FUZE ARMING DEVICE

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EXEMPLARY CLAIM

1. A safety and arming device for an ordnance fuze comprising:

a housing having an explosive initiator mounted therein and being connected to the fuze,

an arming rotor rotatably mounted within said housing adjacent said initiator,

said arming rotor having an explosive detonator mounted therein for detonation by said initiator and transmission of that detonation to the main charge of the ordnance item,

said arming rotor being normally held in a safety position wherein said detonator is rotatably out of line with said initiator to prevent ignition of said detonator by said initiator and being rotatably movable to an armed position wherein said initiator and said detonator are aligned to provide a continuous detonation path from the initiator to the main charge,

air flow responsive means mounted upon said housing for vibratory response at its natural frequency when exposed to air velocities in excess of a predetermined minimum velocity, and

motion translating means connected to said flow responsive means and to said arming rotor, whereby vibration of the flow responsive means at its natural resonant frequency for a predetermined duration of time will cause the arming rotor to be moved from its safety position to its armed position.

13 Claims, 5 Drawing Figures
FUZE ARMING DEVICE

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.

The present invention relates to a fuze arming device and more particularly to a safety and arming device for a fuze of the type employed in free falling bombs.

To insure adequate protection of personnel during the shipping and handling of bombs and to protect the aircraft carrier or landing strip upon which the bomb delivering planes are based, it is necessary to provide the bomb fuze with a safety and arming device which maintains the fuze in a safe condition until the weapon is released over the target and the plane is out of the lethal range of the weapon. In the past, bomb fuzes have been provided with safety and arming devices which were designed to be moved from a safe to an armed position in response to movement of a rotating vane or pinwheel which were intended to be rotated by reaction with the air when the bomb is in a free falling flight. Although these devices have served the purpose, they have not proven entirely satisfactory under modern delivery velocities because the rotating vanes or pinwheels now require the use of high speed bearings which are expensive and do not have a high degree of reliability. These rotating vanes or pinwheels also created sealing problems in trying to maintain a weathertight bomb housing while transmitting the rotary motion of the vane to the interior of the bomb housing. When a rotating vane type of safety and arming device is used on a bomb which is to be launched from an aircraft carrier based plane, it is desirous that the arming mechanism be provided with a means to discriminate between the takeoff and landing velocity of the aircraft and the air velocities encountered at release over the target so that arming of the fuze cannot occur until the plane has departed from the carrier. Various types of speed discriminating clutches have been proposed and used in the drive train from the rotating vane into the arming mechanism. Thus a clutch mechanism is required in conjunction with the vane. Safety and arming devices driven by rotating vanes are essentially distance measuring devices which do not provide adequate protection to the aircraft when the bomb is released from the aircraft at high speed inasmuch as the fast rotating vane would arm the fuze before the bomb has reached a safe distance from the aircraft, thus exemplifying the need for a time based safety and arming mechanism which will guarantee the safety of the pilot and his plane whether the bomb be released at slow or high speeds. Consequently the vane requires a timing mechanism in series, such as a clockwork.

On the other hand, mechanisms have been designed with a piston or bellows for response to the ram air pressure encountered by the bomb for arming the bomb fuze. Although the piston and bellows type devices are capable of discriminating between ondeck air velocities and air velocities at the time of launch, they are not capable of discriminating between the air environment and the target. Therefore, in the event that a bomb having a piston or bellows driven safety and arming mechanism would be accidentally dropped over the side of an aircraft carrier, the piston or bellows would be actuated upon entry of the bomb into the water, thus arming the fuze and endangering the safety of the carrier and its crew.

