Nov. 20, 1945. G. H. LELAND 2,389,202

BOMB RACK

Filed Feb. 2, 1942 2 Sheets-Sheet 1

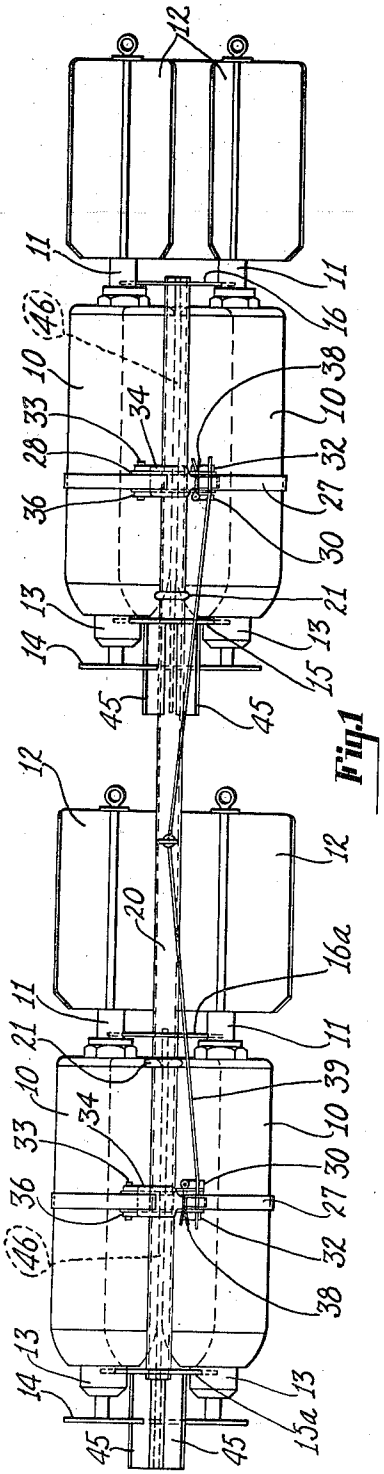

Fig. 1

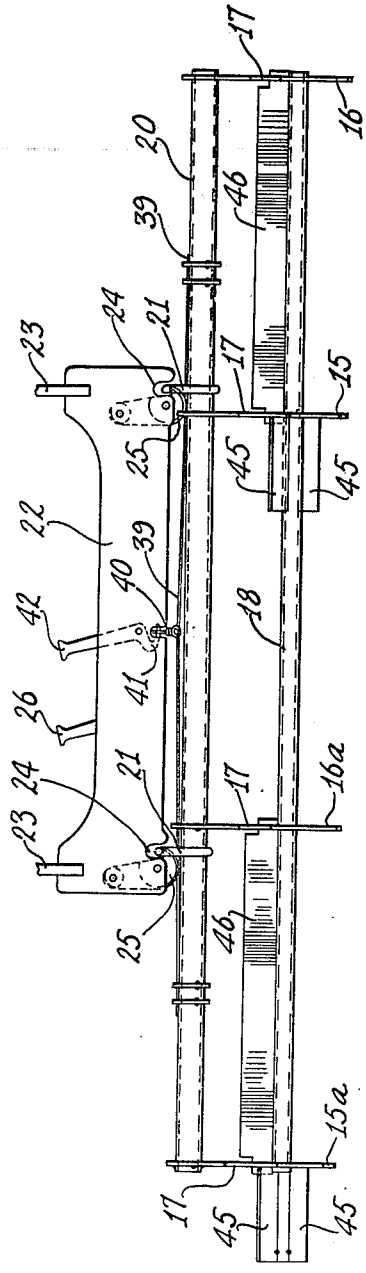

Fig. 2

