

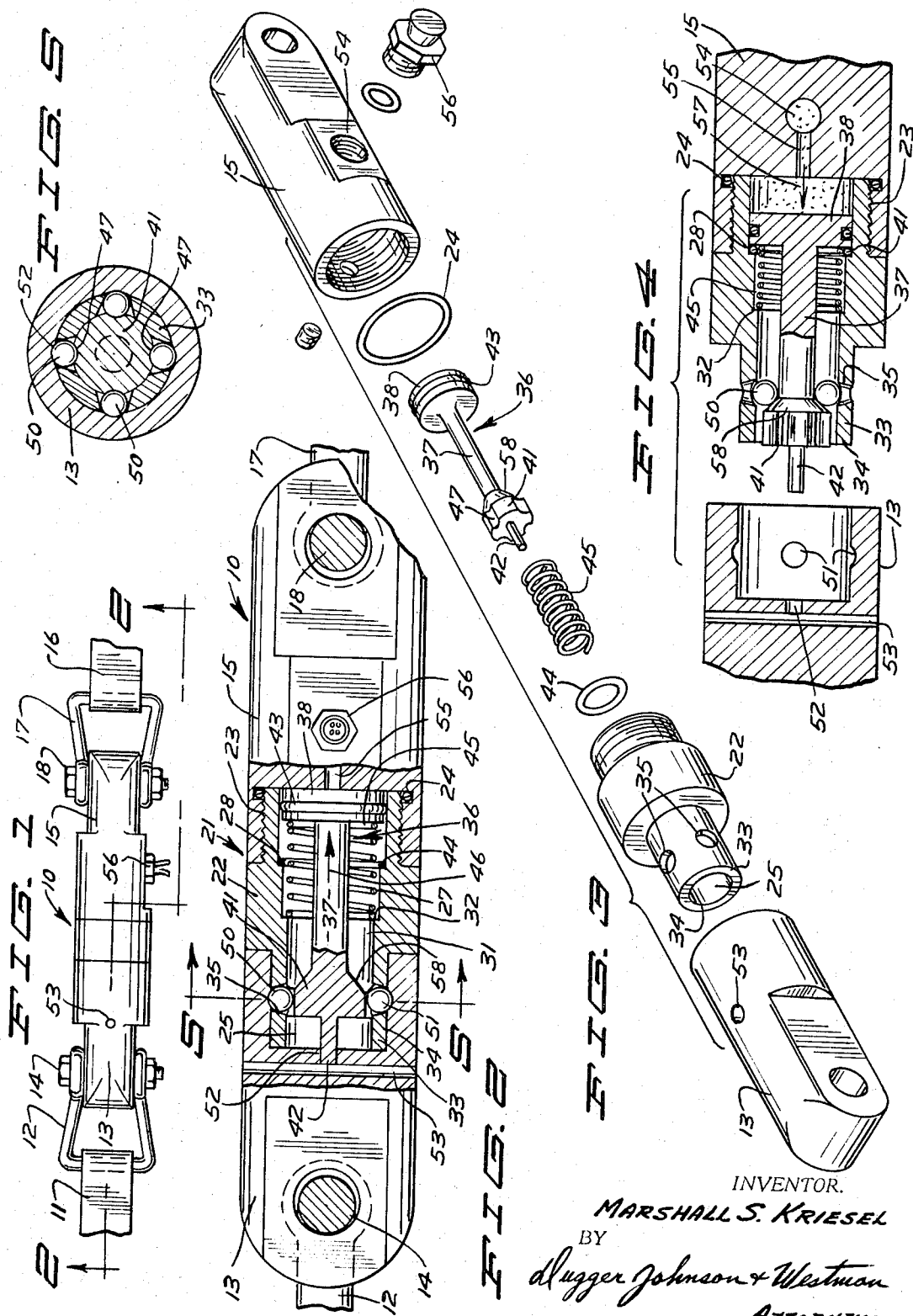
March 19, 1968

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3,373,656

EXPLOSIVELY ACTUATED THRUSTER RELEASER

Filed April 18, 1966



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EXPLOSIVELY ACTUATED THRUSTER RELEASER
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Filed Apr. 18, 1966, Ser. No. 543,239

2 Claims. (Cl. 89-1)

ABSTRACT OF THE DISCLOSURE

An explosively actuated releasing mechanism comprising two interlocking members held together by ball retainers wherein the ball retainers are released upon energization of an explosive charge acting on a piston and wherein the balls used as retainers cannot escape from the support when the separable item is released. In addition, the piston which releases the balls has an ejector finger which positively removes the separable item and insures that the two items will come apart.

