May 10, 1955 M. G. CLAY 2,707,918

FUSE FOR A MILITARY SHELL

Filed April 6, 1954 2 Sheets-Sheet 1

Fig. 1

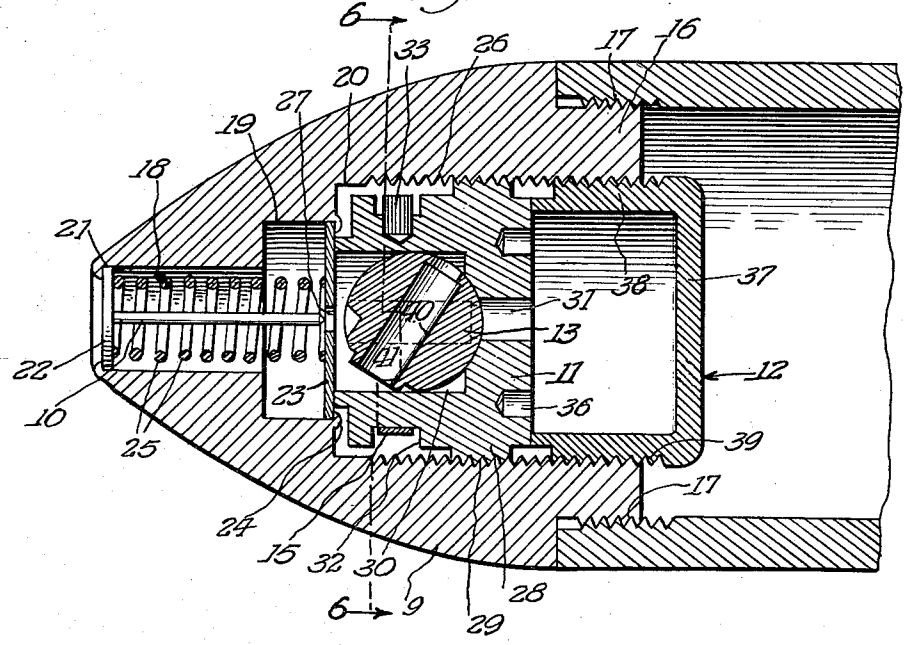


Fig. 2

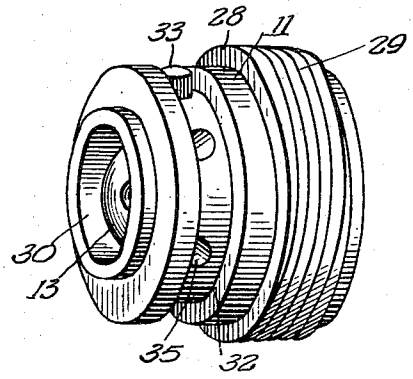


Fig. 3

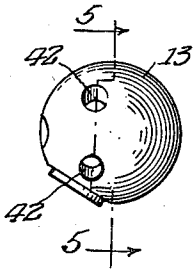


Fig. 5

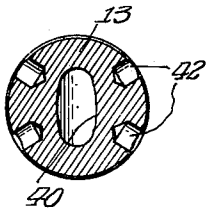
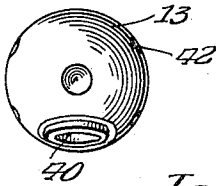


Fig. 4



Inventor
Murray G. Clay
By Fred Fenlaw atty.

