

Dec. 24, 1946.

J. H. CHURCH ET AL

2,412,967

PETARD MISSILE

Filed April 23, 1941

Fig. 1.

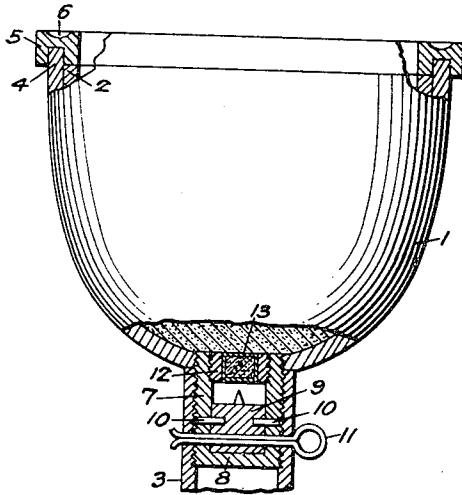


Fig. 2.

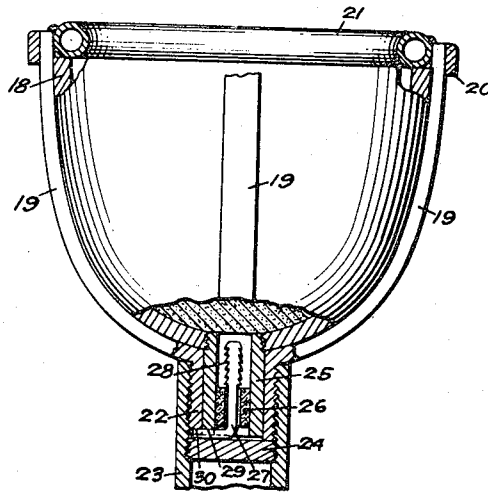


Fig. 3.

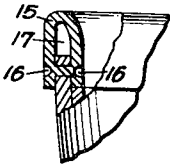


Fig. 4.

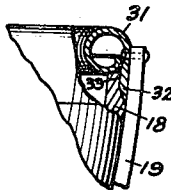


Fig. 5.

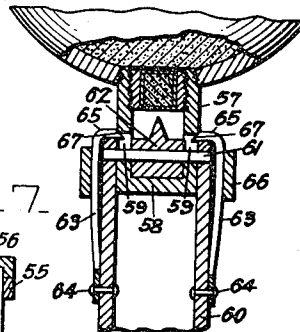


Fig. 6.

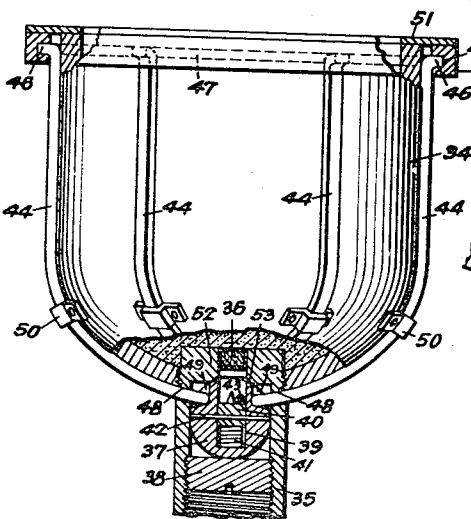


Fig. 7.

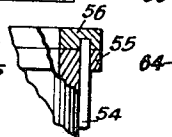


Fig. 8.

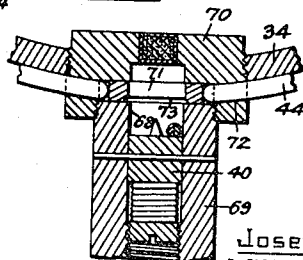
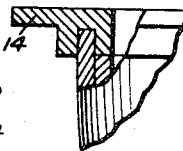


Fig. 9.



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UNITED STATES PATENT OFFICE

2,412,967

PETARD MISSILE

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Application April 23, 1941, Serial No. 389,923

13 Claims. (Cl. 102—56)

(Granted under the act of March 3, 1883, as
amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to us of any royalty thereon.

This invention relates to explosive missiles, and in particular to a petard to be applied from a distance.

