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H. E. MALONE ET AL
EXPLOSIVE DEVICE CARRIER

2,364,302

Filed Jan. 15, 1941

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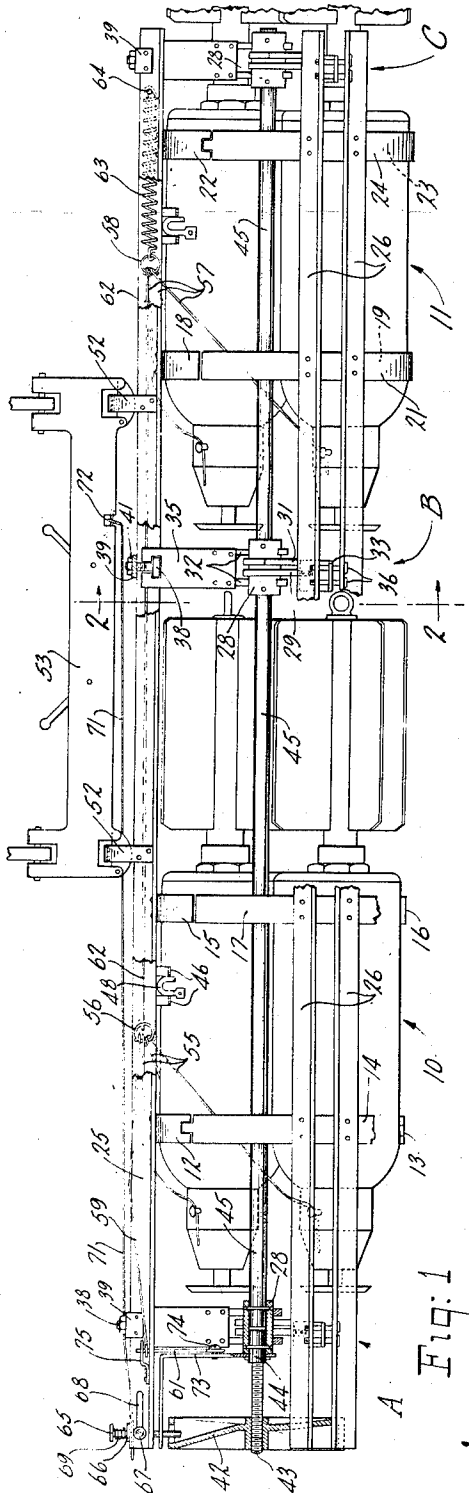
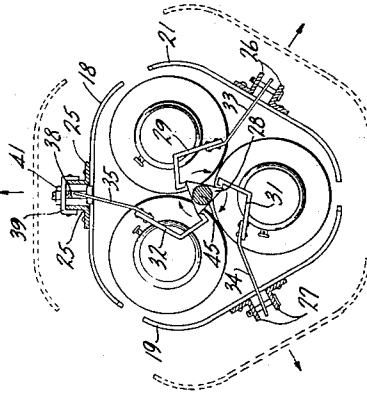
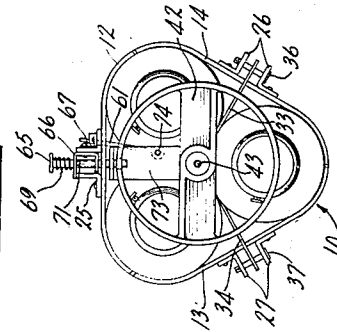
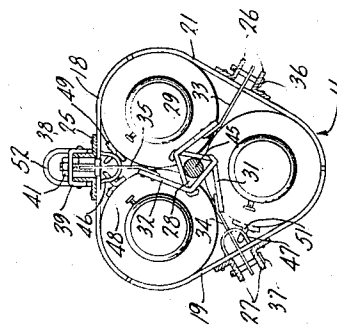


