

Oct. 16, 1945.

L. N. BARNUM ET AL

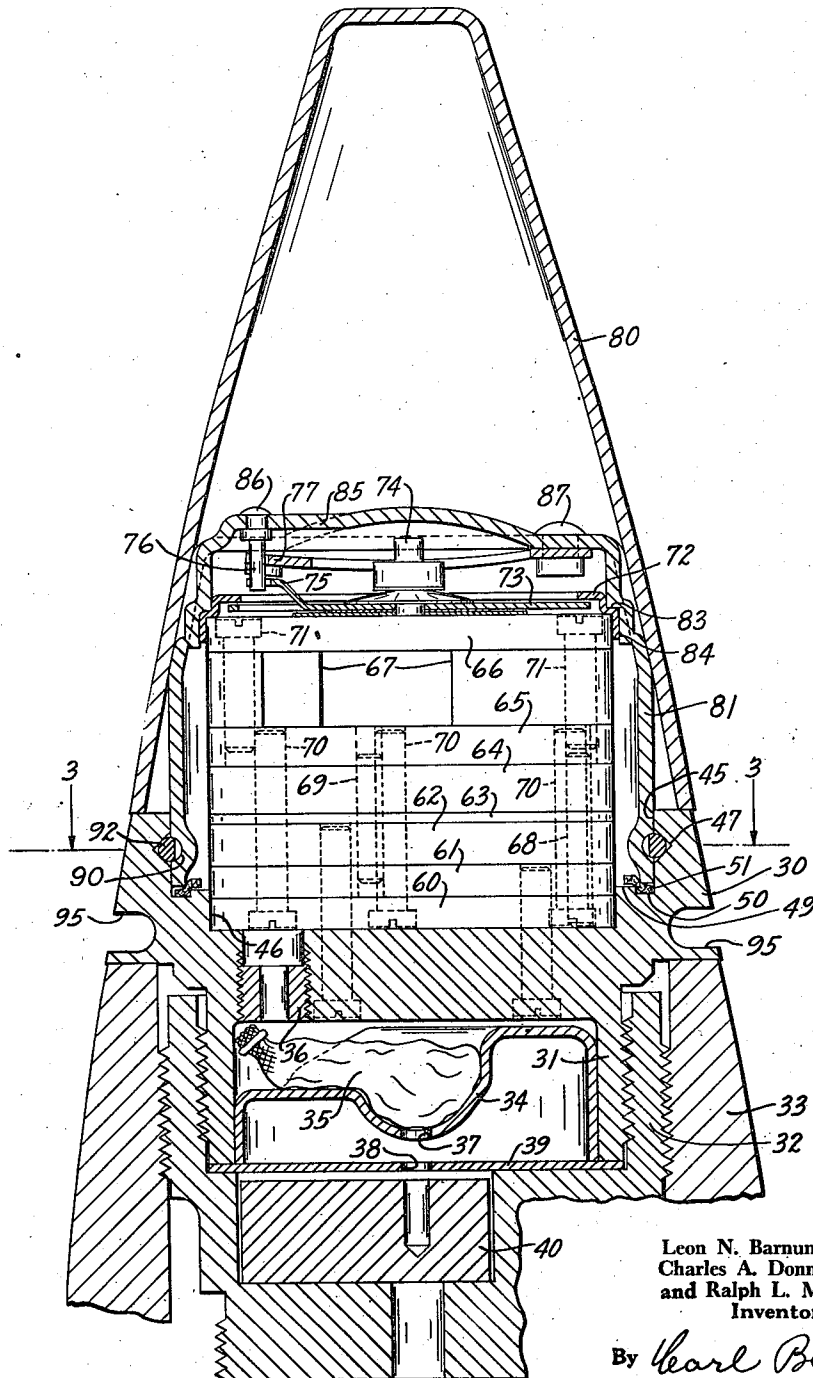
2,386,834

MECHANICAL DEVICE

Filed April 3, 1943

2 Sheets-Sheet 1

FIG. 1



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2 Sheets-Sheet 2

FIG. 2

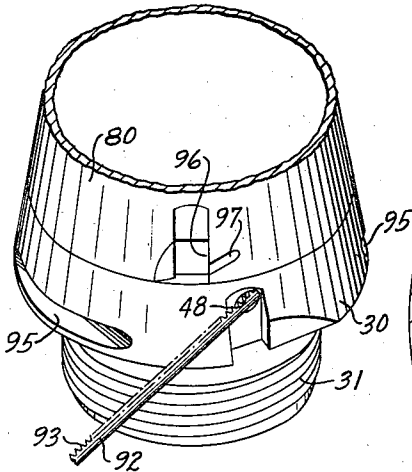