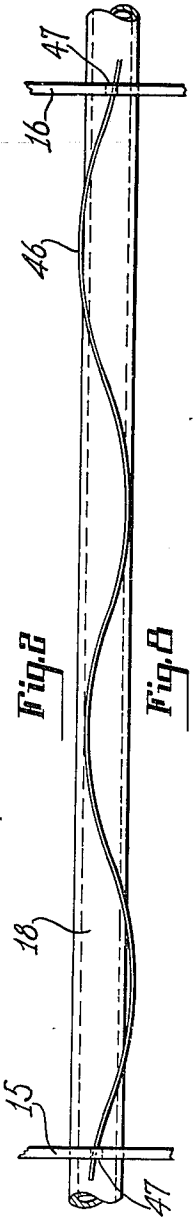

Fig. 3

INVENTOR
GEORGE H. LELAND

BY

ATTORNEY

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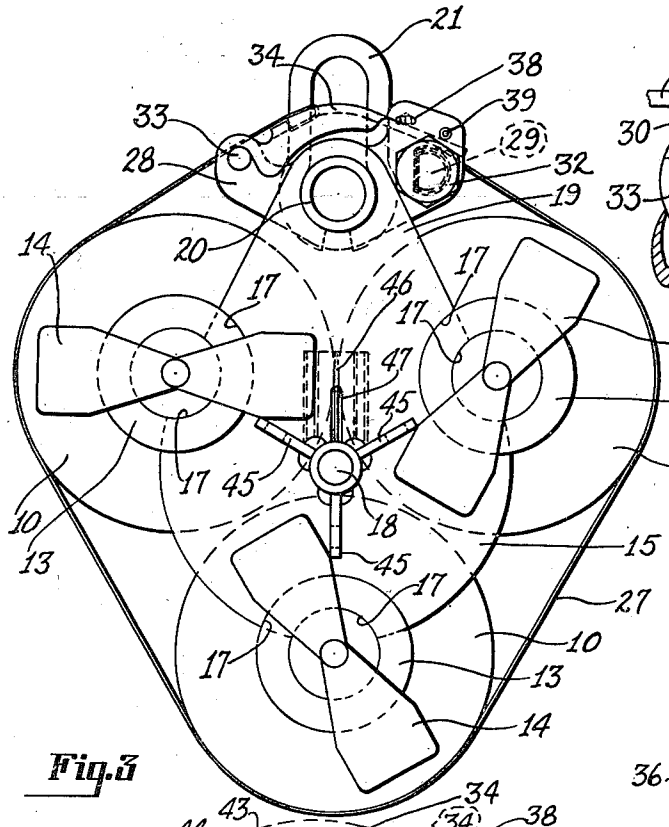

