May 6, 1947. P. H. GIROUARD 2,420,237

BOMB FUSE DEVICE

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Fig. 1

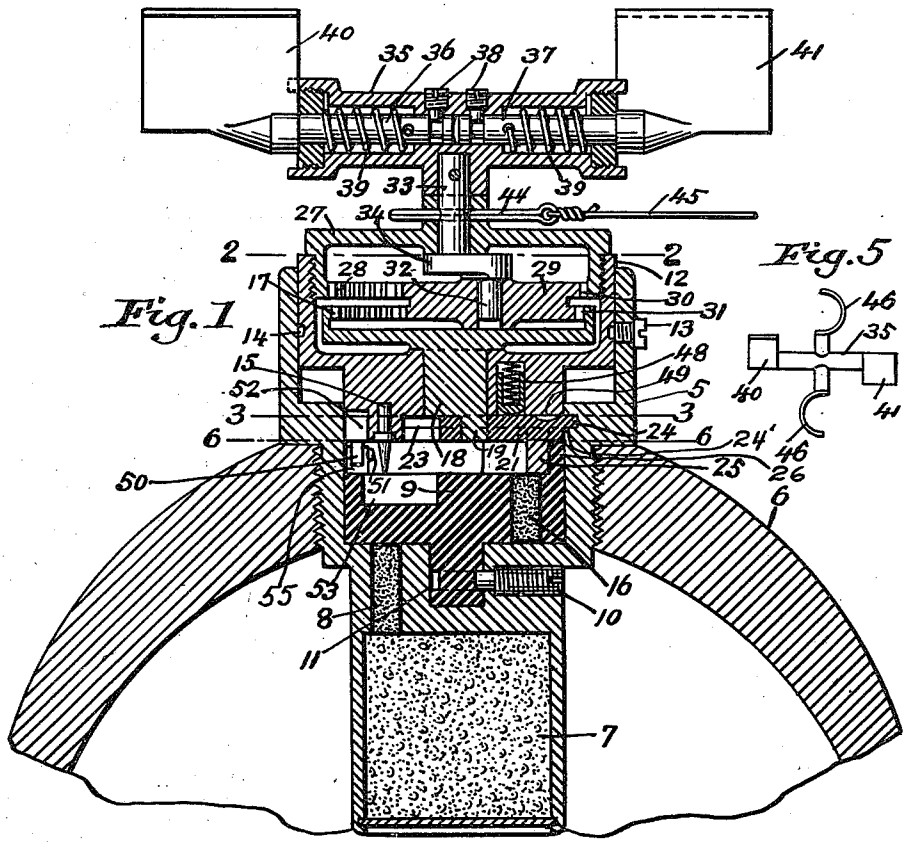

Fig. 5

Fig. 2

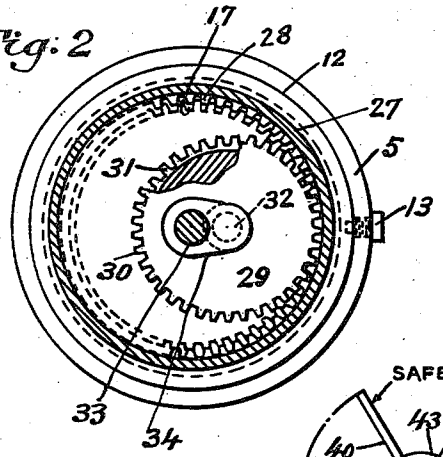

Fig. 3

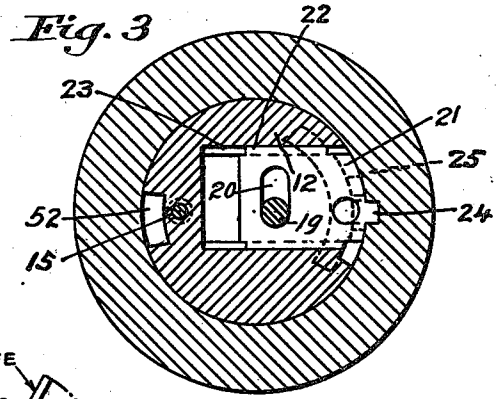

Fig. 4

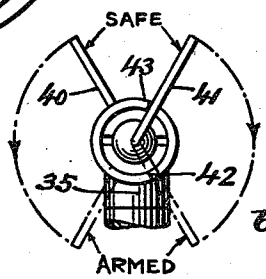

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Fig. 6

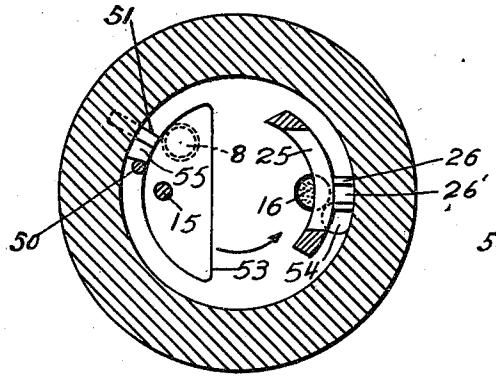


Fig. 8

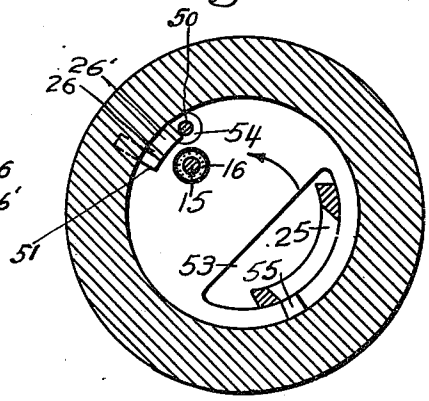


Fig. 7

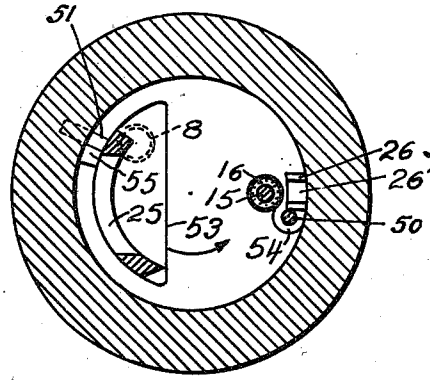


Fig. 9

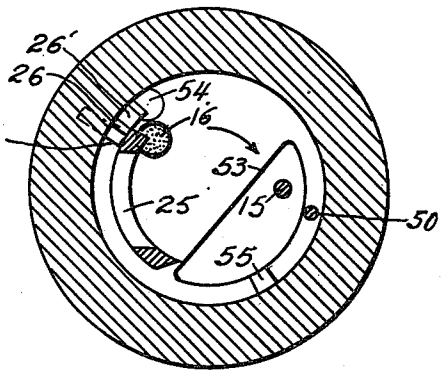
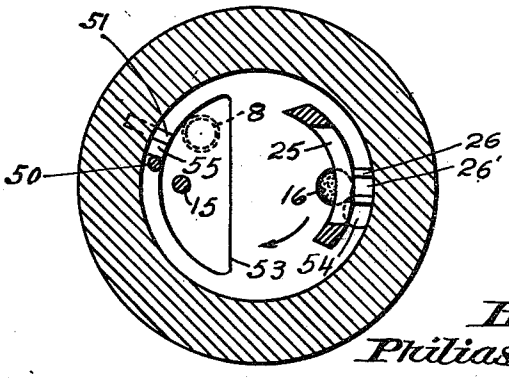


Fig. 10.



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2,420,237

BOMB FUSE DEVICE

Philias H. Girouard, Washington, D. C.

Application February 3, 1933, Serial No. 655,119

15 Claims. (Cl. 102—81.2)

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

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This invention relates to a fuse for an aerial bomb and has for one object to provide a fuse of the type mentioned having a propeller that will be actuated by wind pressure above a predetermined magnitude to arm the fuse but to unarm the fuse if the wind pressure decreased below that value.