FIG. 3

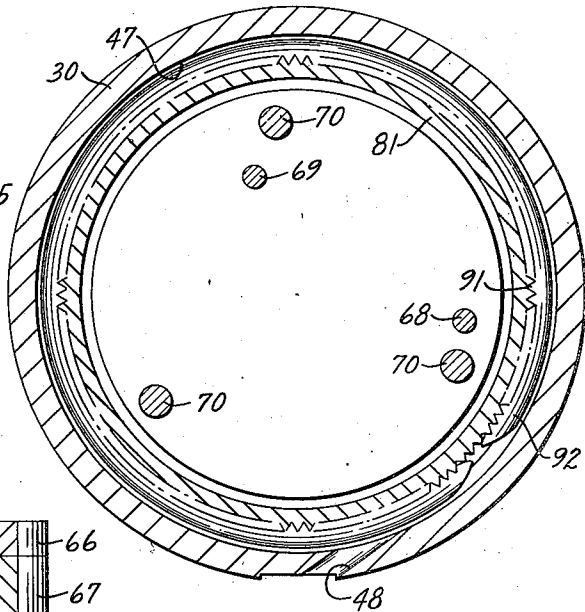


FIG. 4

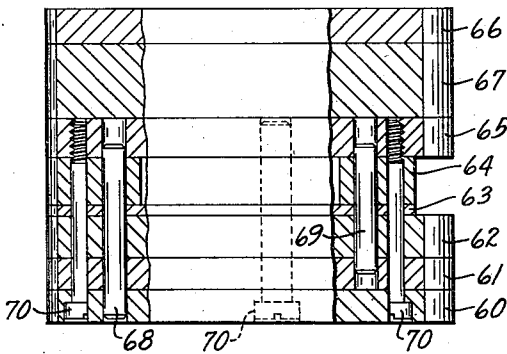


FIG. 5

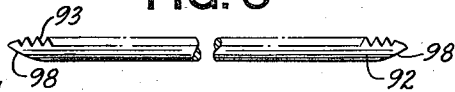


FIG. 7

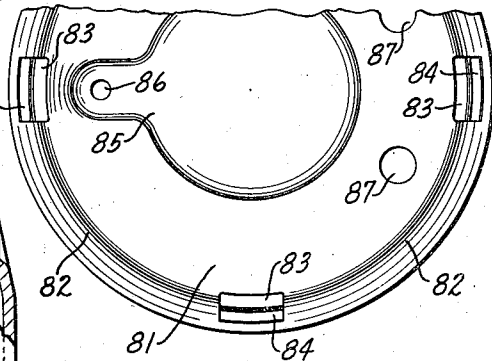
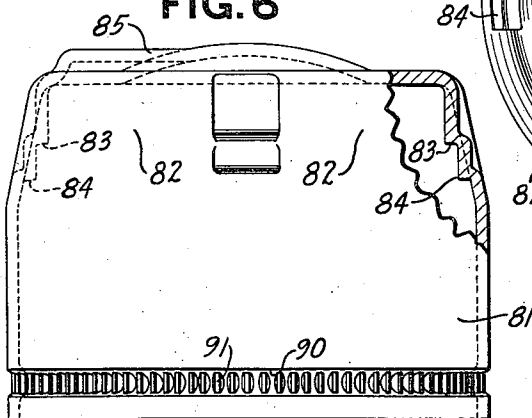