Fig. 3

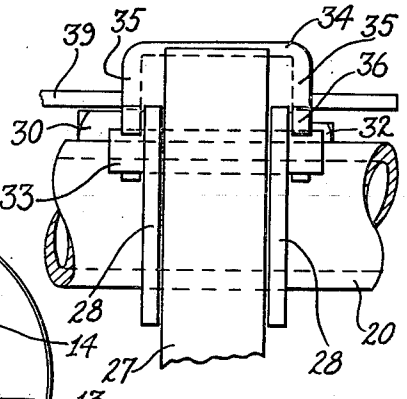

Fig. 6

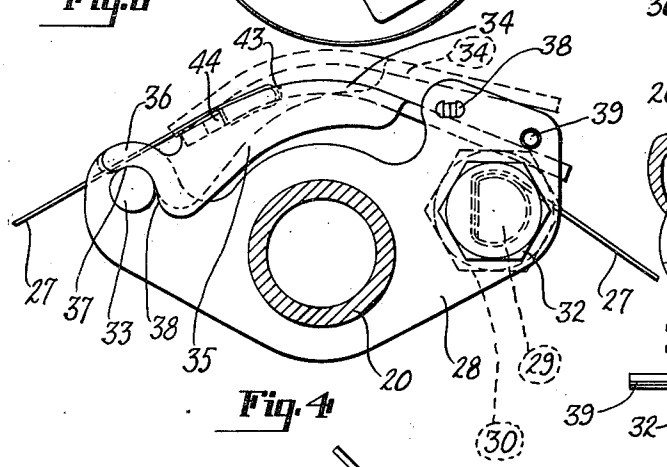

Fig. 4

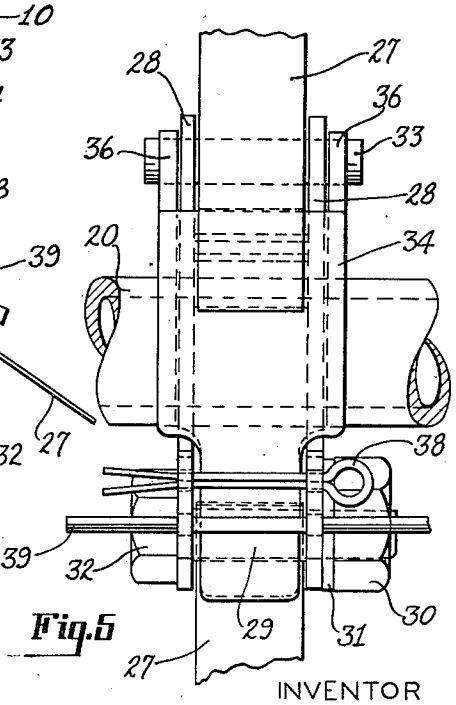

Fig. 5

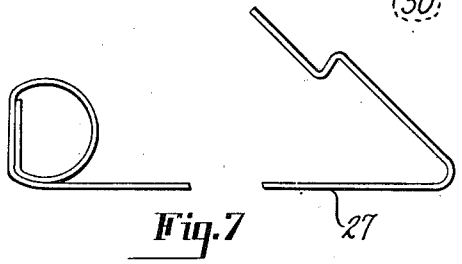

Fig. 7

INVENTOR
GEORGE H. LELAND

BY Edmund Reed
ATTORNEY

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UNITED STATES PATENT OFFICE

2,389,202

BOMB RACK

George H. Leland, Dayton, Ohio

Application February 2, 1942, Serial No. 429,205

2 Claims. (Cl. 89—1.5)

This invention relates to a bomb rack, commonly called a bomb cluster adapter, and is in the nature of an improvement upon the bomb racks shown in my pending applications for patent Serial No. 368,386, filed December 3, 1940, (Patent No. 2,346,494, granted April 11, 1944), and Serial No. 414,831, filed October 13, 1941 (Patent No. 2,379,364, granted June 26, 1945). A bomb cluster of this type is adapted to be detachably supported by an aircraft and released therefrom for downward movement with relation thereto and includes flexible means, such as a band, for normally retaining a cluster of bombs in predetermined positions, and means controlled by the downward movement of the cluster for loosening the retaining means or band and releasing the bombs for separate movement.

One object of the invention is to provide such a bomb rack with a mechanical band connecting and loosening device of a character which will insure the proper loosening of the band when the cluster of bombs falls from the aircraft.

A further object of the invention is to provide a bomb rack with a band loosening device which, when released, will be actuated by the pull of the band thereon, and with means for causing the band to exert on said loosening device a pull sufficient to fully operate the same.

A further object of the invention is to provide means for imparting relative lateral movements to the bombs, or a part thereof, when released, to cause them to act on the band to augment the normal pull of the latter on the loosening device.

Other objects of the invention may appear as the device is described in detail.

In the accompanying drawings Fig. 1 is a plan view of a bomb rack embodying my invention, with the bombs in position thereon; Fig. 2 is a side elevation of the bomb rack, omitting the bombs; Fig. 3 is a front elevation of the bomb rack with the bombs in place thereon; Fig. 4 is a side elevation of the band connecting and releasing device; Fig. 5 is a plan view of the band connecting and releasing device; Fig. 6 is an end elevation of the band connecting and releasing device; Fig. 7 is a detail view of the band, partly broken away; and Fig. 8 is an edge view of the spring for separating the bombs after they have been released.