Fig. 1

Fig. 2

Fig. 3

Fig. 4



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2 Sheets-Sheet 2

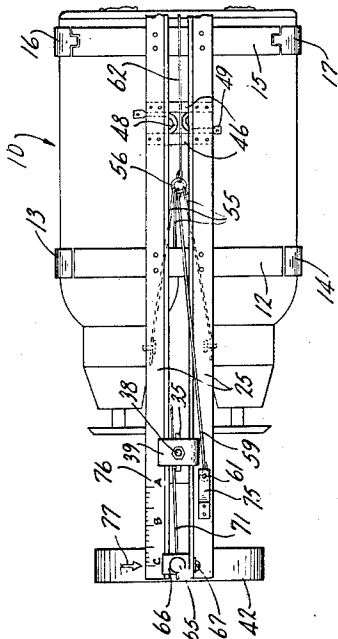


Fig: 5

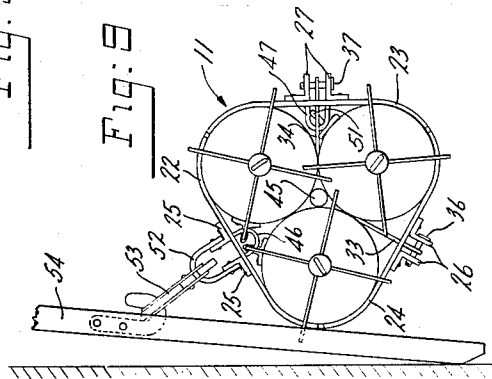


Fig: 6

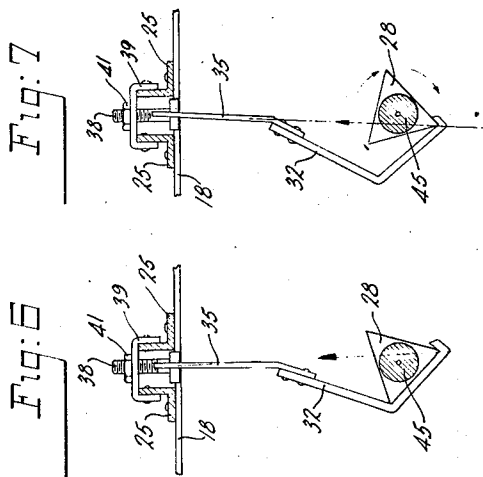


Fig: 7

Fig: 8

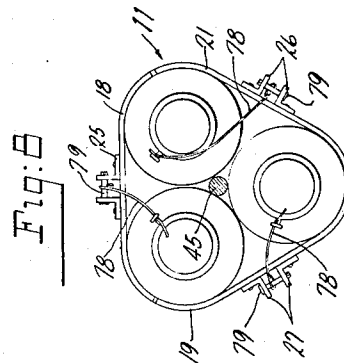


Fig: 8

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2,364,302

EXPLOSIVE DEVICE CARRIER

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8 Claims. (Cl. 89—1.5)

The primary object of this invention is to provide a device which will retain a plurality of articles in a prescribed arrangement until dispersal of the device and release of the articles is desired.

Another object is to provide a device which will safely retain a group of bombs in a compact cluster so long as they are carried within and until shortly after they are released from a bombing plane, such device disposed to thereafter automatically disperse and permit the bombs to fall individually.

A further object is to provide a bomb rack which will safely carry a plurality of bombs as a single unit while in transit within a bombing plane, but which will permit the bombs to fall to their target as individual units.

Other objects and advantages reside in certain novel features of construction, arrangement, operation and combination of the parts which will be hereinafter more fully described in the specification, and particularly pointed out in the appended claims, and of which the preferred embodiments are illustrated in the accompanying drawings.