The present invention provides a safety and arming device for a bomb fuze which embraces all of the advantages of similarly employed safety and arming devices and yet possesses none of the aforesaid disadvantages. To achieve this advance in the art, the safety and arming mechanism of the present invention is driven by a reed mounted exteriorly of the bomb housing which reed is caused to vibrate at its natural frequency when exposed to air velocities in excess of a predetermined minimum velocity. The reed is so designed that the predetermined minimum velocity required to induce vibration in the reed is slightly above the takeoff and landing velocity of the type of aircraft used in delivering the bomb to the target, thus preventing arming of the fuze if inadvertently released prior to or during takeoff or landing of the aircraft. Since the reed vibrates only at its natural frequency even at speeds in excess of the predetermined minimum air velocity, the safety and arming mechanism of the present invention is essentially a time based device which prevents arming of the fuze until expiration of a predetermined time interval subsequent to release of the bomb independently of the air speed of the aircraft, thus guaranteeing the safety of the aircraft and the aircraft carrier.

It is an object of the present invention to provide a new and improved safety and arming device for an ordnance fuze which will maintain the fuze in an unarmed condition for a predetermined interval of time subsequent to launching of the weapon.

Another object is to provide a safety and arming device for an ordnance fuze in an aircraft launched weapon which will permit arming of the fuze only when exposed to air velocities in excess of the takeoff and landing velocity of the aircraft.

A further object of the invention is the provision of a safety and arming device for an ordnance fuze in an aircraft launched weapon which will arm the fuze when exposed to air velocities of a predetermined magnitude but which will not arm the fuze when exposed to movement through water at any velocity likely to be encountered is inadvertently falling over side of a carrier during launch or landing tactics.

Still another object is to provide a safety and arming device for an ordnance fuze which will maintain the fuze in a safe condition after launch until the ordnance item has experienced flight through its intended environment at a predetermined minimum velocity for a predetermined duration of time.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like reference numerals designate like parts through the figures thereof and wherein:

FIG. 1 shows a perspective view, partly in section, of one embodiment of the invention;

FIG. 2 illustrates a perspective view, partly in section, of a second embodiment of the invention;

FIG. 3 illustrates a perspective view, partly in section, of a third embodiment of the invention;

FIG. 4 shows a sectional view of a fourth embodiment of the invention; and

FIG. 5 illustrates an exploded perspective view of the embodiment of the invention illustrated in FIG. 4.

Referring now to the drawings, there is shown in FIG. 1 a portion of a bomb casing 11 which is orientated in such a manner that if the whole bomb could be seen in the drawings, the nose portion of the bomb would be in the left side of the figure and the tail portion on the right side of the figure. The bomb casing is fabricated with an internal annular collar 12 to define an aperture or well in the side of the bomb casing to receive the safety and arming mechanism. The safety and arming mechanism for the bomb fuze is contained within a cylindrical housing 13 which has an external annular flange 14 near the upper end thereof to define an annular shoulder 15 adapted to engage an internal annular seat 16 formed on collar 12. The cylindrical housing has a transverse plate 17 fixedly secured therein to divide the container 13 into an upper chamber and a lower chamber. Positioned within and substantially filling the lower chamber is the booster charge 18 which is in communication with the main bomb charge and is designed to detonate the main charge. Mounted upon the transverse support plate 17 and extending into the upper chamber is a pivot post 19 upon which is rotatably mounted an arming rotor 21. As shown in FIG. 1, the arming rotor is provided with a pair of oppositely disposed through apertures 22 and 23 formed therein, said apertures being axially aligned with a second pair of through apertures 24 and 25 formed in the transverse support plate 17. The electroresponsive through apertures 22 and 23 formed in the arming rotor are
packed with an initiator explosive composition in the form of detonators to define a pair of explosive trains through the arming rotor, while the through apertures 24 and 25 in the transverse support plate 17 are packed with a secondary explosive composition to define a pair of leads 28 and 29 adapted to detonate booster charge 18. A pair of electroresistive explosive inserts is adapted to be inserted in the upper chamber of the housing 13 by any conventional means, not shown, the initiator 31 being coaxially aligned with lead 28 while initiator 32 is coaxially aligned with lead 29. A pair of electrical conductors 33 and 34 connect the electroresistive explosive initiators 31 and 32 with any conventional condition responsive fuse activating means 35 mounted in the bomb. As shown in FIG. 1, the arming rotor 21 has been rotated by the gear train from its safe position to its armed position wherein explosive trains 26 and 27 are in axial alignment with initiators 31 and 32 and leads 28 and 29, respectively, to provide a continuous explosive detonation path therebetween. In this position, transmission of an electrical signal through conductors 33 and 34 in response to the bomb activating mechanism will cause the ignition of igniters 31 and 32 which in turn will ignite explosive trains 26 and 27, respectively, which detonate and transfer this detonation through the arming rotor to the leads 28 and 29, respectively, for actuation of the booster charge 18 and detonation of the main charge in the bomb. In its unarmed position, the arming rotor 21 will be angularly orientated such that the explosive trains 26 and 27 are not axially aligned with igniters 31 and 32 and leads 28 and 29, but instead, the ignition and detonation path will be obstructed by the body portion of the inert arming rotor which will prevent detonation of the bomb by accidental actuation of the igniters 31 and 32. The arming rotor acts as a shutter to obstruct the ignition and detonation path until the arming sequence has been performed.