In these drawings I have illustrated one embodiment of my invention and have shown the same in connection with a bomb rack adapted to support six bombs in two clusters of three bombs each, but it will be understood that the invention may take various forms and may be used in connection with bomb racks of various kinds.

The bomb rack, or cluster adapter, here illustrated is designed for use with bombs of relatively small size, such as are known as "fragmentation" bombs. Such a bomb usually comprises a cylindrical body 10 having a rearwardly projecting portion 11 of small diameter to which are secured the vanes 12 which control the flight of the bomb. At its front end the bomb has a part 13 of small diameter in which is located the firing mechanism for controlling the explosion of the bomb, this mechanism including a rotatable device 14 similar in shape to a propeller, which, by its rotation, releases the firing control or fuse for operation. In that form here illustrated the bomb rack comprises a bomb positioning device having a plurality of bomb seats arranged about a longitudinal axis and a band for securing the bombs thereon. The positioning device may take various forms and in the arrangement here shown, which is adapted to support two clusters of bombs, it comprises two pairs of plates, 15 and 16 and 15a and 16a. The plates of each pair are spaced one from the other lengthwise of the bomb and are provided in their edges with outwardly facing recesses 17, the corresponding recesses in the two plates being arranged in alinement to receive the reduced end portions of the respective bombs and form seats therefor, the size of the recesses and the longitudinal spacing of the plates being determined in accordance with the size of the bombs. The two plates, and in the present instance the plates of both pairs, are rigidly connected one to the other, in the present instance by a longitudinal member, such as a rod 18, which extends through the several plates and is rigidly connected thereto, as by welding. Each plate is provided with an upwardly extending part 19, see Fig. 3, through which extends a second longitudinal member or rod 20 to which the plates are rigidly secured, as by welding, and which constitutes the supporting member for the bomb rack. Rigidly connected with this supporting member are suitable attaching devices 21 having openings therethrough to receive retaining devices by means of which the rack may be detachably connected with a supporting structure carried by an aircraft. This supporting structure is here shown as of a type which is standard with the United States Army Air Corps and is commonly known as a bomb shackle. It is not necessary to describe the bomb shackle in detail but for the present purpose it will be noted that it comprises an elongate body

22 having means 23 whereby it may be secured to the aircraft. In its lower edges it is provided with recesses 24 adapted to receive the attaching devices 21 of the bomb rack. Pivotally mounted adjacent the recesses are hook-shaped retaining devices 25 adapted to extend into the openings in the respective attaching devices and thus support the bomb rack on the body 22 of the bomb shackle. The pivotally mounted hook-shaped devices are connected, by means not here shown, with a lever 26 by means of which they may be moved into and out of supporting engagement with the attaching devices 21.

The bombs are releasably secured on the positioning device by means of a flexible device, such as a band 27, there being in the present instance a single band for each cluster of bombs but obviously any suitable number of bands may be employed. Each band is provided with means whereby, after it has been placed about the bombs, the ends of the band may be releasably connected one with the other and drawn tight to firmly retain the bombs on their seats until such time as it is desired to release the same. The band connecting means may take various forms and, as here shown, it comprises a body portion having means at its ends for connecting the respective ends of the band therewith. This body portion is preferably, but not necessarily, connected with a fixed part of the rack and is here shown as rigidly secured to the supporting member or rod 20. In the form illustrated the body portion comprises two members 28 substantially identical in shape and rigidly secured to the rod 18 in spaced relation one to the other, the ends of the body portion extending laterally beyond the respective sides of the supporting rod. Means are provided at each end of the body portion for connecting the respective ends of the band 27 therewith. The band is here shown as a flat strap, usually of metal, and the members 28 are spaced apart a distance slightly greater than the width of the band. In the present arrangement one of the band connecting means is operable to release the band and the other is in the nature of a permanent connection which is not released. This latter connection is shown as comprising a rotatable member, such as a bolt 29, which is rotatably mounted in suitable openings in the respective members 28, and is provided with means, such as a nut 30 and lock washer 31, for locking the same against rotation. The end portion of the band 27 is wrapped about that portion of the rotatable member 29 which lies between the members 28, this portion of the rotatable member being provided with means, for preventing the band from slipping thereon, as by flattening one side thereof. After the band has been initially placed about the rotatable member 29 the latter is rotated, as by applying a suitable wrench or the like to the head 32 thereof, to draw the band tight about the cluster of bombs, the other end of the band having been previously connected with the other end of the body portion of the connecting device. When the band has been tightened the nut 30 is tightened down to lock the rotatable member against rotation and thus maintain the connection of the band therewith.