In the drawings:

Fig. 1 is a side elevation of the mechanism showing four bombs in place, the two top right hand bombs (looking from the front) having been removed for clarity;

Fig. 2 is a cross sectional view in elevation taken along the line 2—2 of Fig. 1 and showing the locking mechanism of the device;

Fig. 3 is a front elevation of the device;

Fig. 4 is a second cross sectional view through the line 2—2 of Fig. 1, but shows the mechanism in the preliminary stages of dispersement;

Fig. 5 is a partial plan view from the top;

Fig. 6 is an enlarged view of a portion of the locking device illustrating the arrangement of the parts in the locked position;

Fig. 7 is an enlarged view of a portion of the locking device with the parts shown in the unlocked position;

Fig. 8 is a cross sectional view from the front showing an alternative method of "arming" the bombs; while

Fig. 9 illustrates the preferred method of hanging the assembly.

While the invention is susceptible of various modifications and alternative construction, the drawings shown and the disclosure herein illustrate the preferred embodiments. It is to be understood, however, that there is no intention to limit the invention to the specific forms disclosed,

but rather to cover all modifications and alternative constructions falling within the spirit and scope of the invention.

Generally stated the invention contemplates providing a structure which will securely retain a number of bombs in a compact assembly or cluster while they are being carried within an airplane; which structure when released from the airplane will continue to retain the bombs in their confinement until after a time delay of adjustable duration and after such time delay will, by dispersal of the parts of the assembly, release the bombs and permit them to assume their own trajectory in a downward flight toward the earth.

In order to conserve space as much as possible the invention utilizes an over center locking device which couples together by a rotary member all of the movable portions of the restraining mechanism. The time delay device is made to take the form of a rotary reaction blade of high inertia which begins to rotate due to its motion through the air as soon as the structure is dropped from the airplane. Means are provided for suddenly causing the propeller to cease rotating and for utilizing the energy so derived for unlocking the locking device. Means are also provided to enable the entire structure to be dropped without disassembly in the event such is desired. Safety means are also incorporated to prevent premature detonation of the bombs. In the principal structure this latter means takes the form of a number of "arming" wires, one for each bomb, which are adapted to be pulled from a "safe" position to an "armed" position, thus arming the bombs, by a spring whose action in turn is controlled by the same propeller which causes the operation of the locking device. In the modification of the device, as in the principal structure, the safety means consists of wires engaging each of the bombs, but in the case of the modification the wires are fastened directly to the parts which ultimately disperse. These parts in themselves "arm" the bombs when dispersal occurs, the ultimate difference in the two modifications being that in the latter modification a spring in cooperation with the propeller is not utilized to positively pull the arming wires as in the principal structure.

In the figures, a front series of bombs 10 and a rear series of bombs 11 are held together and restrained from radial dispersion by a series of restraining members which include for the first series of bombs 10 a resilient top front strap 12, a left side front strap 13, a right side front strap 14, a top rear strap 15, a left side rear

strap 16 and a right side rear strap 17; and which include for the rear series of bombs a resilient top front strap 18, a left side front strap 19, a right side front strap 21, a top rear strap 22, a left side rear strap 23 and a right side rear strap 24. Each of the aforementioned straps is secured to backing members comprised of a pair of angle bars such as a top pair of angles 25, a right side pair of angles 26 and a left side pair of angles 27, each of the straps being secured to only one pair of backing members. Thus the top front strap 12 and the top rear strap 15 for the front series of bombs 10, and the top front strap 18 and the top rear strap 22 for the rear series of bombs 11, are attached to the pair of angles 25 by any suitable means as by riveting. Similarly the left side front strap 13, and the left side rear strap 16 for the first series of bombs 10, the left side front strap 19 and the left side rear strap 23 for the rear series of bombs 11, are secured to the left side pair of angles 27; and the right side front strap 14, the right side rear strap 17, the right side front strap 21 and the right side rear strap 24 are secured to the right side pair of angles 26. Each of the straps is arranged to span two bombs and the terminal ends of each strap are shaped to conform with the contour of the bomb with which it engages. The front straps 12, 13 and 14, as well as the rear straps 22, 23 and 24, are arranged with tongue and groove engaging members so that when assembled they are mutually interlocking and relative lateral motion between the respective top, right and left assemblies is prevented. The rear straps 15, 16 and 17, and the front straps 18, 19 and 21 when assembled are arranged to abut each other with a slight gap.