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FUSE FOR A MILITARY SHELL

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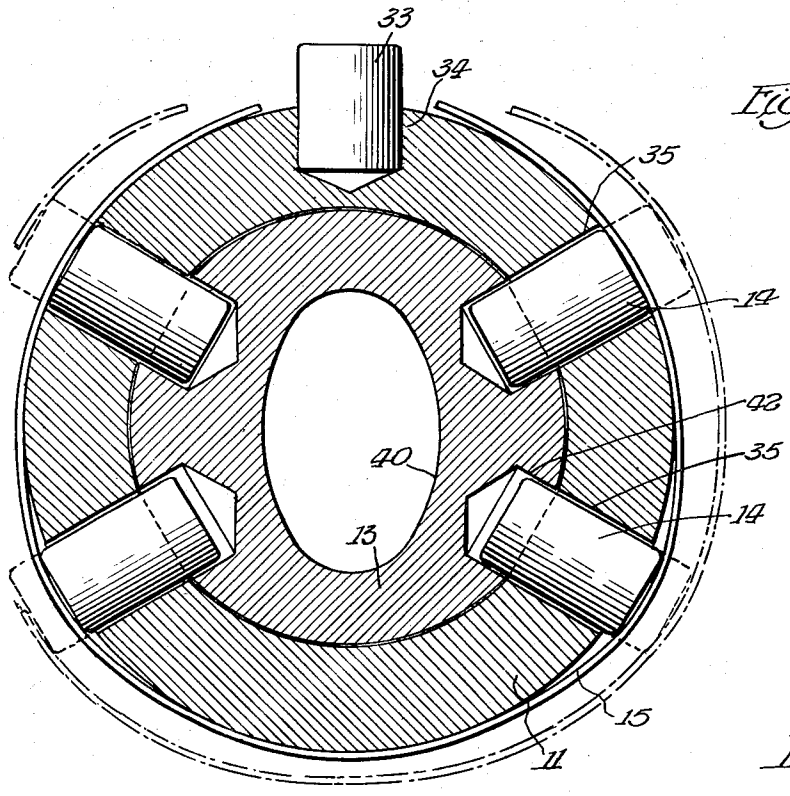


Fig. 6

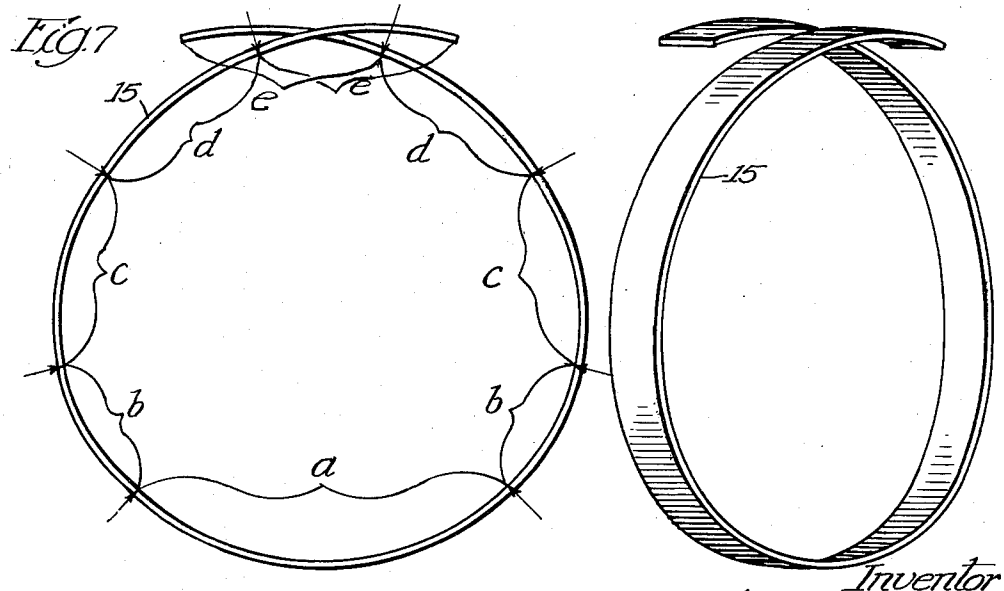


Fig. 7

Fig. 8

Inventor
Murray G. Clay
By: Fred Kerlack Atty.

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FUSE FOR A MILITARY SHELL

Murray G. Clay, Chicago, Ill.