The cylindrical arming rotor 21 is provided with gears 35 formed on the outer peripheral surface thereof for engagement with a worm gear 36 connected by means of a worm gear shaft 37 to a reduction gearing assembly shown generally at 38. Rotation of the gear train 38 by an air flow sensing element will produce rotation of the arming rotor and arming of the fuze.

The upper end portion of the safety and arming housing 13 is closed by an end wall 39 and a cap 40 is secured thereto by means of screws 41. The cap has a downwardly depending curved portion adapted to partially extend into a concave trough formed in the upper surface of the end wall 39 in such a manner that when the cap is secured to the top of the end wall, the cap and end wall cooperate to define an air flow channel 42 of rectangular cross-section. Prior to release of the bomb, the flow channel is normally covered by a tear strip 43 which is integrally attached to the upper surface of the cap 40 in such a manner as to completely cover the entrance and exit of the flow channel 42. The tear strip is connected to the aircraft so that when the bomb is released, the tear strip is removed and air is permitted to flow through the flow channel 42 in the direction of the arrows as the bomb falls away from plane. An air deflecting flap 44 formed of a thin curved strip of resilient material is attached to a portion of the cap 40 so that, when the tear strip is removed, the leading edge of the flap 44 is permitted to bend upwardly and deflect the flow of air into the flow channel 42. Positioned in the flow channel is an air flow sensing reed 45 which may be constructed of a thin strip of tempered metal, wood, plastic or may be one end of a slender tempered metal rod or wire. The reed is supported at its right end by clamping engagement between the cap 40 and the end wall 39 and the left portion of the reed is freely suspended in the flow channel 42. When air flow through the channel 42 reaches a predetermined velocity, the air flow will excite the reed 45 and its natural frequency will cause the reed to continue vibrating at its natural frequency so long as the velocity of air flow through the channel remains above the predetermined critical velocity. The vibratory motion of the reed is converted into rotary motion of the arming rotor 21 by means of a ratchet pawl 46 connected to the free end of the reed 45 and extending through a slot 47 formed in the end wall 39 of the housing 13 for engagement with the teeth of a ratchet wheel in the gear train 38. The pawl reciprocates with the vibrating reed 45 to advance the ratchet wheel one tooth for each complete vibration of the reed until the ratchet wheel is engaged with the pawl and causes the gear train to operate properly.

To prevent arming of the weapon by induced vibrations, such as those from the aircraft engine, a mechanism is provided to lock the reed in a fixed position and prevent vibration of the reed until the tear strip has been removed. For this purpose, a small plunger 68 is reciprocally received within a bore formed in cap 40. A helical compression spring 69 surrounds said plunger and engages at one end a flange 71 formed on the plunger and, at its other end, is seated upon an annular shoulder formed in the plunger receiving bore. Spring 69 resiliently biases the plunger outwardly and out of contact with the reed but when the tear strip is in place, the tear strip forces the plunger downwardly against the bias of spring 69 and into contact with the reed. Removal of the tear strip permits the spring to force the plunger outwardly and therefore frees the reed for vibration by the air stream.