A locking device serves to pull each of the backing structures toward a common center and in so doing to force all of the straps into intimate engagement with the bombs over which they extend and thus to hold them in a prescribed compact arrangement whereby they outline substantially an equilateral triangle. Referring to Figs. 1 and 2 this locking device is shown to comprise three identical units shown at A, B and C, each consisting of a triangular rotor 28, and cooperating therewith a right hook member 29, a left hook member 31 and a top hook member 32. Secured to each hook member in any suitable manner such as by riveting or welding is a connector strap illustrated respectively as a right connector 33, a left connector 34 and a top connector 35. The connectors 33 and 34 are secured to their respective backing members 26 and 27 by means of pins 36 and 37 which pass through suitable apertures in the angular members and in the connectors. The pins are prevented from working or falling out of place by cotter keys passing through apertures in their front ends. The top connector member 35 is provided with a T slot into which the head of a T bolt 38 fits. A U-shaped bracket member 39 is disposed to fit over the opening between the top pair of angles 25 and to serve as a bearing plate for the nut 41 which is adapted to thread onto the T bolt 38 after the latter passes through a suitable aperture in the U bracket 39. It will be understood that when this nut 41 is tightened the hook member 32 is made to bear even more strongly on the triangular rotor 28, causing it to be elevated and causing the hook members 29 and 31 and their respective connectors 33 and 34 to be stressed. This re-

sults in a clamping action and forces all of the straps 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23 and 24 to bear against their respective bombs, thereby holding the bombs in a compact, rigid cluster. Because of the particular manner in which the rotor 28 and the hook members 29, 31 and 32 are shaped and disposed, when these members are stressed a moment of force is created which tends to rotate the triangular rotary member 28 in a counterclockwise direction. (Refer to Fig. 2.) An illustration of the force relationships is shown in Fig. 6. It will be seen that when the flat sides of the triangular rotor 28 are in engagement with corresponding flat sides of the hooks 29, 31 and 32 a resultant line of force passes through a point to the right of the center of rotation of the rotor, thus producing the moment referred to.

Since the moment is in a counterclockwise direction and since the rotor 28 is already restrained from moving in this direction by the engagement of the flat sides of the hooks with those of the rotor, there is no resultant motion of the rotor in either direction and it may be said to be in a locked position.

If sufficient external force in a clockwise direction is applied to the rotor so as to overcome the counterclockwise moment the rotor will move. At it does so, the resultant line of force of the hooks will progressively pass more nearly through the center of rotation of the rotor, somewhat later through the center of rotation and finally pass through a point to the left side of the center of rotation. As soon as the latter condition exists a clockwise couple is created which of itself then causes the rotor to rotate. This latter condition is shown in Fig. 7. When the rotor 28 rotates sufficiently to disengage the tips of the hooks 29, 31 and 32 from the apices of the triangular rotor 28, the backing structures are no longer restrained and they disperse with an initial force created by the spring action of the straps 12 to 24 and continue to fall away by their own weight or are blown away, permitting the bombs to fall away and disperse.

It will be understood that the clamping device just described is essentially an over center self-locking device which serves to securely hold the backing members together when in the locked position and yet disposed to be easily operated with a minimum of effort from a tripping device to unlatch the interlocking members which serve to hold the assembly together as an integral unit. By utilizing the over center action only a small amount of effort is required of the tripping device to control the much larger forces which are utilized to hold the assembly together.

Fig. 4 illustrates the arrangement of the parts just following the clockwise unlocking action of the rotor 28, illustrating that the hooks 29, 31 and 32 are just about to leave their contact with the rotor 28 and showing the initial dispersal action of the backing structures made up of the angles 25, 26 and 27 and the straps 12 to 24 attached thereto.