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4 Claims. (Cl. 102—79)

The present invention relates to fuses. More particularly the invention relates to that type of fuse which forms the front end of a high explosive or other military shell, is adapted after firing of the shell and upon impact to activate the shell, and as its principal parts or components comprises: (1) a conical nose piece which embodies at the large rear end thereof means for connection to the front end of the casing of the shell and has at its small front end an aperture with a separately formed rigidly mounted thin metal crosswall thereacross; (2) a firing pin which is connected to, and extends rearwards from, the central portion of the crosswall and is coaxially positioned with respect to the axis of the nose piece; (3) a bushing-like member which is mounted in the nose piece directly behind the firing pin, embodies in its central portion an open front ball-receiving cavity and a small sized hole between the rear end of the cavity and the rear end surface of the member, has an external annular groove around and in spaced relation with the central portion of the ball-receiving cavity, is provided with a single fixedly mounted radially extending stop pin in the groove, and has formed therein between the groove and the central portion of the ball-receiving cavity four open ended radially extending bores which are positioned, respectively, at 2, 4, 8 and 10 o'clock locations with respect to the stop pin; (4) a cup-shaped receptacle which is disposed in the nose piece behind the bushing-like member and is adapted to contain a booster charge; (5) a ball which is disposed in the cavity in the bushing-like member, has a diametric hole for a detonating cap, is adapted normally to be retained in an unarmed position wherein its hole is angularly disposed with respect to the axis of the nose piece, is further adapted when released and subjected to centrifugal force after firing of the shell to rotate automatically into an armed position wherein its hole is coaxially positioned with respect to the axis of the nose piece and the front end of the cap is in alignment with the inner end of the firing pin, and has formed therein four radially extending sockets which, when the ball is in its unarmed position, are in registry with the inner ends of the four radially extending bores in the bushing-like member; (6) four radially extending detent pins which are slidably mounted in the bores, are adapted normally to assume an operative position wherein their inner ends are disposed in the sockets in the ball and serve to hold the ball in its unarmed position, and are further adapted when subjected to centrifugal force to slide outwards and thus release the ball so that it rotates into its armed position; and (7) an arcuate leaf spring which is disposed in, and extends around, the annular external groove in the bushing-like member, has its ends terminating adjacent the stop pin, and is adapted to retain the detent pins in their operative position until the fuse after firing of the shell passes beyond a certain or predetermined rotational speed.

In a fuse of the aforementioned type, it has heretofore been customary to form the arcuate leaf spring so that

before mounting in place in the annular external groove in the bushing-like member, it is substantially circular, has the ends thereof in overlapped relation, and is of less diameter than the internal diameter of the groove. In practice, it has been found that when the arcuate leaf spring is so formed, the two detent pins that are nearer the fixed radially extending stop pin are released by the spring long before the detent pins that are farther from the stop pin. This is directly attributable to the fact that the end portions of a substantially circular leaf spring are more flexible and have more give in them than the central portion of the spring. A fuse in which the pins that are nearer the stop pin are released in advance of the other two detent pins is subject to the objection that it becomes partially armed at one rotational speed and fully armed at a much greater or higher rotational speed. Government specifications or regulations require that in a fuse of the type under consideration, full arming take place when the fuse after firing of the shell with which it is associated comes within a certain range of rotational speeds. If the spring is formed as heretofore mentioned, such specifications or regulations are difficult and oft times impossible to meet because of commercial variations in spring sizes and thicknesses and the fact that the pins that are nearer the stop pin and the pins that are farther from the stop pin are released at rotational speeds that are quite far apart.

The principal object of the present invention is to provide a fuse which is an improvement upon, and eliminates the disadvantages of, previously designed fuses of the same general character and is characterized by the fact that the arcuate leaf spring is of such original shape or configuration that it operates when the fuse reaches a predetermined rotational speed after firing of the shell with which the fuse is used substantially simultaneously to release all four of the detent pins. By having the leaf spring so designed that it releases all four of the pins substantially simultaneously when the fuse reaches a predetermined rotational speed, it is possible, even though allowing for commercial variations or tolerances, to meet Government specifications or regulations which require full arming within a limited predetermined range of rotational speeds. Generally speaking, the spring originally is of such varying radii from its central portion to its ends that when the spring is in place in the annular external groove in the bushing-like member, the portions of the spring that overlie the outer ends of the two detent pins that are nearer the stop pin urge such detent pins inwards with the maximum pressure which can be developed in the spring. By having the spring so originally configured, all four of the detent pins are released together when the fuse reaches a predetermined rotational speed.