In operation, exposure of the reed 45 to an air stream through channel 42 in excess of the predetermined velocity will produce vibration of the reed 45 at its natural frequency. The vibrating motion of the reed 45 is translated by means of pawl 46 to a rotating motion of the gear train 38 and ultimately to the rotation of the arming rotor 21. Since the reed will vibrate at its natural frequency when exposed to air of any velocity, the rate of frequency of vibration of the reed remains constant throughout the arming of the fuze and therefore the rotational movement of the arming rotor 21 is maintained at a constant rate. For this reason, the safety and arming device of the present invention provides a time based system which possesses all of the aforementioned advantages characteristic of such systems and guarantees that arming of the fuze will not occur until the expiration of a predetermined interval of time after release of the bomb. The safety and arming device of the present invention may be seen to be self-powered in that it derives its power from the air stream and further performs an air speed discriminating function without requiring the necessity of any clutches or other structure by virtue of the fact that the reed will only vibrate when exposed to an air stream in excess of a predetermined velocity. It may also be seen that the safety and arming device of the present invention is capable of discriminating between environments in which the reed will only vibrate when exposed to an air stream and other environments in which the reed is exposed to an expected flow of water through the channel 42 and therefore positively prevents arming in the event that the bomb is accidentally dropped over the side of the aircraft carrier.

Referring now to FIG. 2, there is shown a second embodiment of the invention similar to the device of FIG. 1 but utilizing a tuning fork as the air velocity sensing member. The tuning fork 51 is mounted upon the housing of the safety and arming device in much the same manner as the FIG. 1 device but is insulated therewith by an elastomeric seal 52. The tuning fork has one tine 54a projecting longitudinally into the flow channel 42 for excitation by the air stream through said channel. The second tine 54b of the tuning fork is positioned below the end wall 39 and is connected to gear train 38 by means of pawl 46. When tine 54a of the tuning fork is exposed to an air stream through channel 42 of a velocity in excess of the predetermined critical velocity required to excite the tine into vibration at its natural frequency, tine 54b of the tuning fork will be caused to vibrate in resonance with tine 53 and therefore will drive the gear train 38 and arming rotor 21 at a constant angular velocity. The device is also provided with a means for changing the frequency of vibration of the tuning fork by means of changing the effective length of the tines of
the tuning fork. An adjustment block 53 is clamped in a position between the upper flat surface of the tuning fork base 51 and the bottom surface of the cap 40. The block 53 has a downwardly depending leg portion 53a with a pair of transverse slots formed therein to receive the first and second times of the tuning fork. A screw head 55 with the bottom surface thereof is counter-balanced by a position cap 40 and formed on the bottom surface thereof a downwardly depending peg 56 which is eccentrically positioned with respect to the central axis of the screw head. The peg 56 extends within a slot 57 formed in the upper surface of the adjustment block. To effect a change in the frequency of the tuning fork, the screw head 55 may be angularly rotated by means of a screw driver to move the peg 56 eccentrically about the axis of the screw head and, by virtue of the engagement of peg 56 with slot 57, movement of the peg will cause the adjustment block 53a and its depending leg 54 to slideably move longitudinally along the times of the tuning fork. It may be seen, therefore, that suitable indicia may be provided on the upper surface of the housing cap 40 adjacent the screw head 55, which indicia may be calibrated in terms of time intervals for appropriate settings of the fuze arming mechanism. The use of a tuning fork as the air speed sensing mechanism simplifies the task of sealing the housing of the safety and arming device from the elements of the weather and further provides a simple means for selectively changing the arming interval of the safety and arming mechanism by changing the natural frequency of the tuning fork. Rotation of the tuning fork 56 is shown another embodiment of the invention similar to the safety and arming mechanisms of FIGS. 1 and 2, but employing a torsion bar oscillator as the air speed sensing device. The cylindrical housing 13 is received within well 12 of the bomb casing 11 and is provided with an upper end wall 39, the thick end wall 39 having a transverse aperture 42 of rectangular cross section formed therein to define a channel for air flow from inlet 58 through outlet 59. The upper portion of the end wall 39 is provided with a cover 40 secured thereto by means of screws 41 to provide access to the interior of the flow channel 42. A flat rectangular blade 61 is positioned longitudinally with the channel 42 and is secured at its midportion to one end of a torsion rod 62, the other end of the torsion rod being fixedly secured to a side wall of the air channel 42. Fixedly secured to the under side of the cap 40 at a position between the torsion bar 62 and the inlet 58 of the air channel is an air foil 63 which serves to reduce the starting time for the blade to oscillate in response to a predetermined air velocity flowing through the channel 42. The downstream end of the blade 61 has a pointed nose 64 at its end wall which extends outwardly through a slot 64 in the end wall 39 to translate the oscillating movement of the blade 61 to rotational movement of gear train 38 and ultimately into rotation of the arming rotor 21 in the manner described with reference to the structure shown in FIG. 1. The torsion bar 62 is secured at one end to a side wall of the air channel 42 and has its other end freely suspended into the air channel to support the rectangular blade 61. The blade and torsion bar constitute a torsion bar oscillator which is caused to oscillate at its natural frequency when exposed to an air flow having a velocity in excess of a predetermined critical velocity required to excite the torsion bar oscillator into movement. The inertia-torsion system is air driven to vibrate at its natural frequency and thereby furnishes a time base for rotation of the gear train 38 and the rotation of the arming rotor 21 at a predetermined angular velocity, thus guaranteeing the expiration of a constant time interval required to move the arming rotor from its safety position to its arming position. The safety and arming device of FIG. 3 possesses all of the advantages of the devices described in FIGS. 1 and 2 and has the further advantage that the torsion system is counter-balanced and therefore is insensitive to mechanical shocks or vibrations and hence cannot normally be excited into operation by induced vibrations created during shipping or transit.