FIG. 6



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UNITED STATES PATENT OFFICE

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MECHANICAL DEVICE

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Application April 3, 1943, Serial No. 481,678

6 Claims. (Cl. 287—119)

This invention relates to improvements in time fuzes for explosive shells, and more particularly to the ogive construction, the means for securing the ogive to the body of the fuze, and also the means for positively holding the timing unit to prevent damage thereto as the projectile is passing through the gun barrel, in order to insure that the timing unit will function properly and at a predetermined time according to the setting of the same before it is placed in the gun from which it is fired.

The mechanical time fuze in general comprises a body, with a powder bag retainer or receptacle in the bottom and a timing unit in the top, this timing unit being concealed by an ogive composed of an outer cap and an inner cap secured to the body of the fuze.

In one type of mechanical time fuze, the ogive comprises a top cap of cast aluminum and a bottom cap of cast brass, the two caps being held together by a threaded tenon on the aluminum cap, which screws into a tapped hole in the bottom cap. The timing unit sets in an opening in the top of the body and is secured to the body by screws. This body was also of cast aluminum, and the powder bag retainer was made of brass rod.

The lower cap of the ogive was connected to the fuze body by a circular spring wire lying in a groove on the inside of said cap and having both ends thereof bent at right angles and projected through a small hole in the cap. The fuze body was provided with a groove opposite the groove in the cap, and, to tension the spring wire, four set screws were used, which pressed against the spring to force portions thereof, adjacent said screws, into the groove in the fuze body. These screws were given a sufficient number of turns against the spring wire to cause enough pressure to prevent the ogive from being accidentally turned, but permitting it to be turned by the standard fuze setting device.

The assembled time fuze is screwed into a booster, which is in turn screwed into the projectile of the shell.

In order to eliminate the use of a proportionately large amount of critical war material, such as brass and aluminum, a change in the structure of the mechanical time fuze is being made by substituting a pressed steel ogive, comprising an outer cap and an inner cap, for the former aluminum-and-brass ogive, by substituting a malleable iron body for the former aluminum casting body, and by further substituting a pressed steel

powder bag retainer for the former brass powder bag retainer.

These changes in materials, as above mentioned, from aluminum and brass castings to pressed steel, presented problems in manufacture, particularly in connection with the assembling of the two-piece pressed steel ogive and the fuze body, in order to obtain an effective pressure lock between the ogive and the body, so that no relative movement between said ogive and said body can be effected, either accidentally or intentionally, when not desirable, at the same time permitting a relative movement between the ogive and the body of the fuze to set the timing device or unit so that it can be automatically armed at the proper time.

One of the other problems presented was the holding of the timing unit absolutely rigid, so that no damage will happen to the same through centrifugal force as the shell is rifled through the gun barrel, especially when the barrel is worn, and also so that no damage can happen to the timing unit by the terrific shock which it sustains upon the firing of the shell from the gun.

Another problem presented was the matter of sealing the timing unit inside the inner cap of the ogive to prevent moisture from getting inside the cap, which causes rusting of the steel parts.

It is not here necessary to go into any great detailed consideration of the timing device, it being thought sufficient to state that this timing device or unit is built up of a series of seven plates and a set of spacers which are secured together by means of dowel pins and screws, there being one dowel pin connecting the second, third, fourth, fifth, and sixth plates, and a second dowel pin connecting the first six plates, counting from the bottom. There are three filister head screws connecting the six bottom plates, which screws are threaded into the sixth plate. There are also three screws connecting the two top plates and the set of spacers between them. These screws are also threaded into the sixth plate from the bottom. The first four and the sixth plates from the bottom are made of brass, and the fifth plate is made of an aluminum alloy, which, of course, is softer material than brass.