Since it is desired that the assembly be disassembled outside of the airplane which carries it, it is desirable to incorporate a time delay device which will actuate the locking mechanism some time after the assembly has left the airplane. A reaction wheel 42 is provided for this purpose. When the assembly is dropped from the plane in an armed condition (which expression will be explained later) it has an initial forward velocity

relative to the air, equal to that of the airplane which carries it. This relative velocity acting on the blades of the reaction member 42 causes it to revolve in a clockwise direction on a shoulder screw 43. After an interval of time, determined by the speed of revolution of the reaction member 42 and the length of the screw 43 over which the reaction member 42 must travel, the reaction member 42 impinges against a shoulder 44 on the shoulder screw 43, causing sufficient impact to cause the triangular rotors 28 to revolve clockwise and release the hooks 29, 31 and 32 in the manner described above.

As shown in Fig. 2, each of the triangular rotors 28 shown at A, B and C are secured to a shaft 45 which transmits the rotary motion of the shoulder screw 43 to the rotors 28 at positions B and C. The front triangular rotor 28 serves as a coupling unit to couple together the shoulder screw 43 and the shaft 45 both of which, in the preferred form, are driven into the triangular rotor 28 and pinned. The reaction member 42 is provided with a heavy rim in order that it may store sufficient energy to unlock the assembly by its impetus when it engages the shoulder 44.

Means are provided to prevent lateral motion of the bombs within the rack structure. In the preferred form this means takes the form of a pair of adjacent lateral restraining brackets 46 secured to the top pair of angles 25, and a pair of adjacent lateral restraining brackets 47 secured to the left side pair of angles 27 for the front series of bombs 10. The lateral restraining brackets 46 are positioned to engage each side of bomb eyes 48 and 49 secured respectively to the left top bomb and the right top bomb. The left side lateral restraining brackets 47 similarly engage each side of a hook 51 secured to the bottom bomb. It will be apparent from Fig. 2 that it is possible for the bombs to turn a limited amount about their axes when they are assembled. This turning movement is limited by the bomb eyes 49 and 51 engaging either an adjacent bomb or an angle member of the assembly. The lateral restraining brackets 46 and 47 are so shaped and arranged that regardless of the degree of turning of the bombs within these limits the eyes 49 and 51 can never completely dislodge themselves from within the openings formed by the brackets. Similar lateral restraining means are provided for the rear series of bombs 11. One of these may be seen in Fig. 1.

The entire structure is arranged to be supported by a pair of hooks 52 secured to the top angles 25 in any suitable manner as by riveting. A suitable bomb shackle 53, which is no part of the invention, is adapted to engage the hooks 52. The bomb shackle in turn is adapted to be fastened to an internal structure of the airplane which is simulated as a structural member and hook 54 in Fig. 9.

In order to insure safe handling of the bombs while in transit, adequate arming devices are used. As is standard practice, each of the bombs is equipped with an arming pin. While this pin is under stress the bomb cannot be detonated when handled in any ordinary manner. These pins are maintained in the stressed position by means of a wire which passes through a suitable aperture in them. When the wire is withdrawn the pin is rendered free and the bomb is rendered armed and may be fired by any impact with the firing head. In the preferred structure while the bombs are within the rack, wires are passed through each of the arming pins. A series of