Referring to FIGS. 4 and 5, there is shown another embodiment of the present invention which employs a torsion bar oscillator as the air flow sensing element such as the one described in FIG. 3, but in this case, the torsion bar is mounted with its axis parallel to the axis of the bomb and parallel to the air flow through the channel. As seen in FIG. 4, the cylindrical housing for the safety and arming mechanism is received within well 12 of the bomb casing 11, the bottom surface thereof a downwardly depending peg 56 which is eccentrically positioned with respect to the central axis of the screw head. The peg 56 extends within a slot 57 formed in the upper surface of the adjustment block. To effect a change in the frequency of the tuning fork, the screw head 55 may be angularly rotated by means of a screw driver to move the peg 56 eccentrically about the axis of the screw head and, by virtue of the engagement of peg 56 with slot 57, movement of the peg will cause the adjustment block 53a and its depending leg 54 to slideably move longitudinally along the times of the tuning fork. It may be seen, therefore, that suitable indicia may be provided on the upper surface of the housing cap 40 adjacent the screw head 55, which indicia may be calibrated in terms of time intervals for appropriate settings of the fuze arming mechanism. The use of a tuning fork as the air speed sensing mechanism simplifies the task of sealing the housing of the safety and arming device from the elements of the weather and further provides a simple means for selectively changing the arming interval of the safety and arming mechanism by changing the natural frequency of the tuning fork. Rotation of the tuning fork 56 is shown another embodiment of the invention similar to the safety and arming mechanisms of FIGS. 1 and 2, but employing a torsion bar oscillator as the air speed sensing device. The cylindrical housing 13 is received within well 12 of the bomb casing 11 and is provided with an upper end wall 39, the thick end wall 39 having a transverse aperture 42 of rectangular cross section similar to that of the FIG. 3 device and positioned within the channel 42 as a flat-hour-glass shaped block 65 shown more clearly in FIG. 5. A torsion rod 66 is secured at one end to the hour-glass shaped block 65 and is freely suspended at its other end within the flow channel 42. The block 65 is mounted within the channel 42 adjacent the inlet end thereof and has the torsion rod 66 positioned axially within the channel 42 on the downstream side of the block 65. A flat blade 67 is mounted at its mid-section perpendicular to the torsion rod. The hour-glass shaped block 65 directs the air flow against opposite sides of the blade 67 simultaneously, which when exposed to an air stream flowing above a predetermined velocity, will be excited into angular oscillation about the axis of the torsion rod, thus causing paw 46 to rotate the gear train 38 as the torsion rod inertia system oscillates at its natural resonant frequency. Rotation of the gear train 38 causes the arming rotor 21 to rotate from a safety position to an arming position at the expiration of a predetermined interval, the time base being provided by the oscillation of the torsion bar oscillator at its natural resonant frequency. The embodiment of the invention shown in FIGS. 4 and 5 operates in a manner similar to that of the embodiment illustrated in FIG. 3 but has the advantage thereon of having the air stream act upon both sides of the blade 67 at the same time during both directions of oscillating movement of the blade and therefore extracts greater mechanical work output from the aerodynamic stream.