A further object is to provide means to unarm the fuse if the wind pressure is directed across the axis of the bomb, as would be the case if the bomb should catch on a plane after having been released from the bomb rack and so hang with the axis of the bomb transverse to the fore-and-aft line of the plane.

In the drawings:

Fig. 1 is a longitudinal section of my invention assembled in the nose of a bomb;

Figs. 2 and 3 are transverse sections on lines 2—2 and 3—3, respectively, of Fig. 1;

Fig. 4 is a schematic detail view of the vanes in the safe and in the armed positions.

Fig. 5 is a detail view of the propeller vane assembly;

Figs. 6 to 10 are taken on line 6—6 of Fig. 1, looking down, and show, respectively: Fig. 6, the positions of several members when the bomb is unarmed; Fig. 7, when the parts have moved approximately half way to the armed position; Fig. 8, the armed position; Fig. 9, when moved substantially half way to the unarmed position; and Fig. 10, the unarmed position.

The frame 5 of my fuse mechanism is mounted in the body 6 of the bomb that contains the main explosive charge, a booster charge 7 surrounded by part of the main charge, and an explosive lead 8 extending from the booster charge to a location where it may be fired by the detonator. Detonator holder 9 is rotatably mounted in frame 5 and is retained therein by a stud 10 that extends into a groove 11 in the detonator holder. Gear housing member 12 is rotatable in the upper part of frame 5 wherein it is held by a pin 13 that is engaged with groove 14 and is adapted to be sheared when the nose of the bomb impacts upon a target, to permit the firing pin 15 carried by member 12 to be driven against detonator 16 in its holder 9, the detonator at that time being aligned with explosive lead 8.

Internal gear 17 is carried on a spindle 18 that is rotatable in member 12 and that has an eccentric pin 19 extending into a slot 20 in detonator holder lock 21. This lock has laterally extending flanges 22 that ride in rabbets 23 formed in the sides of a cut-away portion in member 12 and a tab 24 that engages a slot in the

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wall of frame 5 to lock members 9 and 12 against rotation with respect to it. The under side of the outer end of lock 21 is cut away as indicated at 24' to clear lug 26 on member 9 when the lock is retracted, there being a slot 26' cut into lug 26 to receive the outer end of lock 21. A loop 25 depends from the bottom of member 12 and passes under member 21.

Secured to upper end of member 12 is a cup-shaped cap 27 carrying an internal gear 28 that has a greater number of teeth than gear 17. A double pinion 29 has one set of teeth 30 to engage gear 28 and another set to mesh with gear 17; pinion 29 slides over the surface of disk 31 of gear 17 and is rotatable on a pintle 32 eccentrically connected to a shaft 33 by crank 34, shaft 33 being journaled in cap 27.

A substantially T-shaped bearing member 35 has its stem secured to shaft 33 and has rotatable shafts 36 and 37 retained in its cross piece by screws 38 with a spring 39 secured at one end to each of shafts 36 and 37 and the other end of each spring attached to member 35 under tension that tends to hold the propeller vanes 40 and 41 in the positions shown in Fig. 1, which are the same as the full line positions in Fig. 4. The radially inner edge of each of vanes 40 and 41 moves in a cut-away portion of the end of the cross piece of member 35 between shoulders 42 and 43, which shoulders serve as stops to limit the rotative movement of the vane with its shaft. Rotation of shaft 33 before dropping the bomb is normally prevented by a pin 44 that passes through the shaft and a portion of cap 27 in which the shaft is journaled, the arming wire 45 connected to pin 44 being secured to the bombing rack to withdraw pin 44 when the bomb is released from the rack.

In Fig. 5 is shown a propeller vane assembly having concavo-convex vanes 46 connected to member 35 between vanes 40 and 41. The shape of these vanes 46 is such that wind pressure acting transversely of the axis of the bomb body, regardless of direction, will always tend to turn shaft 33 to move the fuse elements into the unarmed position, as will be presently explained.