Therefore, in some instances, due to the terrific centrifugal force to which the timing unit is subjected as the projectile is rifled through the gun barrel, and particularly when the gun barrel is slightly worn, the travel of the projectile is not on a true line, and it wobbles or precesses. When this occurs, the two dowel pins sometimes bend at the part where they pass through the fifth

plate, which, as above stated, is made of softer material than brass, and, when these dowel pins bend, it of course puts a tremendous strain on the three screws that are threaded into the sixth plate, with the consequent result that these three screws often shear off at the line between the fifth and sixth plates.

To overcome such damage to the timing unit, the inner cap of the ogive is constructed to retain the timing unit absolutely rigid relatively to the fuze body.

It is therefore an object of this invention to produce an ogive for a mechanical time fuze to eliminate the above-mentioned difficulties and damage in connection with the timing unit.

Another object of this invention is the provision of novel means of assembling the ogive to the fuze body.

Another object is the production of a pressure lock between the ogive and the fuze body which prevents accidental or intentional relative movement between the ogive and the body by ordinary hand pressure should a person pick up one of the time fuzes and attempt to change its setting from "safety" to any other position after it has once been set on "safety," and which will at the same time prevent any accidental relative movement between the ogive and the body during the time the projectile is being fired until the proper predetermined time in accordance with a pre-set position made in a standard fuze setter.

Another object of this invention is the production of a novel securing means or pressure lock between the ogive and the fuze body which facilitates the assembling of the ogive to the body in the matter of cost of manufacture and time saved in assembling.

Another object of this invention is the production of a novel device to create a pressure lock between the ogive and the fuze body by the insertion of a serrated rod through a passage-way in the fuze body, which passage-way is tangent to an annular groove formed by the outside of the inner cap of the ogive and the inner wall of the fuze body.

Another object of the present invention is the provision of an annular row of serrations formed in the outside of the inner cap of the ogive to cooperate with a pressure lock creating means adapted to be inserted into a passage-way through the outside of the fuze body into an annular groove on the inside of the fuze body which is opposite the annular row of serrations in the inner cap of the ogive.

Another object of this invention is the provision of a novel body for a mechanical time fuze, which body is provided with an annular groove in the wall of an opening, which groove is connected by a passage-way tangential to said groove.

Another object of this invention is the provision of a pressed steel ogive comprising an outer cap and an inner cap, the latter having a plurality of lanced or shouldered sections to cooperate with and retain the timing unit of the fuze in proper relation to the fuze body at all times.

Another object of this invention is the production of a pressed steel ogive for a mechanical time fuze having an outer cap and an inner cap welded together as a unit, the inner cap having a plurality of double stepped lanced sections to cooperate with the edge of the timing unit on the top and side at intervals around said edge.

A still further object of this invention is the provision of a moisture-proof seal between the

bottom of the inner cap of the ogive and the fuze body, which sealing means is flexible enough to bend and at the same time tough enough to withstand the turning of the ogive relative to the fuze body without tearing or breaking during assembling and when the timing mechanism is set by the fuze setter.

With these and incidental objects in view, the invention consists of certain novel features of construction and combinations of parts, the essential elements of which are set forth in the appended claims and a preferred form or embodiment of which is hereinafter described with reference to the drawings which accompany and form a part of this specification.

Of said drawings:

Fig. 1 is a view showing the ogive, the fuze body, the powder bag retainer, the booster, and part of the projectile in section, and showing the timing units plates in full.

Fig. 2 is a perspective view, partially broken away, of the ogive and the fuze body, with the pressure lock means in the position in which it is inserted by hand prior to its being completely drawn into its pressure lock producing position by the turning of the ogive relative to the fuze body by a fixture or tool not shown in this application.

Fig. 3 is a section on line 3—3 of Fig. 1, looking in the direction of the arrows, and shows the pressure lock producing means completely drawn into position in the groove in the fuze body and the lower cap of the ogive.