From the foregoing it may be seen that the present invention provides a safety and arming mechanism for an ordinance fuze which guarantees that arming of the fuze will not occur until the mechanism has been exposed to an air velocity in excess of a predetermined minimum velocity for a predetermined duration of time. The aforesaid invention provides a safety and arming mechanism which is capable of discriminating between environments, is capable of discriminating between air velocities, is powered by the air stream and therefore requires no outside source of power other than the environment itself, and the device has a very fast start-up time.

While the invention has been described with reference to four embodiments thereof which give satisfactory results, it will be obvious to those skilled in the art to which the invention pertains, after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, in the appended claims to cover all sorts of changes and modifications.

What is claimed is:

1. A safety and arming device for an ordinance fuze comprising:
a housing having an explosive initiator mounted therein and being connected to the fuze,

2. an arming rotor rotatably mounted within said housing adjacent said initiator,
said arming rotor having an explosive detonator mounted therein for detonation by said initiator and transmission of that detonation to the main charge of the ordinance item,
said arming rotor being normally held in a safety position wherein said detonator is rotatably out of line with said initiator to prevent ignition of said detonator by said initiator and being rotatably movable to an armed position wherein said initiator and said detonator are aligned to
of time. 8. The device of claim 7 wherein said flow responsive means comprises:
a thin, flexible reed having one end thereof mounted upon
said housing and having its other end positioned for expo-
sure to an air stream around the ordnance item.
3. The device of claim 2 wherein said motion translating
means comprises:
a gear train comprising a plurality of reduction gears,
the final gear in the gear train having worm gear mounted
upon its shaft for engagement with gear teeth formed on
the arming rotor,
a pawl connected to said reed and engaging the first gear of
the gear train,
whereby vibration of the reed at its natural resonant
frequency causes reciprocation of the pawl which is trans-
lated to rotary motion of the initial gear of the gear train
which rotates the worm gear to finally rotate the arming
rotor from its safety position to its armed position after a
predetermined time interval.
4. The device of claim 3 wherein said housing is provided
with an end wall having a slot formed therein,
said thin flexible reed is mounted exteriorly of said end wall
for exposure to the air stream, and
said pawl is connected to said other end of the reed and ex-
tends through said slot for engagement with the first
wheel in said gear train.
5. The device of claim 1 wherein, said air flow responsive
means comprises:
a tuning fork having at least one node thereof positioned for
exposure to the flow of air around said ordnance item.
6. The device of claim 1 wherein said air flow responsive
means comprises a tuning fork,
said housing having an end wall with a slot formed therein,
said tuning fork having one node extending through said slot
for exposure to said air stream exteriorly of said housing and
having its other node disposed on the opposite side of
said end wall within said housing for connection to said
motion translating means.
7. The device of claim 6 wherein said motion translating
means comprises:
a gear train mounted within said housing,
a pawl mounted upon said other node of the tuning fork and
extending into said housing in contact with the first gear
in said gear train,
the final gear in the gear train having a worm gear attached
to its shaft,
said worm gear being positioned for engagement with spur
gears formed on the arming rotor,
whereby exposure of said one node of the tuning fork to an