Another object of the invention is to provide a fuse of the aforementioned character in which the original configuration of the arcuate leaf spring is such that when the spring is in place in the annular external groove in the bushing-like member, the portions of the spring that are adjacent the two detent pins that are farther from the stop pin are in the form of comparatively shallow lobes which permit the two aforementioned pins to extend outwards to a greater extent than the other two pins before the spring in response to the action by the pins releases all four pins substantially simultaneously.

A further object of the invention is to provide a fuse of the type and character under consideration in which the original configuration of the arcuate spring is such that when the spring is in place in the annular external groove in the bushing-like member, the extremities or end portions of the spring are spaced slightly outwards from the adjacent portions of the bottom of the groove to the end that the end edges of the spring do not dig

into such portions and prevent proper operation of the spring.

Other objects of the invention and the various advantages and characteristics of the present fuse will be apparent from a consideration of the following detailed description. The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion thereof.

In the drawings which accompany and form a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views:

Figure 1 is a longitudinal section showing a fuse embodying the invention with the ball thereof in its unarmed position;

Figure 2 is a front perspective view of the bushing-like member of the fuse;

Figure 3 is a side view of the ball;

Figure 4 is a front view of the ball;

Figure 5 is a section taken on the line 5—5 of Figure 3 and illustrating in detail the arrangement of the sockets for receiving the inner ends of the detent pins;

Figure 6 is an enlarged transverse section taken on the line 6—6 of Figure 1 and illustrating in detail the configuration of the arcuate leaf spring when it is in place in the groove and before it releases the detent pins;

Figure 7 is a front view showing the spring in its original position, i. e. before it is mounted in the external annular groove in the bushing-like member; and

Figure 8 is a perspective view of the spring before mounting of the spring in its operative position.

The fuse which is shown in the drawings constitutes the preferred form or embodiment of the invention. It forms the front end of a high explosive or other military shell and as its principal parts or components comprises a nose piece **9**, a firing pin **10**, a bushing-like member **11**, a cup-shaped receptacle **12**, a ball **13**, four radially extending detent pins **14**, and an arcuate leaf spring **15**. Except for the particular construction and design of the leaf spring **15**, the fuse is conventional.

The nose piece **9** of the fuse is both conical and hollow and is formed of aluminum or other suitable metal. The large rear end of the nose piece is provided with a reduced extension **16** which fits within the front end of the casing of the shell with which the fuse is associated, and has an external screw thread **17** for connecting it in place. From its small front end to its large rear end, the nose piece **9** is provided sequentially with a bore **18**, a first counterbore **19** and a second counterbore **20**. These three bores are coaxially positioned with respect to the axis of the nose piece. The bore **18** is for all intents and purposes of uniform diameter from end to end and leads rearwards from the tip of the nose piece. The front end of the bore **18** constitutes or forms an aperture **21** in the tip of the nose piece and has extending thereacross a circular thin metal crosswall **22**. The tip of the nose piece is swaged inwards over the marginal portion of the crosswall **22** in order fixedly to secure the crosswall within the aperture **21**. The first counterbore **19** is located in the front central portion of the nose piece **9** and communicates with the rear end of the bore **18**. It is of uniform diameter from end to end and has an abutment disc **23** mounted slidably therein. Such disc is urged rearwards against an annular stop shoulder **24** by way of a spiral compression spring **25**. One end of the spring **25** abuts against the rear surface of the crosswall **22** and the other end of the spring abuts against the central portion of the front surface of the abutment disc **23**. As shown in the drawings, the first counterbore **19** is of greater diameter than the bore **18**. The second counterbore **20** leads rearwards from the first counterbore **19** and extends through the rear end surface of the extension **16**. It is of uniform diameter from end to end and has a female screw thread **26**.

The firing pin **10** of the fuse is connected to, and extends rearwards from, the central portion of the crosswall **22** and is coaxially positioned with respect to the axis of the nose piece **9**. The rear end of the firing pin is disposed in the first counterbore **19** and is in alignment with a hole **27** in the central portion of the abutment disc **23**. Such hole permits the disc to slide forward against the force of the spring **25** in response to forward displacement of the ball **13**.