front arming wires 55 are utilized to hold the arming pins in each of the front bombs in unarmed position. Each of the front arming wires 55 has one of its ends secured to the front arming ring 56, and the other of its ends passed through the arming pin of one of the front bombs so that each bomb is independently controlled by a single wire. In a similar manner rear arming wires 57 are attached to the rear arming ring 58 at one end and to arming pins of the rear series of bombs 11 at the other end. A front main bomb arming wire 59 has one of its ends secured to the front arming ring 56 and its other end looped and restrained by a main bomb arming pin 61 whose function and arrangement will be described hereinafter. A connecting wire 62 has one of its ends secured to the front arming ring 56 and the other of its ends secured to the rear arming ring 58 so as to connect the two rings 56 and 58 together. An arming spring 63 is arranged in the opening between the two angles 25 with one of its ends secured to the rear arming ring 58 and the other of its ends secured to a pin 64 passing through suitable apertures in each of the angles 25 and serving to restrain the spring from movement. As may be readily seen from the Fig. 1, the arming spring 63 serves to hold taut a wire assembly made up of the front main bomb arming wire 59, the front arming ring 56, the connecting wire 62 and the rear arming ring 58 so that when the front end of the main bomb arming wire is released the spring pulling on the arming rings 58 and 56 indirectly pulls on the front arming wires 55 and rear arming wires 57 causing them to be extracted from the apertures of the arming pins in the bombs.

A master arming pin 65 is also provided. This pin 65 passes through suitable apertures in a U-shaped arming pin bracket 66 which may best be seen in Figs. 1 and 3. This arming pin bracket 66 is arranged with one of its legs extending in the opening between the pair of angle members 25 and is secured to the right angle of the top pair of angles 25 by means of a screw 67 which passes through an elongated slot 68 in the right angle member (Fig. 1) and is threaded into the U-shaped bracket 66. By utilizing this fastening means the U-shaped bracket 66 may be shifted along the angle member 25 for reasons which will be explained hereinafter. The master pin 65 is biased in an upward direction by means of a compression spring 69, but is restrained from upward movement when in the unarmed position by means of one end of the master arming wire 71 which passes under the upper leg of the U-shaped arming bracket 66 and through a suitable aperture in the arming pin 65. The other end of the master arming wire 71 is provided with an eye and is arranged to fit in the arming opening 72 within the bomb shackle 53 as used for single bombs.

The means provided to actuate the main bomb arming pin 61 consists of an L-shaped actuator 73 secured to the front rotary member 28 as by staking. As shown in Fig. 3, the main bomb arming pin 61 is secured to the L-shaped actuator 73 at its right edge by means of a screw 74 which passes through the main arming pin 61 and threads into the L-shaped actuator 73. When the L-shaped actuator 73 rotates in a clockwise manner with the triangular rotor 28, the pin 61 is pulled downwardly. The main arming pin 61 passes through a suitable aperture in the right hand angle member of the top pair of angles 25 and then through an S-shaped bearing member

75 riveted to the right angle member 25. The eye or the loop in the front end of the main bomb arming wire 59 is disposed to fit within the passage formed by one side of the S-shaped member 75 and the top side of the right angle member 25. The apertures in the S-shaped bearing member 75 and the angle member 25 serve as guides for the pin 61 which passes through them as well as through the eye in the end of the main bomb arming wire 59. When the main bomb arming pin 61 is actuated by the L-shaped actuator 73, it is withdrawn from these two apertures by its downward movement and allows the main bomb arming wire to be released. It will be noted that the master pin 65 passes through both the L-shaped actuator 73 and periphery of the reaction member 42 so that when it is in place neither the reaction member 42 nor the L-shaped actuator 73 may be rotated and hence neither the bombs nor the rack itself may be conditioned for detonation or dispersal. So long as this arming pin is in place the bomb assembly is entirely harmless.

Sometimes it is desired to drop a group of bombs without detonating them. In this event the main arming wire 71 is dropped with the entire assembly by opening the latch in the opening 72 in the bomb shackle 53 at the same time that the hooks 52 are released. When this is done the assembly drops with the arming pin 65 in place and the entire assembly is rendered harmless. If, however, it is desired to drop the bombs on a bombing mission, when the assembly is dropped the arming wire 71 is not dropped with it but rather remains secured to the bomb shackle 53. This is accomplished by allowing the latch controlling the opening 72 in the bomb shackle 53 to remain in its locked position. Under these conditions as soon as the assembly drops far enough to enable the master arming wire 71 to be withdrawn from the aperture in the master arming pin 65, the compression spring 69 urges the arming pin 65 in an upward direction causing it to withdraw from the openings in the reaction member 42 and the L-shaped arming pin actuator 73 permitting them to move when suitable forces are applied. When the assembly drops into the slip stream of the airplane the reaction member 42 immediately begins to rotate as has been described above. After some interval of time the reaction member 42 engages the shoulder 44, initiating a rotary movement of all of the members connected to the shoulder screw 43 and the shaft 45.