air velocity above the predetermined critical velocity
causes said one node to vibrate at its natural resonant
frequency and said other node is induced to sympathetic
vibration at its natural resonant frequency, the vibrating
motion of said other node and reciprocal motion of the
pawl is translated into rotary motion of the gear train and
rotary motion of the arming rotor to move the arming
rotor from its safety position to its armed position at the
expiration of a predetermined interval of time.
8. The device of claim 7 further comprising:
means connected to said housing and contacting the times of
the tuning fork to change the resonant frequency of said
tuning fork.
9. The device of claim 8 wherein said means for changing
the frequency of the tuning fork comprises:
a block slideably mounted upon the outer surface of the
base of the tuning fork,
said block having a leg portion formed thereon and extend-
ing perpendicular to said block,
said leg portion having a pair of slots formed therein to
close each of said pairs of the tuning fork,
whereby the block may be selectively moved longitudinally
along the tuning fork to change the effective length of the
times of said tuning fork and thereby change the natural
resonant frequency of the tuning fork to consequently
change the timing interval required for arming of the
fuzes.
10. The device of claim 1 wherein said flow responsive
means comprises:
a torsion rod connected at one end to a portion of said hous-
ing and extending into said air stream at an angle perpen-
dicular thereto,
an elongated thin blade connected to the other end of said
torsion rod at a mid-portion of said blade,
said blade being disposed longitudinally along the air
stream,
whereby exposure of said blade to an air stream above a
predetermined minimum velocity will cause said blade to
oscillate about said torsion bar at its natural resonant
frequency.
11. The device of claim 10 wherein said motion translating
means comprises:
a gear train mounted within said housing,
a pawl connected at one end to a portion of said blade and
having its other end in contact with the first gear of said
gear train,
the final gear of said gear train having a worm gear mounted
upon its gear shaft,
said worm gear being in operative engagement with spur
gears formed on the outer peripheral surface of the said
arming rotor,
whereby the oscillating motion of the blade is translated
into rotary motion of the gear train by means of the pawl
and the rotary motion of the gear train rotatably drives
the arming rotor from its safety position to its armed posi-
tion upon the expiration of a predetermined time interval.
12. The device of claim 1 wherein said flow responsive
means comprises:
a torsion bar mounted at one end upon said housing and ex-
tending in a direction parallel to the direction of air flow,
a thin blade connected at its mid-portion to the other end of
said torsion bar and extending in a direction transverse to
the air flow,
whereby exposure of said blade to an air flow having a
velocity in excess of the predetermined minimum velocity
will cause the blade to rotatably oscillate about the axis of
the torsion bar at its natural resonant frequency.
13. The device of claim 12 wherein said motion translating
means comprises:
a gear train mounted within said housing, a ratchet pawl
connected to said torsion bar and contacting at one end
the first gear in the gear train,
the final gear in the gear train having a worm gear mounted
upon its gear shaft,
said worm gear being in operative engagement with spur
gears formed on the outer peripheral surface of said arm-
ing rotor,
whereby rotatable oscillation of the blade at its natural
frequency causes reciprocal movement of its ratchet pawl
which is translated into rotary movement of the gear train
which rotatably drives the arming rotor from its safety
position to its armed position upon the expiration of the
predetermined time interval.

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