The present invention has relation to explosively actuated release mechanisms and more particularly to a release mechanism which can be used for separating two items such as a cargo parachute from a load in a plane when the load will not release properly, separating ejection seats from aircraft, booster rockets from the main rockets, balloon payloads from the balloon and separating other jettisonable equipment.

The unit is designed to be attached between high strength shackles, and as shown, includes means to positively thrust away the two separable elements once the unit has been actuated. Further, the unit is extremely simple to make, and is totally encapsulated to prevent fragmentation or gas leakage once the explosive fuel has been ignited.

The unit is reusable merely by disassembling, resetting and reassembling. Of course, a new explosive device would have to be inserted in each time.

It is an object of the present invention to present a separable release device which can be used for holding two objects together, one of which may be jettisoned.

It is a further object of the present invention to present a self-contained explosively actuated release device wherein the two items to be attached together can be quickly fastened to provide mounting means and the separation unit will carry high loads.

It is a further object of the present invention to present a release device wherein the separable elements are positively forced apart upon actuation of the device.

It is another object of the present invention to present a release device which can be electrically ignited to trigger the explosion.

Other objects are inherent in the specification and will become apparent as the description proceeds.

In the drawings:

FIG. 1 is a top plan view of a release device made according to the present invention installed between two relatively jettisonable load carrying straps;

FIG. 2 is an enlarged view taken as on line 2-2 of FIG. 1 with parts in section and parts broken away;

FIG. 3 is an exploded view of the device of FIG. 2;

FIG. 4 is an exploded view of the device of FIG. 2 showing the two separable elements after the device has been actuated and the two elements have separated; and

FIG. 5 is a sectional view taken as on line 5-5 of FIG. 2.

Referring to the drawings and the numerals of reference thereon, the self-contained release device is shown generally at 10 in FIG. 1. The device 10 is shown attached to a load carrying strap 11 for example, the cargo strap

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coming from a load in an aircraft, through the use of a shackle or clevis 12. The shackle is attached to a release end 13 of the release device with a bolt 14 which passes through a provided opening in the release end and the shackle. The base end section 15 of the release device 10 is attached to a load extraction line 16 through the use of a clevis 17 and bolt 18.

The unit is made so that upon actuation it will separate and the release end 13 will be freed from the rest of the unit so that anything attached to the strap 11 will be separated from anything attached to the strap 16. A normal situation where such a release device is used is in the emergency release of a cargo parachute from its cargo. For example, if cargo in a plane was attached to the strap 16, and a chute was unfurled and attached to the strap 11, and if something happened to the cargo so that it would not slide out of the plane, the drag of the chute could cause aircraft to be lost. When the malfunction is observed, the device 10 is actuated, the unit would separate and the release end 13 would be released from the rest of the unit so that the chute would be dropped.

Referring now to FIGS. 2 and 3, where the unit is shown more in detail, the release device 10 includes a main housing 21 which comprises the base section 15, and an intermediate section 22 which is threadably attached as at 23 to the base section 15. An O ring 24 is utilized for sealing the internal cavity of the base section 15 into which the intermediate section 22 is threaded.

As shown, the intermediate section 22 has a longitudinally extending opening 25 defined therethrough. The opening 25 includes a first portion 26 adjacent the base section 15, and a second intermediate portion 27 which is of smaller internal diameter than the first portion 26. A shoulder 28 is formed where the first portion 26 and the second portion 27 of the longitudinal opening 25 join. The opening 25 also includes a third portion 31 which is adjacent the release end section 13 of the release device. A shoulder 32 is defined where second portion 27 and third portion 31 join. The shoulder 32 and the shoulder 28 are both annular shoulders.

As shown, the intermediate section 22 has a longitudinal end portion 33 which is adjacent the release end of the unit. The end portion 33 is defined by a thin wall portion 34 through which a plurality of openings 35 (four as shown) are defined. The openings 35 are a reverse conical shape, in other words, they are of greater diameter at the inside of the thin wall portion 34 than they are at the outside.

A piston assembly 36 is mounted inside the opening 25. The piston assembly includes a shank 37, a piston head 38 which is adjacent the base section 15, a ball retaining portion 41 which is integral with the shank and remote from the head 38, and also has an integral ejector finger 42 extending toward the release end section. The piston head 38 is slidably mounted in the first portion 26 of the opening 25 and as shown is cylindrical. An O ring 43 is mounted in a provided groove and sealingly engages the outer surface of the first portion 26 of opening 25. An O ring 44 is also loosely disposed in the first portion 26 of the opening 25 and the O ring 44 is positioned against the shoulder 28 as shown.

A coil spring 45 is mounted inside the opening 25 and seats against the shoulder 32 between the portion 31 and portion 27 of the opening. The spring is also positioned to engage the backside of the piston head 38 and resiliently urge the piston in direction as indicated by the arrow 46 in FIG. 2.