After a few degrees of rotation the L-shaped actuator member 73 rotates sufficiently to withdraw the main bomb arming pin 61 from the apertures in the S-shaped bearing member 75 and the top angle member 25, releasing the main bomb arming wire 59. Upon this occurrence all of the bomb arming wires 55 and 57 are withdrawn from the bombs under the action of the tension coil spring 63 and the bombs are put into their armed condition. Shortly after this sequence of events the reaction member 42 revolves sufficiently farther to unlatch the members restraining the bombs in their clustered position by rotating the rotor member 28 sufficiently to unhook the hooks 29, 21 and 32. The backing members then fall or are blown away and the bombs are free to fall in their individual trajectories in an armed condition. Because of the relatively much higher air resistance offered by the structural members of the assembly compared to that offered by the bombs, the struc-

tural members will be retarded in flight and the bombs will soon precede them in the flight toward earth.

It is apparent that the time delay created by the reaction member 42 is dependent upon the distance the reaction member 42 must travel along the shoulder screw 43. If the reaction member 42 is started at the extreme end of the screw 43, the delay time will be longer, whereas if it is started near the shoulder 44 the delay time will be short. As shown in Fig. 5, a scale 76 is inscribed on the left angle member 25 and an index mark 77 is inscribed on the periphery of the reaction member 42. By adjusting the reaction member 42 on the screw 43 to a given position relative to the scale 76, the time delay rendered may be set. This is done when the bomb rack is loaded and before the main arming pin 65 is inserted. After adjustment of the reaction member 42 is made, the U-shaped bracket 66 is shifted along the front end of the angle member 25 until the apertures through which the main arming pin 65 must pass are in alignment. An elongated slot in the L-shaped actuator 73 permits this adjustment to be made.

Fig. 8 shows a modification in the method of arming the bombs. In this modification rather than have the bombs armed through the use of a coil spring and trigger, each of the arming wires for the bombs are secured to one of the pair of backing members of the rack assembly. If this is done when the rack assembly disperses, after being tripped by the reaction wheel 42, the arming wires are withdrawn by the mere dispersal of the three pieces of the assembly. In the modification shown each of the arming wires 78 is looped at one end and made to pass within the opening formed by a pair of angle members. Pins 79 passing through suitable apertures in the angle members and through the openings in the loops serve to secure the arming wires to their respective pairs of angle members.

It should be understood that the straps 12 to 24, among other reasons, are constructed to be resilient in order that the carrier device will readily disperse when the clamping means is unlocked. When the device is in the assembled position the straps 12 to 24 act as cantilever springs tending to urge the several backing structures away from the bombs. When the clamping means releases the backing structures these structures spring or fly away from the bombs under the spring force of the straps 12 to 24 and permit the bombs to disperse without interference with portions of the carrier structure.

While the structure shown illustrates an arrangement for holding two separate clusters of bombs, it is obvious that the structure may be extended to accommodate any number of clusters of bombs. Similarly it may be modified to include only one cluster of bombs.

While the preferred form of the invention has been described for illustrative purposes, it will be apparent that many changes may be made in the various parts and general arrangement without departing from the spirit and scope of the invention. It is therefore desired to be limited only by the scope of the appended claims.