Petards have been known from the earliest days of gunpowder. They consisted of a hood-shaped or bell-shaped container with a planar rim at the large open end for application at the face of the work to be blasted, and were filled with an explosive which was set off from the apex end of the petard. The peculiar destructive action of a petard is due to the fact that the container holds the explosive at the face of the object to be destroyed for a very small time interval which is sufficient to give direction to the blast. After this very small time interval, the container may fall away or recoil, but the main result of directing the blast has already been accomplished. Early petards were heavy affairs as to the container and thus lent some degree of efficacy by reason of their inertia. However, the provision of a heavy container is burdensome and unnecessary since a petard will function as well with a light container, especially when a close seal is maintained between the petard rim and the target. Petards have been used in underwater blasting, wherein the weight of a column of water lends its inertia to the holding of the container during the necessary time interval. At detonating, and even deflagrating, time intervals, the inertia of the atmosphere becomes appreciable for this purpose and petards with light containers have been used in modern blasting (Patent No. 1,440,601). As noted in the aforementioned patent, a dead air space at the blasting face forms a desideratum of petard practise, and this well-known expedient is contemplated in the petards of the present invention. The patent further advises that the "striking gap" . . . may be varied in shape and volume to secure different effects." In this regard, the teaching in *Zeitschrift fur das gesamte Schiess- und Sprengstoffwesen*, May 15, 1914, pages 183-187 will be found of considerable importance.

In a military sense petards have been used in the past to good advantage in siege work to batter down doors and other obstacles. In these cases, the petard, usually a cumbersome object, was carried by the petardier to a stationary object and secured, facing thereto, or positioned as with a bipod and sling, and touched off. In modern warfare it becomes desirable to perform demoli-

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tion work on moving fortresses such as tanks or other automotive vehicles, ships and aeroplanes, armored or otherwise. Application of a petard in the case of moving targets would necessarily take place from a remote position, a procedure heretofore not considered.

Petards are particularly well adapted for use as comparatively slow-moving offensive missiles, in which in a more modern view, emphasis is placed upon penetration rather than demolition work. The flat-faced missile is, therefore, mainly a carrier for an explosive which is, itself, designed to effect penetration, and the missile, by its shape, serves to position the explosive at the target for most effective results. With a large area of explosive presented to the target at impact, penetration is enhanced, even at glancing angles of impact. However, the optimum case will obtain where the explosive body is detonated with its axis perpendicular to the target and the flat-faced missiles are admirably adapted to swing into such position in the case where angular contact is made. However, such a righting action will not take place if the projectile rebounds or ricochets from the target. A rebound or ricochet would also vitiate the delicate matter of timing of the detonation of the main charge, important in penetration missiles of the type herein described.

We have found that by including on the front face of our missile, especially at the rim, a leading impact unit of a material of low resilience, or of a hollow structure to simulate, by collapsing, the shock-deadening effects of a material of low resilience, the missile is improved in its functioning as regards impact and penetration. The calculated timing is preserved and the detonation takes place with the missile at a favorable angle. Furthermore, such a leading impact unit will serve to hold the face of the missile in sealed relation with the target for the small period of time between impact and detonation which is requisite for petard action. This full rim contact for petard action is but a cumulative incident in the series of advantages presented by the shock-absorbing impact member of the invention. If lead is used as an impact unit, a further advantage is noted in that the center of gravity of the missile will be moved forward, especially where a light container is employed, and aid the missile in aligning itself in flight for proper approach to the target with a view to petard action. Soft noses on ogival projectiles are common, but their use was never conceived with such problems in mind as are dealt with in the present invention

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which concerns a faced missile. The problem of the present invention is to decelerate, align and seal a plane-faced missile at the target as well as direct it in flight, or any combination of these functions.

The invention further contemplates the provision of a percussion firing unit which is so coordinated with the impact face of a missile as to remain unarmed after impact until or unless the missile is aligned perpendicular to the target.

It might well be mentioned that toy darts are known which are built with a target-gripping cup, usually of rubber, but these do not involve problems attending the use of an explosive, nor are they concerned with penetration of a target or other objective. Neither do they involve an impact unit of low resilience which will bring about a deceleration of the missile without rebound.

The petard of the present invention is distinguished from known devices of a similar nature in that it is essentially a petard missile for application from a distance and carries an impact firing means. It is believed that such a combination spells a novel concept in the art.

It is therefore an object of the invention to provide a plane-faced explosive missile with a non-resilient, shock-absorbing impact member.

It is a further object of the invention to provide a petard missile with a coronal impact member of shock-dissipating material.

It is a further object of this invention to provide an explosive missile which will align in flight, decelerate at the target, align itself and adhere thereto, or respond in any combination of these functions as the exigencies require.

It is a further object of the invention to provide a petard for application from a distance, and having impact firing means.

It is a further object of the invention to provide an explosive missile which will fire only when positioned normal to the target.

To these and other ends, the invention consists in the construction, arrangement and combination of elements described hereinafter and pointed out in the claims forming a part of this specification.