The bushing-like member **11** of the fuse is disposed in the front portion of the second counterbore **20** and has at the rear end thereof an integral outwardly extending flange **28** which has a male screw thread **29** in interfitting relation with the female screw thread **26**. In the central portion of the member **11** is an open front ball-receiving cavity **30** and a small sized hole **31** between the rear end of the cavity and the rear end surface of the member. The cavity **30** and the hole **31** are positioned coaxially with respect to the axis of the nose piece **9**. The cavity **30** is of less diameter than the first counterbore **19** and has its open front facing towards the abutment disc **23**. The bushing-like member **11** has an external annular groove **32** around and in spaced relation with the central portion of the ball-receiving cavity **30** and is provided with a single radially extending stop pin **33** in the groove. The groove **32** is rectangular in cross section. The inner end of the pin **33** is mounted in a socket **34** in the bushing-like member and is connected thereto by a drive fit in order that it is in rigid relation with the member. The portion of the member **11** that is disposed between the annular groove **32** and the central portion of the ball-receiving cavity is provided with four open ended radially extending bores **35**. The latter are of uniform diameter from end to end and are positioned, respectively, at 2, 4, 8 and 10 o'clock locations with respect to the stop pin **33** as shown in Figure 6 of the drawings. The rear end of the bushing-like member **11** is provided with a pair of diametrically opposite sockets **36** for receiving a suitable wrench or other turning tool in connection with mounting or removal of the member with respect to the nose piece **9**.

The cup shaped receptacle **12** is disposed for the most part in the rear portion of the second counterbore **20**. It is adapted to contain a booster charge (not shown) and consists of a circular or disc-like crosswall **37** and a forwardly extending cylindrical side wall **38**. The side wall of the receptacle is provided in its outer periphery with a male screw thread **39** which is in interfitting relation with the female screw thread **26**. The rear end of the small sized hole **31** leads to the interior of the receptacle **12** as shown in Figure 1.

The ball **13** of the fuse is disposed in the cavity **30** in the bushing-like member **11** and has a diametric hole **40** for a detonating cap **41**. It is adapted normally to be retained in an unarmed position wherein its diametric hole **40** is angularly disposed with respect to the axis of the nose piece (see full line position in Figure 1). It is further adapted when released and subjected to centrifugal force after firing of the shell to rotate automatically into an armed position wherein its hole is coaxially positioned with respect to the axis of the nose piece and the front end of the cap is in alignment with the inner or rear end of the firing pin **10** (see dotted line position in Figure 1). When the ball is in its armed position and the nose piece after firing of the shell is impacted against an object, the firing pin **10** moves rearwards and detonates the cap **41** which in turn fires the booster charge in the cup shaped receptacle **12**. In the event that the nose piece after firing of the shell strikes such a glancing blow that the tip of the nose piece is not crushed, the ball due to its momentum moves forward with respect to the nose piece and causes the rear end of the firing pin to detonate the cap **41**. The ball **13** has formed therein four radially extending sockets **42** which, when the ball is in its unarmed position, are in registry with the inner ends of the

four radially extending bores 35 in the bushing-like member 11.

The four radially extending detent pins 14 of the fuse are slidably mounted in the bores 35, respectively, and are adapted normally to assume an operative position wherein their inner ends are disposed in the sockets 42 in the ball and serve to hold the ball in its unarmed position (see full line position of detent pins of Figure 6). They are further adapted when subjected to centrifugal force to slide outwards and into a position wherein their inner ends are out of the sockets 42 and the ball is hence released so that it rotates into its armed position in response to centrifugal force.