What is claimed is:

1. In a carrier for a plurality of bombs, the combination of, a plurality of holding members each formed to engage at least a pair of bombs, connector means extending from the holding members inwardly between the bombs, rotatable holding means having a portion which engages

the connector means to hold the bombs together as a unit when the holding means is in a normal position, and which is moved out of engagement with the connector means to release the bombs when the holding means is turned to a release position, a rotatable air motion responsive device set in rotation in response to falling of the carrier, means for suddenly diminishing the speed of said device after a period of rotation thereof, and means for utilizing the resulting inertia force to rotate said release member to releasing position.

2. In a carrier for a plurality of bombs, the combination of, a plurality of holding members each formed to engage at least a pair of bombs, connector means extending from the holding members inwardly between the bombs, rotatable holding means having a portion which engages the connector means to hold the bombs together as a unit when the holding means is in a normal position, and which is moved out of engagement with the connector means to release the bombs when the holding means is turned to a release position, and means for rotating said holding means to releasing position after the carrier is dropped.

3. In a carrier for a plurality of bombs, the combination of, a plurality of holding members each formed to engage at least a pair of bombs, connector means extending from the holding members inwardly between the bombs, rotatable holding means having a portion which engages the connector means to hold the bombs together as a unit when the holding means is in a normal position, and which is moved out of engagement with the connector means to release the bombs when the holding means is turned to a release position, said connector means and said holding means being constructed and arranged relatively to each other to cause the holding forces between the holding means and the connector means to oppose initial rotation of said holding means toward releasing position, a rotatable air motion responsive device set in rotation in response to falling of the carrier, means for suddenly diminishing the speed of said device after a period of rotation thereof, and means for utilizing the resulting inertia force to rotate said release member to releasing position.

4. In a carrier for a plurality of bombs, the combination of, a plurality of holding members each formed to engage at least a pair of bombs, connector means extending from the holding members inwardly between the bombs, rotatable holding means having a portion which engages the connector means to hold the bombs together as a unit when the holding means is in a normal position, and which is moved out of engagement with the connector means to release the bombs when the holding means is turned to a release position, said connector means and said holding means being constructed and arranged relatively to each other to cause the holding forces between the holding means and the connector means to oppose initial rotation of said holding means to-

ward releasing position, and means for rotating said holding means to releasing position after the carrier is dropped.

5. In a carrier for a plurality of bombs, the combination of, rotatable holding means adapted to be rotated from a normal position to a releasing position, a plurality of holding members each formed to engage at least one bomb, said holding means being so constructed and arranged that when in normal position it retains said holding members in position to hold the bombs together as a unit, while releasing the holding members upon movement to said releasing position for permitting the bombs to separate, said holding members and the holding means being constructed and arranged relatively to each other to cause the holding forces between the holding members and said holding means to oppose initial rotation of the holding means to releasing position, and means for rotating the holding means to releasing position after the carrier is dropped.

6. In a carrier for a plurality of bombs, the combination of, a bomb holding member for holding a bomb to the carrier, a rotatable holding means having a portion which engages the holding member to hold the bomb to the carrier when the holding means is in a normal position and which is moved out of engagement with the holding member to release the bomb when the holding means is turned to a release position, said bomb holding member and holding means being constructed and arranged relatively to each other to cause the holding force to oppose initial rotation of the holding device toward said release position, and means for rotating said holding means to said release position after the carrier is dropped.

7. In a carrier for a plurality of bombs, the combination of, a bomb holding member for holding a bomb to the carrier, a rotatable holding means having a portion which engages the holding member to hold the bomb to the carrier when the holding means is in a normal position and which is moved out of engagement with the holding member to release the bomb when the holding means is turned to a release position, said bomb holding member and holding means being constructed and arranged relatively to each other to cause the holding force to oppose initial movement of the holding means toward said release position, and means for moving said holding means to said release position after the carrier is dropped.

8. In a carrier for a plurality of bombs each having separate arming devices, the combination of, means for selectively holding said bombs as a unit or for releasing said bombs, air motion responsive means for actuating said means to release the bombs in response to air motion, and means also actuated by said air motion responsive means prior to release of the bombs for operating the arming device of each bomb.

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