The ball detent portion 41 of the piston shank is of greater outside diameter than the shank and closely fits the interior of the third portion of opening 25. The ball detent is provided with four longitudinally extending part cylindrical grooves 47, and four retaining balls 50 are

mounted in the openings 35 and supported within the grooves 47 on the ball retainer. The spherical retaining balls 50 protrude beyond the outer surface of the thin wall 34 a short distance and are adapted to fit within provided part cylindrical receptacles 51 defined on the interior surface of a chamber which in turn is formed into an end portion of the release end section 13. When in position as shown in FIG. 2, the balls are held in the holes 35 and partially into the detent receptacles 51 so that the release section 13 and the intermediate section 22 (and thus the base section 15) cannot separate in longitudinal direction.

The ejector finger 42 fits into a provided opening 52 in the release section 13. A sighting hole 53 is provided transverse to the hole 52 and connected thereto so that it can be seen if the ejector finger is protruding into the sighting hole prior to the operation of the release device. If it is, then the device is not properly assembled. The sighting hole 53 is used for this checking operation.

The base section 15 of the device is provided with a threaded opening 54 which in turn connects with a passageway 55 that opens into the opening 35 when the intermediate section 22 and the base section 15 of the main housing are assembled. The threaded opening is also open to this passageway and is used for mounting a squib 56 in a usual manner. The squib is a known electrically detonated explosive charge device which will, upon actuation, release gaseous pressure in the passageway 55. This pressure will act upon the head of piston 38 as indicated by the arrow 57 in FIG. 4 forcing the piston 38 in this direction. This in turn will move the shank 37 and ball retainer 41 in this direction. This permits the balls 50 to drop down along a ramp surface 58 on the ball retainer and move out of engagement with the detent receptacles 51 on the interior surface of the chamber defined in the end of the release section. This will then permit the release section to slide off the end portion of the intermediate section and separate from the other two parts of the release device. Not only that, the ejection finger will pass into the sight opening 53 and strike the side surface thereof to force the release end section 13 off the intermediate section 22. By the time the piston is moved far enough so that the ejection finger strikes the release section and forces it off, the balls 50 will be in position to clear the inner surface of the chamber defined in the release section.

The force of the gas pressure developed by the squib 56 will counteract the force of the spring 45 to permit the balls to be released. In other words, the spring will normally hold the piston tight up against the end of the interior chamber on the base section 15 and thus will hold the ball retaining member 41 in proper position to retain the balls in openings 35 and partially protruding through the openings into the detent receptacles 51 of the release section. When the device is actuated, the shoulder 32 and the spring 45 act as stop means to prevent the piston from being blown out the open end of the chamber.

Once the sections of the device have separated as shown in FIG. 4, the unit can be reused merely by removing the squib 56 to release the gas pressure inside the piston chamber, then disassembling the intermediate section 22 and the base section 15 by unscrewing them, and then replacing the O rings for the unit, and adding a new release section.

There is no fragmentation during the explosion, as the device is entirely self-contained, and the utilization of the longitudinally extending grooves in the ball retaining member permits close fitting between the balls and these grooves so that there is a relatively high bearing load capacity by the ball retaining member. This means that greater loads can be held because the ball retaining member will not fail from excessive bearing stress when tension loads are placed on the separation device. Also, it is insured that even when under high tension load, the forces on the ball retaining member will be distributed evenly so that the piston will slide back to released position when the squib explodes without fear of malfunction.

I claim:

1. An explosively actuated release device comprising at least two mating sections, a first of said sections having an outer wall in substantially cylindrical form and defining an interior chamber, piston means in said chamber, bias means urging said piston to a first position, a plurality of restricted openings extending radially through the wall of said first section, a separate ball in each of said openings, said balls being of a size so that they will protrude through the wall of said first section but will not pass completely radially outwardly through said restricted openings, ball retainer means carried by said piston and slidable therewith, said ball retainer means being positioned so that when said piston is in its first position it holds the balls with portions thereof protruding through the wall of said first section, explosively actuated means to act on said piston and to move said piston in a direction toward a second of said sections to a second position, stop means on said first section to prevent said piston from moving in said direction past said second position, said ball retainer means being configured to permit said balls to move radially inwardly when the piston is in said second position, said second section being of size to surround a portion of the wall of said first section in the area where said restricted openings in said first section are positioned, receptacle means in the second section aligned with each of said openings, said balls being partially fitted within said receptacle means on said second section when the ball retainer is held by said piston in its first position, said ball retainer being of size to prevent said ball means from being completely released from said first section when the piston is in its second position, thereby to retain said balls within said first section.

2. The combination as specified in claim 1 and an ejector finger carried by said ball retainer engageable with said second section after the latch means is released to force separation of the two sections when the piston moves to its second position.

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