At its other end the body portion of the connecting device is provided with means for releasably connecting the corresponding end of the band therewith and, as here shown, this end of the body portion is provided with a pivot member having a convex bearing surface, which is preferably in the form of a pivot pin 33 which is mounted in the members 28 and projects laterally beyond the outer sides of the respective members, and thus forms in effect two alined pivot members on opposite sides of the connecting device. Cooperating with this pivot member is a lever having at one end thereof a concave bearing to pivotally engage the pivot member and also having means spaced to the rear of the bearing for connecting the end portion of the band therewith in such a manner as to positively prevent the slippage of the band with relation to the lever. The bearing for the lever is of such a character that when the lever is in its normal connecting position the band will extend close to the pivot member and the latter will be adjacent the line of pull of the band, thus enabling the pivot member to hold the lever against lengthwise movement while in connecting position, releasable means being provided to normally retain the member in a predetermined connecting position. When the lever is released from said retaining means it is free for movement about the pivot pin 33 and a pull on the band will impart rotary movement to the lever about the pivot pin and after a relatively short pivoted movement the bearing will be pulled off of the pivot pin and the lever disconnected from the body of the connecting device, thereby freeing one end of the band and releasing the bombs from the positioning device. In the particular construction illustrated the lever is in the form of an elongate plate 34 preferably bent about a transverse axis to accommodate it to the shape of the body portion of the connecting device. At its forward end, that is, the end adjacent the pivot pin 33, it is provided on each side with a longitudinal flange 35, these flanges being spaced apart such a distance that they may extend downwardly on the outer sides of the members 28 of the body portion. The forward ends of the flanges project forwardly beyond the main portion of the plate and are shaped to form open bearings 36 to engage the projecting ends of the pivot pin. Each bearing has a concave bearing surface 37, the forward portion of which conforms substantially to the circumference of the pivot pin and the rear portion of which is tangential to the surface of the pivot pin, as shown at 38. This bearing surface extends transversely to the lever and is so positioned with relation thereto that when the lever is in its normal connecting position, as shown in full lines in Fig. 4, the bearing will abut against the pivot pin to hold the lever against lengthwise movement by the pull of the band 27, it being noted that the pivot pin lies close to the band and adjacent to the line of pull on the lever. The band having been drawn tightly about the bombs is under considerable longitudinal tension and when the lever is released from its retaining means the tension on the band is suddenly relieved, and the band will exert a pull on the lever which will swing the latter about the pivot pin and after the lever has been moved from its normal connecting position the band will pull the bearing off the pivot pin, the tangential rear portion 38 of the bearing surface permitting the disengagement of the lever from the pivot pin after a relatively short pivotal movement of the lever, thus effecting the loosening of the band quickly after the lever has been released.