Fig. 4 is a view, partly in section, of the timing unit, showing the two dowel pins and three screws for holding the six bottom plates together.

Fig. 5 is a detail view, partly broken away, of the pressure lock producing means.

Fig. 6 is a side elevation of the inner cap of the ogive, a portion of the cap being broken away to show the double stepped lanced or shouldered sections.

Fig. 7 is a plan view, partially broken away, of the inner cap of the ogive.

GENERAL DESCRIPTION

Described in general terms, the invention relates to a mechanical time fuze having a malleable iron fuze body supporting a timing unit, which timing unit is sealed by an ogive consisting of an outer cap and an inner cap, the inner cap being secured to the fuze body by a novel pressure lock producing means or slip coupling. A special moisture-proof sealing means is also provided between the inner cap of the ogive and the fuze body.

This fuze, after being completely assembled, is screwed into a booster, which in turn is screwed into the projectile or the shell.

DETAILED DESCRIPTION

Fuze body

Fig. 1 shows a general sectional view of the mechanical time fuze and its relation to the booster and projectile of the shell.

The fuze includes a body 30 having a tenon 31 screwed into a booster 32, which in turn is screwed into a projectile 33.

The tenon 31 is hollowed out to receive a powder bag retainer or receptacle 34 to support a powder bag 35 in position to be fired when the firing pin from the timing device, later described, is released and projected into a firing cap designated generally by the reference character 36. The powder bag retainer 34 is provided with an

opening 37, which normally is sealed, said seal being broken upon the firing of the powder, whereupon this charge or flash of burning powder is projected through an opening 38 in a plate 39 between the powder bag retainer 34 and the booster 32, into a timing device 40 shown generally in the booster 32.

It is not thought necessary to go into any further description in connection with this part of the shell projectile.

The fuze body 30 is provided with a shouldered opening 45 in the top thereof, the smaller diameter 46 of said opening being adapted to receive the timing unit to be described later. The wall of the opening 45 has an annular V groove, the purpose of which will be described later in connection with the pressure lock producing means. A passage-way 48 (Fig. 3) tangential to said groove 47 extends from the groove through the wall of the body 30. A shoulder 49 of the opening 45 has an annular groove 50 to receive a packing ring 51, which acts as a seal between the ogive, described later, and the fuze body 30. This packing ring 51 is made of a flexible material, so that it will bend over the edge of the groove 50 of the shoulder 49, as shown in Fig. 1, to cause a moisture-proof seal to prevent moisture from getting into the timing unit to be described later. This sealing ring 51, while it is flexible, at the same time is tough enough so that it will not tear or break when the ogive is turned relatively to the body during the assembly of the same or during the time the fuze is set by the fuze setter. This sealing ring is also permeated with and covered by a water-proof material, such as wax or any of the other well-known water-proofing materials. The wax also acts as a lubricant, thus reducing friction on the ring 51 when the ogive is turned.

Timing device or unit

It is not necessary to go into any detailed description of the clock mechanism of the timing device, since that particular part of the timing device plays no part in the present invention. This timing unit is shown partly in section and partly in full lines in Figs. 1 and 4.

All of the intricate mechanisms of the timing unit or device are supported and carried by a series of plates and spacers located relatively to each other by dowel pins and secured together by screws.

The above-mentioned plates (Figs. 1 and 4) of the timing unit are designated 60 to 66, and the two spacing plates are numbered 67.

A dowel pin 68 extends substantially through the plate 60, through all of the plates 61 to 64 inclusive, and into the plate 65. A dowel pin 69 extends through the plates 62, 63, and 64 and into the plates 61 and 65. Three flister head screws 70 extend through the plates 60 to 64 inclusive and are threaded into the plate 65 to secure these plates 60 to 65 inclusive together as a unit.

Three screws 71 (only two of which are shown in Fig. 1) extend through the plate 66 and the spacers 67 and are threaded into the plate 65, to hold the top plate 66 and the spacers to the unit formed by the six lower plates 60 to 65 inclusive.