The pitch of vanes 40 and 41 is in such a sense that when in the position shown in Fig. 1, that is, the "safe" position of Fig. 4, wind pressure acting on the vanes in the direction of the longitudinal axis of the bomb will keep the fuse elements in the relative positions disclosed in Fig. 1 with the detonator 16 out of line with the firing pin 15 and the explosive lead 8. It will be noted further that the body of the detonator holder 9

is interposed between the firing pin and the lead 8, that lug 26 on the detonator holder bears against the lower face of member 12 and that the loop 25 on member 12 contacts the detonator holder 9, thus preventing any motion of member 12 toward detonator holder 9 and eliminating the possibility of firing pin 15 reaching lead 8.

When the vanes 40 and 41 are subjected to wind pressure of sufficient magnitude, they turn their shafts 36 and 37 against the constraint of springs 39 and move to the "armed" position of Fig. 4. It is apparent that in this position the torque exerted on shaft 33 is in the opposite angular sense to the couple developed by the vanes in the "safe" position.

When the vanes are in the "armed" position and safety pin 44 has been withdrawn, shaft 33 will be driven in the clockwise sense and will, through crank 34 and pin 32, slide pinion 29 around bodily in the same sense. However, due to the engagement of the teeth 30 on the pinion with internal gear 28, the pinion will be rotated in the counter-clockwise sense due to the fact that the gear 28 is locked to frame 5 by lock 21. Internal gear 17 will be driven in the same sense as pinion 29 by the teeth 31 on pinion 29 since the number of teeth in gear 17 is less than the number in gear 28. For example, if there are two teeth fewer in the former than in the latter, gear 17 will be rotated only the angular distance between two teeth of gear 17 each time shaft 33 makes a revolution, which delays the arming of the fuse. Continued rotation of gear 17 and of spindle 18 connected thereto will cause eccentric pin 19 to withdraw lock 21 from the recess in frame 5 and abut the rear end of the lock against the closed end of the cut-away portion in member 12 in which the lock slides and thus locks the parts together so that pinion 29, member 12 and detonator holder 9 rotate as a unit with shaft 33 and vanes 40 and 41. In this position the spring detent 48 in member 12 will engage depression 49 in lock 21 and thus form a connection between member 12 and lock 21 to return the mechanism to the locked position when the fuse is being unarmed, as will be hereinafter described.

After lock 21 has been drawn back it clears the lug 26 on detonator holder 9 and permits member 12 to rotate independently of the detonator holder, which continues until firing pin 15 is positioned above detonator 16 and lug 50 on member 12 engages the lug 26 (Fig. 7), when the detonator holder 9 is constrained to rotate with member 12 until lug 26 contacts stop 51 fixed to fuse body 5. This prevents further rotation of the parts and stops the mechanism with the detonator 16 aligned with lead 8 and firing pin 15 (Fig. 8). In this position, lug 26 can move into cut-out portion 52 in member 12, loop 25 on member 12 can pass into the cut-out portion 53 in detonator holder 9 and recess 54 in detonator holder 9 is aligned with lug 50 to permit lug 50 to be moved downwardly. With the parts in these positions, upon impact of the nose of the bomb, the member 12 will shear pin 13 and firing pin 15 will be driven into detonator 16 to explode the charge of the bomb.