The arcuate leaf spring 15 of the fuse is disposed in, and extends around, the annular external groove 32 in the bushing-like member 11 and is arranged so that the ends thereof terminate adjacent the stop pin 33 as shown in Figure 6. It is adapted to retain the detent pins 14 in their operative position until the fuse after firing of the shell passes beyond a certain or predetermined rotational speed. Preferably the spring is formed of beryllium copper and is heat treated so as to provide maximum tensile strength. In practice it has been found that if the spring is subjected to a temperature of 650° F. for approximately 30 minutes, it will retain throughout its life maximum tensile strength. The spring is of uniform thickness from end to end and before being mounted in the external annular groove 32 in the bushing-like member 11 has the ends thereof arranged in lapped or crossed relation, is of less mean diameter than the internal diameter of the groove 32, and has the particular shape or configuration shown in Figures 7 and 8 of the drawings. The original shape or configuration of the spring is such that the spring operates, when the fuse reaches a predetermined rotational speed after firing of the shell with which the fuse is used or associated, substantially simultaneously to release all four of the detent pins 14. Generally speaking, the spring both before and after mounting in place in the groove is non-circular. In order that the particular original shape or configuration of the spring 15 may be fully understood, the spring is shown in Figure 7 as being divided into a central or intermediate portion *a*, a pair of portions *b* at the ends of the portion *a*, a pair of portions *c* at the upper ends of the portions *b*, a pair of portions *d* at the upper ends of the portions *c* and a pair of end portions *e* at the upper ends of the portions *d*. If the internal radius of the annular groove 32 in the bushing-like member 11 is .4275", the radii of the aforementioned portions of the spring before mounting in place of the spring are as follows:

Radius of portion *a*	.344"
Mean radius of portions *b*	.219"
Mean radius of portions *c*	.281"
Mean radius of portions *d*	.344"
Mean radius of portions *e*	.407"

It is contemplated that the radii of the portions *b*, *c*, *d* and *e* will be on a progressively increasing basis in the direction of the extremities of the spring. By having the spring originally shaped as heretofore described, the spring when in place operates substantially simultaneously to release all four of the detent pins when the fuse reaches a predetermined rotational speed after firing of the shell. When the spring 15 is expanded and mounted in place in the groove 32, the portions *b* overlie the outer ends of the two pins that are farther from the stop pin 33 and the spring portions *d* overlie the outer ends of the detent pins that are nearer the stop pin, as shown in Figure 6. Because of the original radius of the portions *b* of the spring, such portions when the spring is in place are in the form of lobes (see Figure 6) which result in the two detent pins that are farther from the stop pin being disposed farther outwards from the center than the two detent pins that are nearer the stop pin. The original radius of the portions *d* of the spring is such that

the portions *d*, when the spring is in place, hold the detent pins that are nearer the stop pin so that their outer ends are flush with the outer ends of the bores in which such two pins are mounted. By reason of the fact that when the four detent pins are in their operative position, the pins that are farther from the stop pin are disposed farther from the center than the two detent pins that are nearer the stop pin, the first mentioned two detent pins are subjected to greater centrifugal force than the second mentioned two detent pins and consequently the tendency of all four pins is to release or slide outwards simultaneously when the rotation speed of the fuse reaches a predetermined R. P. M. Because of the particular original radius of the portions *d*, i. e. the portions that overlie the outer ends of the two detent pins that are nearer the stop pin 33, such portions exert against said two detent pins the maximum pressure that can be developed in the spring as a whole. Because of the particular original radius of the end portions *e* of the spring, the extremities of such end portions, when the spring is in place, are spaced outwards from the adjacent portions of the bottom of the groove, and hence, they do not dig into such portions. The length of the spring is such that when the spring is in place in the groove 32, the extremities of the spring are each spaced a small distance from the stop pin 33.

The herein described fuse is highly efficient in operation and this is directly attributable to the fact that the arcuate leaf spring 15 has such original shape or configuration that it operates when the fuse reaches a predetermined rotational speed after firing of the shell substantially simultaneously to release all four of the detent pins. With the present fuse, there is no partial arming when the rotational speed reaches a predetermined R. P. M. and a full arming when the fuse reaches a higher R. P. M.