Pressed on the top plate 66, and secured thereto, is a stepped ring 72 (Fig. 1), which overlies a controlling disk 73 of the timing unit, which is frictionally secured to a shaft 74 that projects from the top of the unit. This controlling disk has a fork 75 surrounding a pin 76 secured to the inner cap of the ogive, to be described later.

It is through this pin 76 and the fork 75 of the controlling disk 73 that the timing mechanism is set upon the turning of the ogive, described later, relative to the fuze body 30. This controlling disk 73 is turned, so that, when the projectile is fired, due to the inertia of the terrific impact upon firing, a spring hammer 77 is forced down, as viewed in Fig. 1, thus flattening out the fork 75 and releasing it from the pin 76, whereupon the timing mechanism is released for action to run a designated or predetermined number of seconds determined by the setting of the ogive relative to the fuze body 30, at which time the firing pin (not shown) is projected through the cap 36 to fire the powder bag 35, with the result that the timing device 40 of the booster is set in motion to cause the projectile to be exploded according to the time set by the ogive.

Ogive

As stated at the outset, in one type of fuze, the ogive was made of an upper cap of cast aluminum and a lower cap of cast brass. Due to the fact that these are critical war materials, it was decided to make the ogive out of a material less critical, and, as a result, sheet steel has been chosen for this purpose. However, other materials adapted to be drawn into the shapes necessary could be used without in any way departing from the spirit of this invention.

The ogive of the present invention comprises an outer cap 80 drawn or formed into a conical shape with a flattened nose, as shown in Fig. 1, and an inner cap 81 (Figs. 1, 6, and 7), which inner cap 81 is welded to the outer cap at four points on the periphery, indicated at 82 (Figs. 6 and 7), where the outer periphery of the inner cap 81 coincides with the inner periphery of the outer cap 80.

As previously pointed out, due to the terrific centrifugal force and the precession of the time fuze and projectile as it passes through the gun barrel, and especially when the gun barrel has become worn from use, the dowel pins 68 and 69 would bend, particularly at the section where they pass through the plate 64, which plate is made of a softer material than are the plates 60 to 63 and 65, with the result that a terrific strain was placed upon the screws 70 approximately on the line of division between the plates 64 and 65, whereupon these three screws would shear off, thus damaging the timing unit to such an extent that it ceased to function.

Therefore, one of the problems presented, upon the decision to make the ogive of, as in the present case, formed sheet metal, was the matter of rigidly securing the timing unit relatively to the fuze body 30 and to the ogive, so that there would be absolutely no play or motion caused by the centrifugal force and precession above mentioned.

Therefore, to overcome the above-mentioned results, the inner cap 81 of the ogive is provided with four stepped or lanced projections or shoulders 83 and 84. The shoulders 83 lightly contact the stepped ring 72, which is secured to the top plate 66 of the timing unit, thus preventing any movement of the timing unit upwardly relative to the fuze body 30 and the ogive 80-81, as shown in Fig. 1. The shoulders 84 also lightly contact the outer diameter of the stepped ring 72 where it projects over the plate 66 of the timing unit, thus preventing any lateral movement of the upper part of the timing unit relative to the body 30 and also relative to the ogive.

Therefore, it has been found by actual tests

that the four sets of shoulders 83 and 84, by their contact with the stepped ring 72 in the manner described above, have eliminated the bending of the dowel pins 68 and 69 and also the shearing of the screws 70, so that no damage is done to the timing unit by centrifugal force and/or precession of the fuze and projectile as it passes through the gun upon being fired from the shell.

The time control pin 76 above mentioned is rigidly secured in a formed section 85 of the top of the inner cap 81 at point 86. The spring hammer 77, which cooperates with the fork 75 of the time controlling disk 73, is riveted to the top of the inner cap at points 87 (Figs. 1 and 7).