Ordinarily the relieving of the tension of the band, by releasing the lever, will cause the band to exert on the lever a pull sufficent to disengage the latter from the pivot pin, but, in some instances, the pull of the band may not be suffi-

cient for that purpose. It will be understood that when the rack and the bombs are falling from the aircraft, and the lever has been released, gravity will cause little or no movement of the bombs with relation to the rack or with relation one to the other and therefore the weight of the bombs will exert little or no pull upon the band. To insure a proper movement of the lever it is preferable that means be provided to augment the pull of the band which results from the relief of the tension thereon. For that purpose I have provided spring means to move the bombs, or a part thereof, with relation one to the other and thus cause the bombs to exert an outward force on the band and augment the pull of the latter on the lever. Preferably this spring means is arranged between adjacent bombs and is held under compression by the bombs so long as these are secured to the rack but when the bombs are released from the rack the spring means expands and imparts relative lateral movements to the bombs between which it was confined. In the present instance I have provided a single spring for each cluster of bombs, this spring being arranged between the two bombs which are uppermost when the rack is supported in its normal position on the aircraft. The spring is here shown, at **46**, as a reversely curved spring extending lengthwise of the rod between the positioning plates **15** and **16** and has end portions of reduced width inserted in slots **47** in the respective plates and slidable in those slots. When the bombs are secured on the positioning means they will contact with the respective sides of the spring and compress the same, that is, flatten out the curves therein, and when the lever has been released the spring will return to its curved form and thus impart lateral movement to both bombs and cause the band to pull the lever off the pivot pin. The spring is here shown as having a series of curves but the number of curves is optional. The relative movement thus imparted to the bombs has the further desirable result of causing the bombs to be distributed over an area greater than that over which they would be distributed in the absence of the spring means.

Any suitable means may be provided for normally retaining the lever in its connecting position and for releasing the same as the bomb rack falls away from the aircraft. In the present instance, the members **28** of the connecting device are provided with two pairs of alined openings. When the band is to be connected it is attached to the lever, the latter placed in engagement with the pivot pin and moved to its connecting position, a cotter pin **38**, or other temporary retaining device, is then inserted through one pair of openings above the lever to maintain the connection while the band is being tightened and until such time as the loaded rack is to be mounted on the aircraft. After one end of the the band has been so attached to the connecting device the other end is attached to the rotatable member **29** and the latter rotated to draw the band tightly about the bombs and then locked to retain the band in that condition, as by tightening down the nut **30**. The rack remains in this condition until it is loaded onto the aircraft. After this has been done a wire **39**, commonly called an arming wire, is inserted through the second pair of openings in the members **28** and the cotter pin withdrawn, thereby placing the releasable connecting device under the control of the arming wire. This arming wire extends from the connecting device to a point adjacent the bomb shackle where it is connected with a master arming wire **40** which is provided with a loop-shaped portion to receive the hook-shaped end **41** of a lever **42** pivotally mounted on the body **22** of the bomb shackle. When, as in the present instance, there are two clusters of bombs, or where more than one band is employed, there is a separate arming wire for each band and all these arming wires lead to and are connected with the master arming wire **40**. This master wire is normally connected with the bomb shackle by the lever **42** and when the attaching devices **25** are retracted and the bomb rack drops away from the bomb shackle the arming wire will be withdrawn from the openings in the connecting device, thereby releasing the connecting lever and permitting the same to be disengaged from the connecting device by the pull of the band. It sometimes happens that it is desired to drop the loaded bomb rack as a unit, that is, without releasing the bombs from the rack. When this is to be done the lever **42** is actuated to withdraw the hook-shaped end thereof from the master arming wire, thereby disconnecting the arming wire or wires from the bomb shackle so that they will not be withdrawn as the rack drops. The drawings show both the arming wire and the cotter pin in lever retaining positions, which condition exists at the time the bomb cluster is mounted on or is about to be mounted on the aircraft, but the cotter pin is withdrawn when the band connecting device is to be placed under the sole control of the arming wire.