If safety pin 44 is removed while the bomb is on an aircraft in flight, the wind caused by the high speed of the craft would arm the fuse, in which condition it would be very dangerous for the craft to land. The present invention prevents such a contingency by causing the fuse to unarm at the slower speeds of landing. When the craft slows down preparatory to landing, the wind pressure on vanes 40 and 41 becomes insufficient to hold shafts 36 and 37 turned to the arming position against the tension of springs 39 and the vanes are moved to the "safe" position. The wind then drives the vanes to turn shaft 33 in the counterclockwise sense which moves pinion 29 bodily in the same sense but the rotation of the pinion on pin 32 is in the opposite sense. The rotation of gear 17 is in the same direction as that of pinion 29 and therefore spindle 18 and eccentric pin 19 will be made to turn in the same direction and thus, through lock 21, member 12 is given a clockwise rotation, longitudinal movement of locking member 21 being prevented by engagement of plunger 48 in depresson 49. Movement of member 12 brings lug 50 on member 12 against lug 55 on the detonator holder 9 (lug 50 is shown approaching lug 55, Fig. 9) and the detonator holder then turns with member 12 until lug 55 contacts stop 51 (Fig. 10), which prevents further movement of the members 9 and 12. The detonator 16 has now been turned out of line with lead 8 and detonator holder 9 is interposed between firing pin 15 and lead 8. After members 9 and 12 have ceased to turn, shaft 18 rotates until eccentric pin 19 has slid lock 21 out into the locking position, the contact of lug 55 against stop 51 providing the necessary reaction to cause plunger 48 to be disengaged from depression 49; all parts are then locked and movement of the parts is stopped.

It is to be understood that the above description and accompanying drawings comprehend only the general and preferred embodiments of my invention and that various changes may be made therein within the scope of the appended claims without sacrificing any of the advantages of this invention.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

I claim:

1. In a fuse, a body member having a transverse partition therein, there being a hole through said partition, a detonator holder rotatably mounted at one side of said partition, said holder having a recess opening on the side thereof opposite said partition and a hole therethrough adapted to be brought into registry with the hole in said partition, a lug on said holder adjacent the hole therein having a slot in its free end, a member slidably and rotatably mounted in said body, shearable means normally acting to prevent sliding movement of said member, a lug extending from said member toward said detonator holder to engage said lug on the holder to move said holder to align the hole therein with the hole in said partition, a firing pin positioned on said member to be aligned with both said holes when said holes are aligned, a fixed lug on said body to engage said lug on the holder and stop the holder when said holes are aligned as aforesaid, a second lug on said holder engageable with the lug on said member to move said holder to the position in which said holes are not aligned, a locking element slidably mounted in said member to engage said slotted lug and said body in one relative position of these parts and having a transverse slot therein and a depression in its outer surface, a loop depending from said member and passing under said element to contact said deto-

nator holder except when disposed over the recess in said holder, a spring pressed plunger in said member adapted to engage said depression when said element is in the unlocked position, a shaft journaled in said member, an eccentric pin projecting from said shaft into the slot in said element, a first internal gear having a disk body mounted on said shaft, a second internal gear having a slightly greater number of teeth than the first internal gear connected to said member and disposed adjacent said first internal gear, a pinion disposed to be slidable on the body of said first internal gear and having two sets of gear teeth each of which sets of teeth is engaged with one of said internal gears, a shaft rotatably mounted in said second internal gear, a crank including a crank arm and a pin journaled in said pinion and connected by the crank arm to the last mentioned shaft, a T-shaped member having the stem thereof fixed to the last mentioned shaft, a vane shaft journaled in each end of the head of said T member, a propeller vane secured to the outer end of each of said vane shafts, said head having stops to limit the rotation of said vane shafts and resilient means normally holding said vanes directed outwardly from a bomb by which said fuse is carried.

2. In a fuse, a body member having in it a passage to contain an explosive lead to an explosive charge, a detonator holder rotatably mounted in said body and having in it a passage to receive a detonator adapted to be moved into alignment with the passage in said body when said fuse is armed, a member rotatably and slidably mounted in said body, means to prevent sliding movement of said member except when in the armed position, a firing pin carried by said member adapted to be moved into alignment with said detonator and said lead in the armed position, a lug on said member extending toward said holder, a first lug on said holder engageable by the lug on said member to move said holder into the armed position and a second lug on said holder engageable by the lug on said member to move said holder to the unarmed position, a fixed lug to stop movement of said holder when in either the fully armed or fully unarmed position, slidable locking means to lock said holder and said member to said body in the fully unarmed position, a first internal gear carried by said member, a second internal gear having a slightly smaller number of teeth than said first gear disposed adjacent thereto, means connected to said second gear to slide said locking means and to rotate said member, a bodily movable pinion having two sets of gear teeth whereof one is meshed with each of said internal gears, a rotatable shaft carried by said first gear, eccentric means connecting said shaft with said pinion, journal means connected to said shaft, vane shafts rotatably mounted in said journal means, a propeller vane mounted on each of said vane shafts, stops on said journal means to limit the rotation of said vane shafts and resilient means acting upon said vane shafts to hold said vanes normally in one position.