The invention is not to be understood to be restricted to the details set forth since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention what I claim as new and desire to secure by Letters Patent is:

1. In a fuse of the type that is adapted to form the front end of a military shell and embodies a hollow conical nose piece having a centrally positioned rearwardly extending firing pin at its small front end, a bushing-like member mounted in the nose piece directly behind the firing pin, embodying in its central portion an open front ball-receiving cavity, having an external annular groove around and in spaced relation with the central portion of the ball-receiving cavity, provided with a single fixedly mounted stop pin in the groove, and having formed therein between the groove and the central portion of the cavity a plurality of open ended radially extending bores in circumferentially spaced relation with one another and the stop pin, a ball disposed in the cavity, having a diametric hole for a detonating cap, adapted normally to be retained in an unarmed position wherein its hole is angularly disposed with respect to the axis of the nose piece, further adapted when released and subjected to centrifugal force after firing of the shell to rotate automatically into an armed position wherein its hole is in parallel relation with the axis of the nose piece and the front end of the cap is in alignment with the inner end of the firing pin, and having formed therein a series of spaced apart pockets corresponding in number to, and adapted when the ball is in its unarmed position to register with the inner ends of, the radially extending bores, a plurality of radially extending detent pins corresponding in number to, and slidably mounted in, the bores, adapted normally to assume an operative position wherein their inner ends are disposed in the sockets of the ball and serve to hold the ball in an unarmed position, and further adapted when subjected to centrifugal force to slide outwards and release the ball

so that it is free to rotate into its armed position, and an arcuate leaf spring disposed in, and extending around, the annular groove in the bushing-like member, having its ends terminating adjacent the stop pin, and adapted to retain the detent pins in their operative position until the fuse after firing of the shell passes beyond a certain or predetermined rotational speed; the improvement which comprises having the spring originally of varying radii from its central portion to its ends, of less mean diameter than the internal diameter of the groove, and of such shape or configuration that when in place in said groove it operates after the fuse reaches a predetermined rotation speed following firing of the shell substantially simultaneously to release all of the detent pins.

2. In a fuse of the type that is adapted to form the front end of a military shell and embodies a hollow conical nose piece having a centrally positioned rearwardly extending firing pin at its small front end, a bushing-like member mounted in the nose piece directly behind the firing pin, embodying in its central portion an open front ball-receiving cavity, having an external annular groove around and in spaced relation with the central portion of the ball-receiving cavity, provided with a single fixedly mounted stop pin in the groove, and having formed therein between the groove and the central portion of the cavity a plurality of open ended radially extending bores in circumferentially spaced relation with one another and the stop pin, a ball disposed in the cavity, having a diametric hole for a detonating cap, adapted normally to be retained in an unarmed position wherein its hole is angularly disposed with respect to the axis of the nose piece, further adapted when released and subjected to centrifugal force after firing of the shell to rotate automatically into an armed position wherein its hole is in parallel relation with the axis of the nose piece and the front end of the cap is in alignment with the inner end of the firing pin, and having formed therein a series of spaced apart pockets corresponding in number to, and adapted when the ball is in its unarmed position to register with the inner ends of, the radially extending bores, a plurality of radially extending detent pins corresponding in number to, and slidably mounted in, the bores, adapted normally to assume an operative position wherein their inner ends are disposed in the sockets of the ball and serve to hold the ball in an unarmed position, and further adapted when subjected to centrifugal force to slide outwards and release the ball so that it is free to rotate into its armed position, and an arcuate leaf spring disposed in, and extending around, the annular groove in the bushing-like member, having its ends terminating adjacent the stop pin, and adapted to retain the detent pins in their operative position until the fuse after firing of the shell passes beyond a certain or predetermined rotational speed; the improvement which comprises having the spring originally of varying radii from its central portion to its ends, of less mean diameter than the internal diameter of the groove, of such shape or configuration that when in place in the groove the portions thereof that are outwards of the detent pins that are farther from the stop pin are in the form of outwardly bulged lobes which permit the last mentioned pins to assume an operative position farther from the center of the groove than the detent pins that are nearer the stop pin, and also of such shape or configuration that when in place in said groove it operates after the fuse reaches a predetermined rotational speed following firing of the shell substantially simultaneously to release all of the detent pins.

