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R. K. PIERSON ET AL

2,604,353

BOMB SLIP, TOWING GEAR, AND ANALOGOUS RELEASABLE ATTACHMENTS

Filed July 30, 1947

2 SHEETS—SHEET 1

Fig. 1.

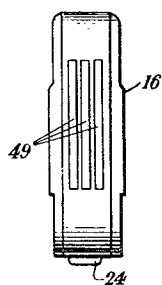
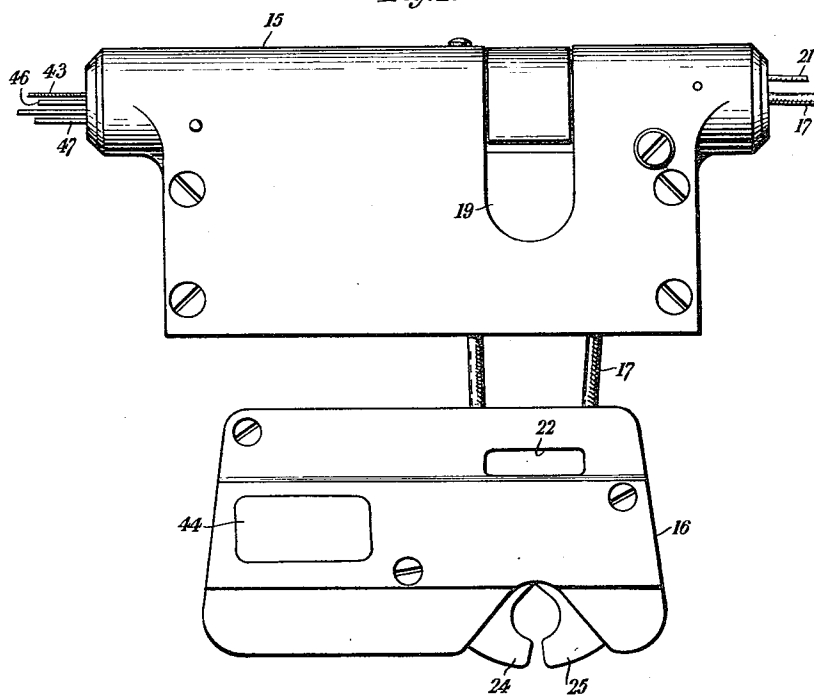


Fig. 5.

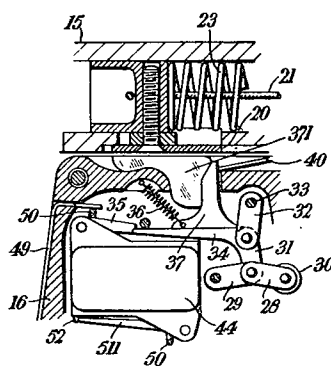


Fig. 4.

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2 SHEETS—SHEET 2

Fig. 2.

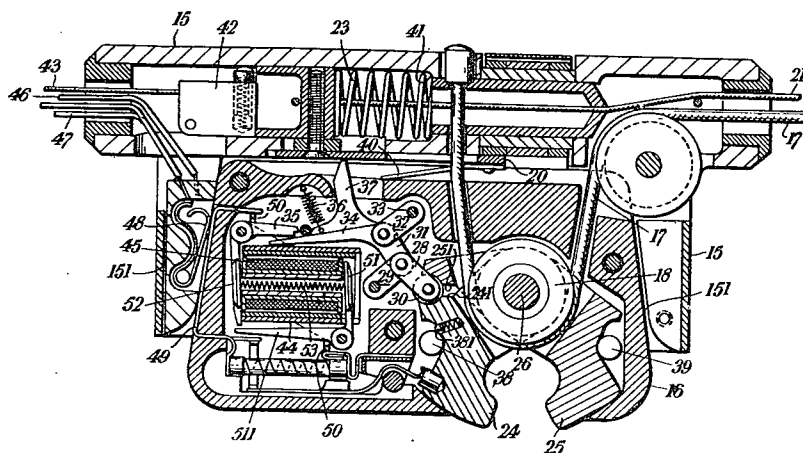
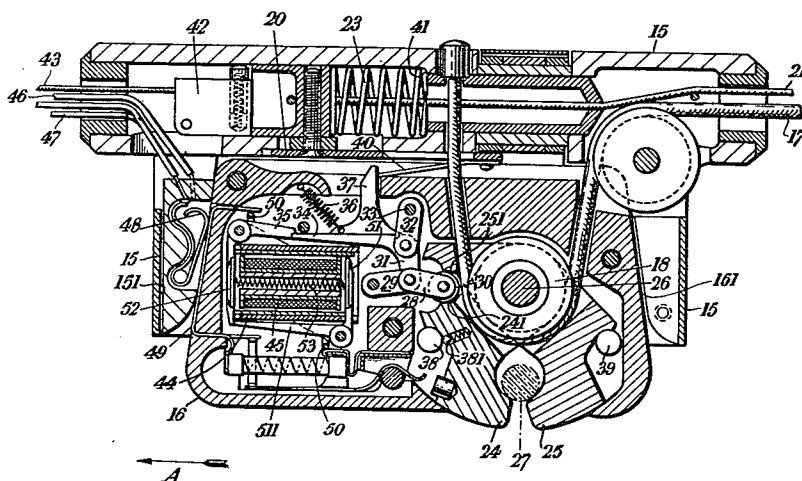