Pressure lock

Another of the problems presented, as has been pointed out at the outset of this specification, was the manner of securing or locking the ogive 80—81 to the fuze body 30. As has been stated, this was formerly accomplished by a spring wire which was carried by the old brass lower cap of the ogive and which was pressed into a groove in the body by means of four set screws.

Such type of locking means or holding means between the ogive and the body was not altogether satisfactory and did not lend itself to the present construction of the ogive, one of the reasons being that it required an operation upon four screws for the assembling of each ogive to its body in order to properly tension the spring to hold the ogive to the body.

This securing of the ogive to the body is very important because enough pressure must be exerted between the ogive and the body to prevent any relative movement between these two members by hand should a person pick one up and attempt to turn it after it has been set on the "safety" position, and such tension must also be sufficient to prevent any relative movement between the ogive and the body through accident during the shipping of the fuzes from their manufacturing source to the place where they are to be used. Further, this pressure must be sufficient to prevent any relative movement between the ogive and the fuze body when the projectile is fired, and, at the same time, this pressure lock must not be so great as to prevent a proper relative movement between the ogive and the body by the standard well-known fuze setting device, which must be done prior to the time the shell is placed in the gun.

With the old type of four set screws, there was nothing to prevent a person from loosening the screws and turning the ogive off its "safety" position, but this can not happen with the present invention, since the pressure lock producing means or slip coupling is entirely enclosed and cannot be tampered with.

Therefore, a pressure lock producing means between the ogive 80—81 and the fuze body 30 is provided by the present invention in the form of a slip coupling.

To provide such a pressure lock, the fuze body 30 has been provided with the previously described V-shaped annular groove 47 in the wall of the opening 45, and the inner cap 81 of the ogive is provided with an annular groove 90 (Figs. 1 and 6), in which is an annular row or ring of serrations or teeth 91. A rod 92 (Figs. 1, 2, 3, and 5), having formed on one side thereof a row of serrations or teeth, is provided as the pressure lock producing means or slip coupling between the ogive and the fuze body. This rod 92 is in-

serted by hand into the passage-way 48, as shown in Fig. 2, which passage-way, as described above, is tangential to the groove 47, after which the fuze body 30 is held rigid in a fixture or tool (not shown in this application). A part of said tool slides in grooves 95 of the body 30, and another part of the tool engages the fuze setting slot 96 formed in the outer cap 80 of the ogive, after which this tool is turned, thus rotating the ogive 80—81 counter-clockwise as viewed in Figs. 2 and 3, whereupon the rod 92, by the engagement of its teeth 93 with the teeth 91 of the inner cap 81, is drawn completely into the groove 47 of the fuze body until it assumes the position shown in Fig. 3, or substantially such position.

The teeth 93 on the rod 92 are formed on the rod when it is in a straight condition, and are of such a pitch that, as the rod is drawn into the position shown in Fig. 3, the pitch of the teeth 93 correspond exactly to the pitch of the teeth 91 on the inner cap 81 of the ogive.

In order to obtain the proper results, the force used to draw this pressure lock producing rod or slip coupler 92 into the groove 47 should not have a torque of more than 120 inch-pounds, thus insuring that a pressure lock of the proper pressure will be created between the ogive 80—81 and the fuze body 30 to produce the necessary results above mentioned, which are the prevention of relative movement between the ogive and the body by hand, or through accident during shipping or otherwise, and which will prevent any displacement of the parts when the gun is fired, so as not to change the predetermined time setting of the fuze before it is placed in the gun, and at the same time permit a proper relative movement between the ogive and the body by the fuze setter.

Since the coupling rod 92 is substantially straight when its end is inserted into the groove 47 through the passage-way 48, as said rod 92 is drawn into the groove 47, it of course finally assumes a circular position, but, due to its springiness or elasticity, it constantly tends to straighten itself, thus creating a pressure lock between the ogive 80—81 and the fuze body 30, which allows a slippage between the ogive and the fuze for the purposes mentioned above.