3. In a fuse of the type that is adapted to form the front end of a military shell and embodies a hollow conical nose piece having a centrally positioned rearwardly extending firing pin at its small front end, a bushing-like member mounted in the nose piece directly behind the firing pin, embodying in its central portion an open front ball-receiving cavity having an external annular groove around and in spaced relation with the central

portion of the ball-receiving cavity, provided with a single fixedly mounted radially extending stop pin in the groove, and having formed therein between the groove and the central portion of the cavity a plurality of open ended radially extending bores in circumferentially spaced relation with one another and the stop pin, a ball disposed in the cavity, having a diametric hole for a detonating cap, adapted normally to be retained in an unarmed position wherein its hole is angularly disposed with respect to the axis of the nose piece, further adapted when released and subjected to centrifugal force after firing of the shell to rotate automatically into an armed position wherein its hole is in parallel relation with the axis of the nose piece and the front end of the cap is in alignment with the inner end of the firing pin, and having formed therein a series of spaced apart pockets corresponding in number to, and adapted when the ball is in its unarmed position to register with the inner ends of, the radially extending bores, a plurality of radially extending bores, a plurality of radially extending detent pins corresponding in number to, and slidably mounted in, the bores, adapted normally to assume an operative position wherein their inner ends are disposed in the sockets of the ball and serve to hold the ball in an unarmed position, and further adapted when subjected to centrifugal force to slide outwards and release the ball so that it is free to rotate into its armed position, and an arcuate leaf spring disposed in, and extending around, the annular groove in the bushing-like member, having its ends terminating adjacent the stop pin, and adapted to retain the detent pins in their operative position until the fuse after firing of the shell passes beyond a certain or predetermined rotational speed; the improvement which comprises having the spring originally of varying radii from its central portion to its ends, of less mean diameter than the internal diameter of the groove, and of such shape or configuration that when in place in the groove its ends are spaced outwards small distances from the adjacent portions of the bottom of the groove and it operates after the fuse reaches a predetermined rotational speed following firing of the shell substantially simultaneously to release all of the detent pins.

4. In a fuse of the type that is adapted to form the front end of a military shell and embodies a hollow conical nose piece having a centrally positioned rearwardly extending firing pin at its small front end, a bushing-like member mounted in the nose piece directly behind the firing pin, embodying in its central portion an open front ball-receiving cavity, having an external annular groove around and in spaced relation with the central portion of the ball-receiving cavity, provided with a single fixedly mounted radially extending stop pin in the groove, and having formed therein between the groove and the central portion of the cavity four open ended radially extending bores at 2, 4, 8 and 10 o'clock locations with respect to the stop pin, a ball disposed in the cavity, having a diametric hole for a detonating cap, adapted normally to be retained in an unarmed position wherein its hole is angularly disposed with respect to the axis of the nose piece, further adapted when released and subjected to centrifugal force after firing of the shell to rotate automatically into an armed position wherein its hole is in parallel relation with the axis of the nose piece and the front end of the cap is in alignment with the inner end of the firing pin, and having formed therein four pockets arranged so that when the ball is in its unarmed position they register with the inner ends of the radially extending bores, four radially extending detent pins mounted slidably in the bores, adapted normally to assume an operative position wherein their inner ends are disposed in the sockets of the ball and serve to hold the ball in an unarmed position, and further adapted when subjected to centrifugal force to slide outwards and release the ball so that it is free to rotate into its armed position, and an arcuate leaf spring disposed in, and extending around, the

annular groove in the bushing-like member, having its ends terminating adjacent, but in spaced relation with, the stop pin, and adapted to retain the detent pins in their operative position until the fuse after firing of the shell passes beyond a certain or predetermined rotational speed; the improvement which comprises having the spring originally of varying radii from its central portion to its ends, of less mean diameter than the internal diameter of the groove, of such shape or configuration that when in place the portions thereof that are outwards of the pins in the 4 and 8 o'clock bores are in the form of outwardly bulged lobes which permit the last mentioned pins to assume an operative position farther from the center of the groove than the other two detent pins, and also of

such shape or configuration that when in place in the groove its ends are spaced outwards from the adjacent portions of the bottom of the groove and it operates after the fuse reaches a predetermined rotational speed following firing of the shell substantially simultaneously to release all of the detent pins.

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