3. In a fuse, elements including a firing pin movable to and from the armed and unarmed positions, a first internal gear operatively connected to said elements, a second internal gear disposed adjacent thereto, said second gear having a slightly greater number of teeth than said first gear, a bodily movable pinion having a separate set of gear teeth meshed with each of said gears, a pin rotatable in said pinion, a rotatable shaft, a crank connecting said pin and said shaft,

a T-shaped member having its stem fixed on said shaft, two vane shafts rotatably mounted in the head of said member, a propeller vane on each of said vane shafts, a spring connected to each of said shafts normally to hold said vanes in such position that they will tend to move said elements to the unarmed position but adapted to yield at wind pressures above a predetermined minimum to permit the direction of pitch of said vanes to change to move said elements to the armed position and stops carried by the head of said member to limit the rotation of said vane shafts.

4. In a fuse, elements including a firing pin movable to and from the armed and unarmed positions, a first internal gear operatively connected to said elements, a second internal gear disposed adjacent thereto, said second gear having a slightly greater number of teeth than said first gear, a bodily movable pinion having a separate set of gear teeth meshed with each of said gears, a pin rotatable in said pinion, a rotatable shaft, a crank connecting said pin and said shaft, a T-shaped member having its stem fixed on said shaft, two vane shafts rotatably mounted in the head of said member, a propeller vane on each of said vane shafts, a spring connected to each of said shafts normally to hold said vanes in such position that they will tend to move said elements to the unarmed position but adapted to yield at wind pressures above a predetermined minimum to permit the direction of pitch of said vanes to change to move said elements to the armed position, stops carried by the head of said member to limit the rotation of said vane shafts and means to lock all of said elements together to move as a unit from or toward the unarmed position and to lock said elements against movement when in the unarmed position.

5. In a fuse, elements including a firing pin movable to and from the armed and unarmed positions, a first internal gear operatively connected to said elements, a second internal gear disposed adjacent thereto, said second gear having a slightly greater number of teeth than said first gear, a bodily movable pinion having a separate set of gear teeth meshed with each of said gears, a pin rotatable in said pinion, a rotatable shaft, a crank connecting said pin and said shaft, a T-shaped member having its stem fixed on said shaft, two vane shafts rotatably mounted in the head of said member, a propeller vane on each of said vane shafts, a spring connected to each of said shafts normally to hold said vanes in such position that they will tend to move said elements to the unarmed position but adapted to yield at wind pressures above a predetermined minimum to permit the direction of pitch of said vanes to change to move said elements to the armed position, stops carried by the head of said member to limit the rotation of said vane shafts, means to lock all of said elements together to move as a unit from or toward the unarmed position and to lock said elements against movement in the unarmed position and concave vanes mounted on said member on opposite sides thereof oriented to move said elements always toward the unarmed position when acted upon by wind pressure transversely to the axis of a bomb by which the fuse is carried.

6. In a fuse, elements including a firing pin movable to and from the armed and unarmed positions, a first internal gear operatively connected to said elements, a second internal gear disposed adjacent thereto, said second gear hav-

ing a slightly greater number of teeth than said first gear, a bodily movable pinion having a separate set of gear teeth meshed with each of said gears, a pin rotatable in said pinion, a rotatable shaft, a crank connecting said pin and said shaft, a T-shaped member having its stem fixed on said shaft, two vane shafts rotatably mounted in the head of said member, a propeller vane on each of said vane shafts, a spring connected to each of said shafts normally to hold said vanes in such position that they will tend to move said elements to the unarmed position but adapted to yield at wind pressures above a predeermined minimum to permit the direction of pitch of said vanes to change to move said elements to the armed position, stops carried by the head of said member to limit the rotation of said vane shafts and concave vanes mounted on said member on opposite sides thereof oriented to move said elements always toward the unarmed position when acted upon by wind pressure transversely to the axis of a bomb by which the fuse is carried.