A practical embodiment of the invention is illustrated in the accompanying drawing wherein:

Figures 1, 2 and 6 are elevational views, partly in section of petard missiles.

Figures 3, 4 and 8 are fragmentary views, partly in section of petard missiles in elevation.

Figure 5 is a detail of a firing mechanism in sectional elevation.

Figure 7 is a detail showing a modification of the device of Figure 6, and

Figure 9 is a modified firing mechanism for use in a missile such as that of Figure 6.

Referring to the drawing by characters of reference, there is shown in Figure 1 a missile composed of a cup-form main body 1. An explosive charge is held therein by a closure member 2, partially shown in the drawing. The particular shape of inner containers or closure members forms no part of the present invention. The closure member, for instance, may be flat or it may be formed with a hollow charge as shown in British Patent No. 28,030 of 1911. A rear stem 3 is indicated on the missile. This may be a handle for carrying and manual delivery, or any conventional unit for attachment to a projecting device. Received about the rim 4 of the body 1 is an annulus 5 of a non-resilient material,

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preferably lead, but which may be constructed of other shock-deadening materials, such as copper, felt, pressed paper, or various plastics, or it may consist of loose material such as shot or sand confined in a container. The anti-skid features of the annulus 5 are enhanced by the addition of an annular trough 6 on its front face. Instead of an annular trough, a series of circular cup-like depressions may be employed in the front face of the annulus 5.

In the rear stem 3 is located the percussion firing means operating on the inertia principle. Within stem 3 an inner sleeve 7 with closed bottom 8 is threaded. Slidably received in sleeve 7 and resting on the sleeve bottom 8 is a firing pin 9 of appreciable mass. The firing pin 9 is immobilized by shear pins 10 and is additionally secured by a pull pin 11 passing through the stem 3, sleeve 7 and firing pin 9. Threadedly received in the top of sleeve 7 is another sleeve 12 carrying a primer capsule 13. Prior to offensive use of the missile, the pull pin 11 is withdrawn, and on impact the pins 10 are sheared while the firing pin 9 continues into the primer or detonating capsule 13.

In Figure 8 is shown the rim of a missile generally similar to that of Figure 1, but wherein the shock-absorbing impact member is provided with a flange 14. Considerations of design may require that the missile body proper bear a high length/width ratio which would not favor retention of the missile in righted position after inclined impact on the target, but rather a continued tumbling. The flange operates to reduce this ratio at the impact section and hence lower the probability of continued tumbling. The flange may be employed on any of the modifications shown.

In Figure 3 is shown a missile like that of Figure 1, in which the shock-deadening annular member 15 is of sheet material lapped about the rim of the body and keyed therein by indentations as at 16, leaving a hollow space 17 above the rim. Here, the first action of the shock member 15 on impact is to deform in shape, followed by compression. This initial change of shape serves to further soften the shock and lengthen the time of deceleration of the solid body, thus adding time for righting the missile prior to detonation.

In Figure 2 is shown a form of missile in which the priming is accomplished by relative forward motion of an inner charge container with respect to the outside framework. An inner explosive container 18 is carried in a framework comprising longitudinal bar members 19 held rigidly in spaced relation by a ring member 20. The forward rim of container 18 is spaced rearward of the forward ends of bars 19 and within the step formed by members 18 and 19 is placed a tubular shock-deadening member 21, protruding forward of all other front members. The tube 21 is shown as welded or soldered, but may be riveted or secured by any other fastening means.

The bars 19 are integral with a tubular tail piece 22 about which is threaded a tubular handling member 23 having a threaded closure plug 24 held therein. The explosive container 18 threadedly carries a tubular tail piece 25 which is slidably received in the tail piece 22. Tube 25 contains priming material 26 within which is contained a smooth portion of a friction pull igniter 27 having a serrated or otherwise roughened portion 28 above the priming material and a lower bent portion received in slots 29, 30 in the tubes 25 and 22 respectively. The thickness of

igniter 27 is slightly greater than slots 29, 30 so that when handling member 23 is screwed up tightly the igniter 27 is securely held against the tube 22. Upon impact, the charge-carrying member 18 will advance, crushing the shock tube 21 and carrying primer 26 past serrations 28 to ignite the primer. The shock member 21 will function in the same general manner as the annulus 5 of Figure 1.

In Figure 4 is shown a fragment of a missile of the same general type as that of Figure 2 wherein the shock member 31 is a tube of coiled section, and has a portion 32 extending into an opening 33 between the charge container 18 and the outer member 19. This form requires considerably more work on the shock member before the container 18 can advance to charge-initiating position. Obviously other forms of initiators than that shown in Figure 2 may be employed.

