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R. G. BURROWS

2,815,698

ATTACHMENTS INCORPORATING EXPLOSIVE BOLTS OR THE LIKE

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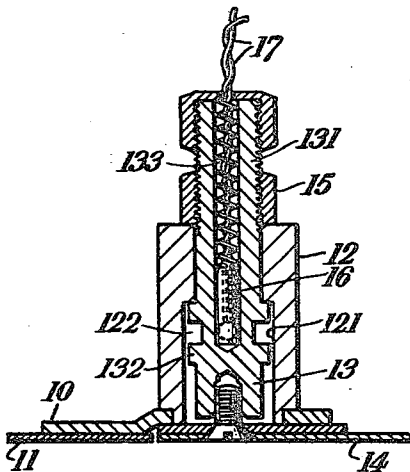


Fig. 1.

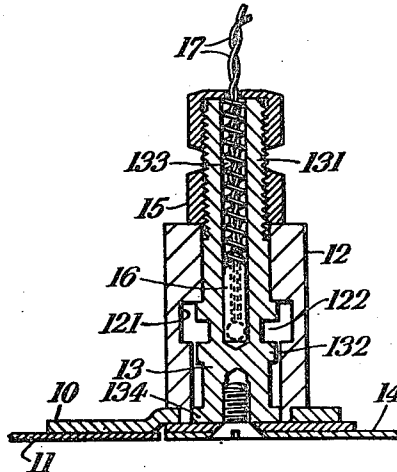


Fig. 3.

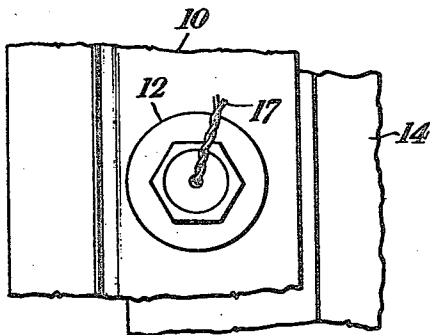


Fig. 2.

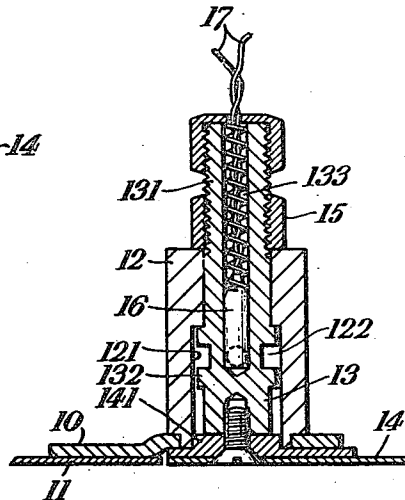


Fig. 4.

INVENTOR

Raymond H. Burrows

By: Watson, Cole, Brindle & Watson

ATTORNEYS

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ATTACHMENTS INCORPORATING EXPLOSIVE BOLTS OR THE LIKE

Raymond George Burrows, Chobham, near Woking, England, assignor to Vickers-Armstrongs Limited, London, England, a British company

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2 Claims. (Cl. 89—1.5)

The invention is concerned with explosive bolts and like fastenings, such for example as are used for the attachment of two members which are intended to be disconnected at a given time and for which purpose the bolts or the like are adapted to be exploded (by the detonation or ignition of an explosive charge contained therein) so that by the rupture and disintegration of the bolts said members are free to separate. In certain circumstances it is desirable to provide means whereby two attached members may not only be rendered free to separate but positively displaced in relation to each other. An instance of such circumstances exists in the case of the attachments used to secure the escape hatches or covers of the control cabins in certain aircraft. Explosive bolts have been proposed for attaching such hatches, but where the suctional effect of the airstream is insufficient to ensure that the hatch is carried away when the bolts are exploded, means for its positive displacement are required. The present invention accordingly, has for its object to provide, in conjunction with an explosive bolt, stud or the like, means whereby the force due to the explosion is effective to impart a positive displacing impetus which will sunder the parts connected and ensure the removal of the attached object.

According to the invention, an attachment for the said purpose comprises, in combination with an explosive charge and means for igniting or detonating the latter, a constricted chamber housing said charge, a cylinder constituted by or communicating directly with said chamber, a piston having a working fit in said cylinder, and means for affixing said chamber (or a member associated therewith) and said piston respectively to the attached objects, the arrangement being such that when said charge is exploded the pressure of the expanding gases then generated is exerted on said piston to drive the latter forcibly out of the cylinder and thereby to effect the physical separation of the chamber and the piston, and, consequently, of the attached objects.

The explosive charge, in the form of a cartridge, containing a detonator having electrical leads connected thereto, may be enclosed within a bolt-like member, the outer end of which is adapted to be affixed to one of the parts to be attached. The said member may be so profiled as to form a piston capable of being received in a cylindrical portion of a bracket which is adapted to be affixed to the other of the parts to be attached.