7. In a fuse, elements movable to and from the armed and unarmed positions and means so to move said elements including propeller vanes adapted to be set with their direction of pitch such that wind pressure below a predetermined value on said vanes tends to move said elements to the unarmed position and to change said direction of pitch to tend to move said elements to the armed position when said pressure is above said predetermined value and resilient means tending to move said vanes to the first mentioned direction of pitch.

8. In a fuse, elements movable to and from the armed and unarmed positions, means so to move said elements including propeller vanes adapted to be set with their direction of pitch such that wind pressure below a predetermined value on said vanes tends to move said elements to the unarmed position and to change said direction of pitch to tend to move said elements to the armed position when said pressure is above said predetermined value, means tending to move said vanes to the first mentioned direction of pitch and other vanes associated with the aforesaid vanes adapted always to move said elements to the unarmed position when acted upon by wind pressure transversely to the axis of a bomb by which the fuse is carried.

9. In a fuse, elements movable to and from the armed and unarmed positions, means including differentially acting gears to move said elements to delay the movement of said elements, a rotatable shaft operatively connected to said gears, a T-shaped member having its stem fixed on said shaft, two vane shafts rotatably mounted in the head of said member, a propeller vane on each of said vane shafts, a spring connected to each of said shafts normally to hold said vanes in such position that they will tend to move said elements to the unarmed position but adapted to yield at wind pressures above a predetermined minimum to permit the direction of pitch of said vanes to change to move said elements to the unarmed position and stops carried by the head of said member to limit the rotation of said vane shafts.

10. In a fuse, elements movable to and from the armed and unarmed positions, means so to move said elements including differentially acting gears operatively connected to said elements, a rotatable shaft connected to said gears, propeller vanes connected to said shaft, said

vanes normally having a direction of pitch that will cause said vanes to move said elements to the unarmed position but movable to a direction of pitch that will cause said vanes to move said elements to the armed position and means tending to hold said vanes with the first mentioned direction of pitch.

11. In a fuse, elements movable to and from the armed and unarmed positions, means actuatable by wind pressure to move said elements toward the unarmed position when said pressure is below a predetermined value and toward the armed position when said pressure is greater than said value and other means tending always to move said elements toward the unarmed position when acted upon by wind pressure transversely to the axis of a bomb by which the fuse is carried.

12. In a fuse, a propeller having elements adapted to have a pitch direction to unarm the fuse when acted upon by wind pressures below a predetermined value and to move to a pitch direction to arm said fuse when said pressures are greater than said value and other elements tending always to unarm said fuse when acted upon by wind pressures transversely to the axis of a bomb by which the fuse is carried.

13. In a fuse, a propeller having elements adapted to have a pitch direction to unarm the fuse when acted upon by wind pressures below a predetermined value and to move to a pitch direction to arm said fuse when said pressures are greater than the said value.

14. In a fuse, a propeller having elements adapted to have a pitch direction to unarm the fuse when acted upon by wind pressures below a predetermined value and to move to a pitch direction to arm said fuse when said pressures are greater than the said value, other elements tending always to unarm said fuse when acted upon by wind pressures transversely to the axis of a bomb by which the fuse is carried and means actuated by said propeller to delay the arming or unarming of said fuse.

15. In mechanism for arming and unarming a bomb fuse, a propeller operatively connected to actuate the mechanism, said propeller including blades mounted for limited rotation about an edge of each, means biasing said blades to one position wherein air pressure of less than a predetermined magnitude thereon actuates the mechanism to the unarmed position but blades are moved in opposition to the biasing means to the armed position by air pressure above said magnitude, and curved blades tending always to move said mechanism to the unarmed position when acted upon by air pressures across the axis of the propeller.

PHILIAS H. GIROUARD.

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