In Figure 6 is shown an explosive missile with a firing unit designed to set off the main charge at impact, only when the missile is axially perpendicular to the target. This is accomplished by a coordination of the crown-shaped forward end of the missile with the primer-actuating unit. A cup-like main charge container 34 threadedly carries a tail piece 35 having a primer 36, a spherical bolt 37 and a screw plug keeper 38. The spherical bolt 37 has a central bore 39, and in this bore is slidably fitted a firing pin 40 held against a spring 41 under full compression by a shear pin 42, and, in addition, by a pull pin 43 extending through the sphere 37 and the tube 35.

Encompassing the outside of container 34 is a series of longitudinal strips 44 attached at their forward ends to a ring member 45 as by a turned end 46 fitting in an annular channel 47 in the ring, or in individual recesses, passing through openings 48 in the tail piece and engaging in pockets 49 in the spherical bolt. The strips are preferably of a tough, springy material, such as steel or brass, and while shown as passing through retaining brackets 50 in the region of curvature of the container 34, it is possible that such reinforcing means may be dispensed with in some cases, especially where the curvature of the missile is slight. In such case, also, the sphere may be engaged by the strips in pockets in its lower hemisphere.

A shock-deadening impact unit 51 is fixed to ring 45 and the forward rim of container 34.

Assembly is easily effected by inserting firing pin 40 into the sphere 37 against spring 41, which when fully compressed forms a guard against setback forces, and inserting the shear pin 42. The sphere 37 is then placed in tube 35 and pull pin 43 inserted. Plug 38 and primer 36 are then added. Strips 44 are then threaded through openings 48 and into engagement with pockets 49 in the sphere 37 and the forward ends of strips 44 are then gathered in and permitted to expand into the receiving channel 47 in the ring 45. The tail piece is now threaded into container 34 carrying with it the strips 44 and ring 45. When all are in place the impact member 51 is attached by any convenient means and the brackets 50 added if necessary or desirable.

At impact, assuming pull pin 43 previously withdrawn, the pin 42 will be sheared and the firing pin 40 started toward the primer. However, if the missile has hit the target at a glancing angle, the outer portion of shock-deadening member 51 and ring 45 will first yield without affording the proper stoppage to shear the pin 42. Thus those strips 44 nearest the point of contact

will operate proportionately to their proximity to the point of impact and the angle of the impact, to swing the spherical bolt 37 and cause the opposite strips to recede and raise that portion of the impact rim 51 opposite the point of impact. With the turning of the bolt 37 the firing pin 40 is directed away from the primer, and when the full shock of impact comes through container 34 to shear the pin 42 the firing pin is received on a corner of upper flange 52 of the tube 35. When the missile swings around presenting its flat face to the target, the strips will be moved to normal position, rotating the sphere 37 and permitting spring 41 to force firing pin 40 into the primer. Since the setting of sphere 37 should not be too critical for actuation of the primer, flange 52 is chamfered as at 53 to regulate the sensitivity to angle of detonation.

It will be understood that the pockets 49 will be of such size as to offer no substantial hindrance to the ends of those strips 44 which are not at or near the main line of thrust, and in fact these pockets may be run together to present a complete annular shoulder and a neck portion.

In Figure 7 is shown a detail of a modification of the Figure 6 device, leaving out the ring 45 and passing the bar members 54 through a flange 55 on the body portion of the missile and embedded in a lead annulus 56. At glancing angles, the bars 54 meet the target prior to the body portion to unarm the firing mechanism as explained in connection with Figure 6.

In Figure 5 is shown another form of firing mechanism. A tubular tail piece 57 with closed bottom 58 has a through perforation 59. An extension 60 of the tail piece 57 is telescoped thereabout and carries a pin 61 which passes through the perforations 59. Pin 61 passes through and carries a slidable firing pin 62. Arms 63 are fixed to tube 60 as by rivets 64 and have bent ends 65 extending into perforations 59, engaging the forward portions thereof so as to prevent forward motion of the tube 60. Arms 63 are kept in locking position by a band 66 which may be removed under setback forces or manually, in the latter case, by motion forward or rearward. The arms 63 may be of spring material with position of relaxation out of the path of tail piece 57 in which case the missile is in condition to detonate on removal of the band 66. Or, the arms 63, springy or otherwise, may have their normal position with ends 65 within the perforations 59 in which case the missile remains safe even with the band removed until a sufficient shock is encountered to force arms 63 outward by tail 57 acting on slant surfaces 67 of bent ends 65. The slant surfaces should be so designed as to function only at impact forces.