The manner in which the invention may be carried into effect is hereinafter described in greater detail with reference to the accompanying drawings, which illustrate the application of the invention to three alternative forms of explosive bolt attachments such as are suitable for fixing a panel of the skin of an aircraft structure, such as the cover or hatch of the cockpit or other compartment. In said drawings Fig. 1 is an axial section of one form of attachment and Fig. 2 is a plan thereof as seen from the interior of the structure. Figs. 3 and 4 are similar

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views to Fig. 1, respectively illustrating two alternative embodiments of the invention.

It is an essential condition of the device provided by this invention that it should provide for the positive outward displacement of the cover, hatch or the like when the bolts which ordinarily secure the latter in position are exploded, e. g. in an emergency requiring the pilot's escape through the hatch opening. It will be seen that the three embodiments herein described possess two components common to all, viz. a bracket 10 which is suitably attached to the cabin structure or frame of the aircraft, of which part is seen at 11, said bracket 10 carrying an off-set body 12 which encloses in a cylinder the piston hereinafter referred to, and a bolt-like member 13 which is attached at its outer end to the plating 14 or other part of the removable hatch or cover.

The body 12 is bored axially to form a cylinder 121 in which the member 13 is received, the latter having a shank 131 which extends through and projects beyond the inner end of the body 12 when the cover 14 is in position, so that it may be held securely by means of a nut 15 screwed on said shank.

The member 13 is also fashioned with a circumferentially formed shoulder or land 132 which fits the bore of the cylinder 121 of the body 12 so as to constitute a piston which will be subjected to the pressure within the space 122.

The shank 131 of the member 13 is also bored from the inner end to form a chamber 133 in which is stowed an explosive cartridge 16, the electric leads 17 connected to which pass out through the end of the shank 131 to the usual circuit connections.

The arrangement is such that, in the event of an emergency necessitating the removal of the panel 14, the cartridges 16 of the several bolts holding the same are simultaneously detonated. The bolts are thereby fractured in the region of the space 122 and the pressure of the expanding gases in the space 122 imparts to the respective pistons 132 an ejective force which is effective to drive the same out of their cylinders 121, displacing the panel 14 laterally into the airstream sufficiently to ensure its being carried away clear of the aircraft structure.

This device may also be used to detach instruments or package containers where it is essential to clear projecting aircraft structure, while the precise timing inherent in the device makes it suitable for dropping flares or the like in a restricted area. It is not subject to the icing troubles associated with the normal bomb slip when mounted externally in the airstream.

In the arrangement shown in Fig. 1, it will be seen that a considerable degree of clearance is provided between the shoulder or land 132 and the bore of the cylinder 121, the purpose of which is to reduce shock at the instant of explosion. The reduced diameter of the member 13 at its outer extremity is intended to permit a certain degree of lateral movement of the panel 14 on detachment.

Where the panel 14 is required to sustain shear loads in normal use, i. e. when in situ, these may be transmitted between the structure member 11 and the panel 14 through the medium either of a plug-like land 134 on the member 13, as shown in Fig. 2, or of a spigot 141 affixed to the panel 14 itself, as shown in Fig. 3. Both the land 13 and the spigot 141 are arranged to fit closely in the end of the cylinder 12.

What I claim as my invention and desire to secure by Letters Patent is:

1. The combination of a pair of separate generally flat members and an explosive bolt mechanism normally securing said members in adjoining substantially coplanar relationship, but capable of forcibly separating said mem-

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bers and urging them into different planes, said mechanism comprising a housing body, means fixedly connecting said body to one said member in overlying relation to the other said member, and wholly on one side of the common plane of said members, said body being formed with a bore opening toward and covered by the other said member, a piston within said bore fixedly connected to said other member and disposed wholly on said one side of the common plane of the members, a frangible connection between said piston and said body normally fixedly securing said piston in said bore, and explosive means in said bore for breaking said connection and forcibly ejecting said piston through the open end of the bore.

2. The combination of a pair of separate flat members and an explosive bolt mechanism normally securing said members in adjoining coplanar relationship, comprising a bracket fixed to one said member and having a portion projecting over the other said member, a housing body fixedly carried by the projecting portion of said bracket, said body being formed with a bore opening through one end thereof toward the other said member, means in said housing closing said bore at a location spaced from

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its open end, a piston operatively disposed in said bore for ejection through its open end, a frangible connection between said piston and said body, said connection normally fixedly retaining the piston in said bore, explosive means in said bore for breaking said frangible connection and forcibly ejecting said piston from the open end of the bore; said other member extending over the open end of said bore in the path of ejection of said piston, and means extending through the open end of the bore and connecting said piston to said other member.

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