To prevent any bending of the edge of the cap 80 adjacent the fuze setting slot 96, this edge of the slot has been strengthened by having a corrugation 97 struck in the surface, as shown in Fig. 2.

To prevent the rod 92 from accidentally backing out of the groove 47 through the passage-way, the ends of the rod 92 are beveled off as at 98.

While the form of mechanism herein shown and described is admirably adapted for fulfilling the objects primarily stated, it is to be understood that it is not intended to confine the invention to the form or embodiment herein disclosed, for it is susceptible of embodiment in various forms all coming within the scope of the claims which follow.

What is claimed is:

1. In a device of the character described, the combination of a device having an opening with an annular groove in the wall of said opening and a passage-way from the groove and in alignment therewith through said wall; a member adapted to fit said opening and inserted therein; an annular row of serrations on said member opposite said groove; and a rod having serrations of the same pitch as said annular serrations and adapted to be inserted into said passage-way

to enter the annular groove until the serrations on the rod engage the annular row of serrations on the member whereby the turning of said member relatively to said device draws the rod inside the groove and locks the member to the device to prevent any accidental relative movement between said device and said member.

2. The combination of a device having an opening with an annular groove in the wall of said opening and a passage-way tangential to said groove and extending through said wall to the outside of said device; a member inserted into said opening and having an annular groove opposite the annular groove in said device; a row of teeth in the groove of the member and extending around said member; and means having teeth on one side thereof and adapted to be inserted into said passage-way into said grooves until the teeth on said means mesh with the teeth in said groove to cause said means to be completely drawn into said grooves under lateral pressure upon the turning of said member relatively to said device to lock said member and device against further relative movement by hand.

3. In a device of the class described, the combination of an element having an opening with an annular groove in the wall thereof and a passage-way tangent to said groove and extending from said groove through said wall; a member inserted in said opening; an annular corrugation formed opposite said groove; a row of teeth formed in the concave side of said corrugation; and a cylindrical resilient member having teeth along one side thereof to mesh with the teeth in the corrugation as the cylindrical member is inserted into the groove through said passage-way, said cylindrical resilient member being then drawn completely into the groove by said meshing teeth upon turning said member relatively to said element whereby lateral pressure is created by the drawing in of said cylindrical member between said element and said first-mentioned member to prevent further relative movement between said element and said first-mentioned member by hand or by the jarring of the assembled unit.

4. The combination of a device having a cylindrical opening with an annular groove in the wall of said opening and parallel with the bottom

of the opening and passage-way from the groove to the outside of the device and tangential to said groove and parallel with the bottom of the opening; a cylindrical cap inserted in said opening; an annular row of teeth formed in said cap opposite said groove; and a rod having teeth on one side thereof to mesh with the teeth on the cap when the rod is inserted into the groove through the passage-way, said rod being then drawn completely into the groove by the teeth in the cap and on the rod by a turning of the cap relatively to said device, whereby said rod is forced into a circular shape, thus creating lateral pressure between said device and rod to prevent relative turning of the cap and device by hand or jarring.

5. In a device of the class described, the combination of a body having an internal groove and a passage-way therefrom to the outside of the body; an ogive having a serrated section; and a pressure lock producing means comprised of a serrated member adapted to be inserted in the passage-way in the body and then drawn completely into the groove in the body by said serrated section of said ogive coacting with the serrated member upon relative movement between the ogive and the body.

6. In a device of the character described, the combination of a member adapted to be rotated and having a recess in the top thereof with an annular groove in the wall of said recess and having a passage-way through the wall of said recess from said groove to the outside of said member; a device inserted in said recess and having an annular row of serrations on the outside thereof opposite said annular groove in said member; and coupling means insertable in said passage-way and having serrations coactable with the said serrations by means of which the coupling means is adapted to be completely drawn into said groove by said serrations upon relative movement between said device and said member to hold said device in said member and prevent accidental relative movement between said member and said device after the coupling means is in the groove.

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