In the embodiment shown in Figure 6, the firing mechanism may be considerably simplified by omitting the spherical bolt. As shown in Figure 9 the firing pin 40 moves in a bore 68 in a tail piece 69. This tail piece 69 is threaded into a plug 70 which is threadedly held in the body 34. Plug 70 and tail piece 69 are spaced to accommodate a ring 71 of internal diameter equal to or slightly greater than bore 68, and to permit transverse sliding of said ring. Bars 44 pass through bores 72 in plug 70 and contact the ring 71. At glancing angles of impact of the missile the ring 71 will be forced by some of the bars 44 into the path of the firing pin and will be restored to normal position, clearing the pin, when the missile is brought to full-faced engagement, as in

the case of Figure 6. The sensitivity may be regulated by chamfering the ring as at 73.

We claim:

1. A petard of the type designed for front explosion comprising an axially symmetric body, percussion fuse means and an explosive charge therein, an axial tail piece adapted for handling the petard, a projecting annular rim forward of the petard defining a flat impact face of substantial cross-section with respect to the petard, and an annular shock-deadening unit of low resilience with respect to that of the petard fixed to said rim on an annular line concentric with said rim and extending forward thereof.

2. A petard of the type designed for front explosion as in claim 1 in which said shock-deadening unit comprises lead.

3. In an explosive missile having a faced impact portion with projecting annular rim on the said portion, an annular shock-deadening member comprising a crown piece looped over and enveloping the said rim, said member comprising a material of low resilience relative to the material of the missile.

4. A petard missile of the type adapted for front explosion comprising a container having an opening and a planar impact portion defined by a rim of the container at said opening, an explosive charge in said container, a closure member in said opening confining said explosive charge, and an annular shock-deadening unit of low resilience with respect to the material of said container on said rim only of said container and extending into the opening and overhanging said closure member.

5. An explosive missile having a rim-shaped impact portion and rear percussion firing means, said firing means comprising a universally mounted bolt, a recess therein, a primer adjacent said recess and a firing pin in said recess, held against spring pressure by a shearable pin, spaced longitudinal impact transmission members connecting said impact portion and said bolt whereby to swing said bolt recess out of alignment with said primer when less than all of said transmission members are actuated at impact.

6. An explosive missile having a faced impact portion, a spring member in the rear of said missile, a firing pin forward of said spring and shearable means holding said firing pin against the pressure of said spring, blocking means in advance of said firing pin and movable into and out of the path thereof and spaced members extending from the periphery of said faced impact portion to the said blocking means and slidable longitudinally relative to said missile to move said blocking means at oblique impact of the missile.

7. An explosive missile as in claim 6 wherein said blocking means comprises a ring with inside diameter sufficient to pass the firing pin and normally surrounding the path of travel thereof.

8. In an explosive missile, a firing means com-

prising a tubular tail piece fixed to said missile and having a closed bottom, diametrically opposite openings in said tail piece, a tube telescoped on said tail piece, a firing pin in said tail piece, a pin passing through said firing pin, openings and tube, arms fixed to the exterior of said tube and having ends bent over the top of said tube and engaging said openings, and a band surrounding said arms and holding said bent ends in said openings.

9. An explosive missile comprising a flat front impact portion and a percussion firing means, compressed spring means tending to move said percussion means to firing position, shearable means holding said percussion means prior to impact, spaced movable impact members on the missile and an operative connection between said impact members and said percussion means, said operative connection arranged to disarm the percussion means from firing position after shearing of said shearable means by impact unless or until the said impact means makes flat contact with a struck target.

10. A petard missile of the type designed for front explosion, comprising a body having a flat impact portion and having an annular member of material of low resilience with respect to that of the missile secured to said impact portion and extending slightly beyond said impact portion, to effect sealing contact between said impact portion and a struck target, deaden the shock of said missile, and inhibit rebound, and impact firing means in said missile.

11. A petard missile of the type adapted for front explosion comprising an explosive charge, a handling portion for engagement with a projector and a flat faced front portion, an annular shock deadening unit of low resiliency relative to the material of the missile, for impact with a target, peripherally attached to and protruding forward of said flat faced portion, said shock deadening unit being of a diameter substantially commensurate with the largest diameter of the missile, and an impact firing means at the rear of the missile.

12. A petard missile of the type adapted for front explosion, as in claim 11, wherein the shock deadening unit comprises lead.

13. In combination, a petard missile of the type designed for front explosion comprising a hollow body containing an explosive charge and having a front flat faced end of substantial cross-sectional area, impact firing means in the base of the missile and an annular shock deadening unit of low resiliency with respect to the material of the missile on the front of the missile and of a diameter commensurate with that of the missile adapted to seal the missile against the target upon impact of the missile.

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