of the two preceding embodiments are indicated by the same references.

The interior of the body 1 of the fuse is provided with an axial cylindrical chamber 45, in which are arranged two cylinder sections 46, 47. The member 5 is provided with a cylindrical extension 48 extending inside the cylinder sections 46, 47 in order to fix to the body 1 a member 49, inside which is a cylindrical chamber 50 through which the percussion pin 3 of the hammer passes longitudinally. A compression spring 51 arranged inside the chamber 50 surrounds the pin 3, and resting against the upper closed portion of this chamber, pulls in the downward direction (in Fig. 2) a ring 52 which can slide axially in this chamber. This ring is locked by two weights 53, fitted in radial holes 54 of the part 49. These weights are in contact on the inside with the pin 3 of the hammer, and are prevented from leaving their hole 54 in the outward direction by the skirt of a hollow piston 55 which can slide, on the one hand, on the part 49, and on the other, in the cylindrical chamber limited by the parts 48. A compression spring 56, resting against the member 5, pulls the piston 55 in the upward direction in Fig. 2. This piston is locked, in the position of the components shown, by a stud 57, fitted in a radial hole of the part 48 and which is held in place, on the inside, by a split metallic ring 58, provided between the two parts 46, 47 and around the exterior wall of the part 48. The parts 46, 47 are chamfered so as to offer the shape of a truncated cone at their extremities which are in contact with the ring 58. An axial clearance 59 exists between the upper extremity of the part 47 and the upper bottom of the chamber 45.

The member 5 is provided with a radial hole 61, in which is fitted, eccentrically in relation to the axis of the

fuse, a weight 62 provided with a slot 63 in which the lower extremity of the pin 3 of the hammer is engaged. This part 62, with its slot 63, cooperates with the enlarged part 24 of the pin 3, as has been described with respect to the part 27 and its slot 28 in the preceding embodiment, in order to secure the muzzle and proximal trajectory safety.

In the embodiment now being considered, the weight 62 is provided with another slot 64, in which the lower part 65 of the piston 55 is engaged. This second embodiment operates as follows:

At the moment the shot is fired, the projectile begins to rotate, and at the same time, owing to inertia, the part 47 is energetically urged in the downward direction in the drawing. This pull continues as long as the projectile is accelerated, i.e., as long as it is in the barrel of the weapon. Owing to the rotation of the projectile, the part 62 is pulled in the outward direction, but it is unable to move as long as the part 65 is engaged in the slot 64. Owing to the effect of this same rotation, the stud 57 is urged in the outward direction by the centrifugal force, and the split ring 58 tends to be opened. As long as the part 47 is strongly forced against this ring owing to the acceleration of the projectile, the ring cannot open and retains the stud 57 in its place. When this acceleration ceases, i.e., as soon as the projectile has left the barrel of the weapon, the part 47 is urged in the upward direction under the action of the ring 58 which opens under the action of the centrifugal force. This ring is disengaged from the parts 46 and 47, and the stud 57 escapes in the outward direction into a chamber 66 of the body 1. The stud 57 was engaged in a calibrated hole 67 of the part 48. The material 68 in the chamber comprised between 48 and 49 above the piston 55, can then escape through this hole into the chamber 66. Then the piston 55, which is now no longer locked by the stud 57, drives the material 68 through the hole 67 and at the same time through calibrated orifices 69 provided in the upper part of the chamber containing this material. When the piston reaches and moves on beyond the upper edge of the hole 67, the material 68 can no longer escape through this hole; it can only continue to escape by the calibrated holes 69. It is at this instant that the part 65 ceases to retain the part 62, which under the action of the centrifugal force, starts to move in the outward direction and ceases to lock the shaft of the percussion pin. In this way the muzzle and proximal trajectory safety is secured. It will be remarked that the hole 67 is much larger than the holes 69, which is easy to understand, because the time required to secure the muzzle and proximal trajectory safety is much shorter than the time interval at the end of which self-destruction must occur. From the moment when the part 62 has released the shaft of the percussion pin, the ignition can take place; as may be easily understood, if the point of the fuse encounters an obstacle, there is then nothing to prevent the shaft from moving downwards when 32 and 10 act upon it following percussion.

If ignition does not take place owing to percussion of the fuse, the moment arrives when the lower extremity 65 of the piston 55 uncovers the holes 54, which allows the weights to move in the outward direction for a distance which is sufficient to allow it to no longer lock the ring 52 and the spring 51. At this moment, the spring 51 drives the ring in the downward direction, this ring strikes the enlarged part 24 of the shaft of the percussion pin, and the point 4 of the latter produces the ignition.

In the embodiment according to Fig. 2, the mass 68 is preferably of the same type as the one indicated above with respect to Fig. 1.

The invention, although illustrated in the two embodiments described by the case of rotating projectiles, is not limited to this type of projectile. The locking means controlled by centrifugal force (27, 41, 57) could actually be replaced by locking means controlled by the linear acceleration (instead of the angular acceleration) occurring at the time the projectile is fired.

What I claim is:

A control device, for the hammer of a projectile fuse provided with muzzle and proximal trajectory safety and self-destruction devices, comprising a percussion pin displaceable by said hammer, a percussion spring operatively associated with said pin for displacing the same to effect a detonation, a dash pot including a mobile member and operatively associated with said pin for regulating the displacement thereof, a buffer fluid in said dash pot and being constituted by a silicone having a chain structure containing $Si(CH_3)_2$ groups and a substantially constant viscosity despite temperature changes, a further spring operatively associated with said dash pot for actuating the mobile member thereof, first locking means for locking the percussion pin in position and the mobile member in position against the action of said further spring and releasing the mobile member in response to rotation of the projectile, second locking means operatively associated with said mobile member and said percussion spring for controlling the percussion spring and releasing the same to actuate the percussion pin in response to the displacement of said mobile member, said dash pot defining axial and radial calibrated orifices, and a displaceable stud included in the first locking means and in the radial orifice for locking the mobile member in position, a displacement of the stud enabling displacement of the mobile member and escape of the buffer fluid through the orifices, a predetermined displacement of the mobile member closing off the radial orifice and preventing escape of fluid therethrough.

References Cited in the file of this patent

UNITED STATES PATENTS

570,065	Smith	Oct. 27, 1896
972,425	Wilson et al.	Oct. 11, 1910
2,405,653	Honger	Aug. 13, 1946
2,407,037	Sowa	Sept. 3, 1946

FOREIGN PATENTS

245,766	Great Britain	Jan. 4, 1926
742,598	France	Jan. 4, 1933