The end of the band may be connected with the connecting lever **34** in any suitable manner. In the present instance the lever or plate **34** is provided, between the flanges **35**, with two slots **43** and **44** of a width sufficient to receive the end portion of the band. The band is connected with the lever by passing the end portion thereof first through the slot **43**, folding the same against the underside of the lever and then extending the same through the slot **44** and folding the extreme end portion thereof onto the upper side of the lever where it will be confined between the lever and the main portion of the band. The rear wall of the slot **44** is provided at its lower edge with a sharp corner about which the band is folded, so that the band will make a sharp bend, at least a right angle and, if desired, slightly less than a right angle, thus positively preventing the band from slipping. If desired, the end portions of the band may be preformed so that the one end may be easily threaded through the slots **43** and **44** and the other end may be connected with the connecting device by withdrawing the bolt **29**, inserting it through the formed end of the band, and then again mounting the bolt in the members **28**.

The rack is also provided with means for normally preventing the operation of the devices which control the firing mechanisms for the bombs, each of which is here shown as including a propeller-like device **14**. For this purpose the positioning device is provided with a part or parts arranged in the paths of rotation of the blades of these controlling devices so that the blades will be held normally against rotation but will be released for rotation as soon as the bombs move out of engagement with the rack. For this purpose the rod **18** is extended beyond the foremost positioning plate **15a** and if the blades are of sufficient length, those on the front cluster of bombs will engage the front portion of the rod **18** and those on the rear cluster of bombs

will engage the intermediate portion of that rod. When, as here shown, the blades are of relatively short length the rod is provided, in front of the plates 15 and 15a with a plurality of short blades 45 extending lengthwise thereof and rigidly secured to the rod and to the respective plates, and of such width that they extend into the paths of rotation of the blades of the respective controlling devices 14 and thus prevent the rotation thereof so long as the bombs are secured to the rack.

While I have shown and described one embodiment of my invention I wish it to be understood that I do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A device for connecting the ends of the supporting band of a bomb cluster adapter, comprising a body portion, means adjacent one end of said body portion for connecting one end of said band therewith and for tightening said band about said cluster of bombs, a pivot pin secured to said body portion adjacent the other end thereof on the inner side of said band and having a convex surface, a lever supported normally in a connecting position lengthwise of said body portion, having means for connecting the other end of said band therewith between the ends thereof and having at one end thereof a concave bearing surface engaging said pivot pin to pivotally and detachably connect said lever with said body portion, and releasable means to hold said lever normally against pivotal movement, said bearing surface being arranged with relation to said pivot pin to prevent the longitudinal movement of said lever by the pull of said band and to permit said lever to be moved about and separated from said pivot pin by the pull of said band when said lever is released for pivotal movement, said concave surface of said lever comprising an arcuate portion of substantially less than 180° and a tangential portion extending rearwardly from said arcuate portion to facilitate the separation of said lever from said pivot pin.

2. A device for connecting the ends of the supporting band of a bomb cluster adapter, comprising a body portion including two laterally spaced members rigidly connected one with the other, a pivot pin mounted adjacent one end of said body portion on the inner side of said band and extending outwardly beyond the respective members, the projecting ends of said pin having convex surfaces, means adjacent the other end of said body portion for connecting one end of said band therewith and for tightening the same about said cluster of bombs, a lever extending lengthwise of said body portion and having at one end thereof and on opposite sides of said body portion parts extending outwardly across and in contact with the respective end portions of said pivot pin to pivotally and detachably connect said lever with said body portion, each of said parts having a recess to receive the adjacent portion of said pin and including a relatively short portion concentric with said convex surface of said pivot pin and a non-concentric portion extending rearwardly from said concentric portion, said lever having between the ends thereof means for connecting the other end of said band therewith, said connecting means being so positioned that the line of pull of said band on said lever is on the outer side of said pivot pin, and releasable means normally preventing the movement of said lever by the pull of said band, whereby when said lever is released for movement the pull of said band thereon will move the same about said pivot pin and then disengage the lever from said pin.

GEORGE H. LELAND.