Fig. 3.

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UNITED STATES PATENT OFFICE

2,604,353

BOMB SLIP, TOWING GEAR, AND ANALOGOUS RELEASABLE ATTACHMENTS

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1 Claim. (Cl. 294—83)

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The invention has reference to releasable attachments for use in conjunction with objects such as bombs, mail bags, supply containers or like articles to be dropped from aircraft, or for use in towing operations, and in other analogous circumstances, such attachments being of the type comprising a pair of load-engaging pivoted jaws which are held engaged by the presence of a movable stop between opposed bearing faces on cooperating parts of said jaws, and in which the arrangement is such that the load itself reacts to impose forces tending to disengage the jaws and to eject said stop, locking mechanism imposing a restraining force on said stop in a direction opposed to said ejective force, and trip-mechanism for releasing the stop to permit disengagement of the load. In some known forms of attachment for these purposes the mechanism has been arranged in such manner that the force necessary to be applied to release the load, as when dropping a bomb or disengaging a towed object or craft, is a function of the load to be released, this effect being attained by arranging for the load to exert such a force upon the locking mechanism that the latter is either held in a neutral position or subjected to a slight restraining action, thus preventing the inadvertent release of the load, e. g. through vibration. Where toggle mechanisms have been employed to transmit the unlocking force they are usually arranged to work over a dead centre between the locked and unlocked positions, so that it is necessary to apply sufficient power to operate them through the dead centre position to unlock the attachment. The resistance to the unlocking operation due to friction alone is very considerable and where it is necessary to raise or wind in the load slightly to permit the attachment to be released the operation can only be performed with the assistance of a certain degree of power.

The object of the present invention is the provision of an improved form of releasable attachment of the said type for use in the circumstances referred to, wherein the power requisite to retain the attachment in engaged condition and to actuate the mechanism for releasing the attachment will be substantially less than that required in known forms of attachment, and which will possess certain additional advantages which are apparent from the following description.

In a releasable attachment of this type in accordance with the present invention, the jaws are so arranged that the forces due to the load acting thereon are for the greater part balanced

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by opposed reactions in the jaws through the stop, but the bearing faces of the jaw-parts between which the stop is held are inclined to each other at an angle such as will, in normal working conditions, impose a slight ejective force on said stop.

The manner in which the invention is carried into effect is hereinafter described with reference to the accompanying drawings, which illustrate by way of example a releasable attachment constructed in accordance with the invention, and which is suitable for use with bombs and other articles to be dropped from aircraft in flight. In the drawings, Fig. 1 is a general elevation of the attachment, Figs. 2 and 3 are longitudinal sections thereof showing the respective positions of the component parts (a) when supporting a load and (b) when the load has been dropped. Fig. 4 is a fragmentary detail view in section, showing the manner in which the attachment is locked in the load-supporting position when it is required to prevent the attachment from being released, and Fig. 5 is an end view of the separable portion of the attachment, showing the electrical contacts thereon.

Referring to Figs. 1 to 5, it will be seen that the device there illustrated comprises a housing 15 which is capable of being fixed to the aircraft and a slip 16 which is shaped so as to be received into a cavity 151 in the housing 15 when hoisted into place by means of a cable 17 passing under a pulley 18. When the slip reaches the position shown in Fig. 2, fitting closely within the housing, it is conveniently engaged by spring-actuated retaining jaws of which one is indicated in Fig. 1 at 19, in the manner described in British Patent Specification No. 497,009. The means by which the slip can be released from the housing are preferably similar to those described in said British Specification No. 497,009, consisting of a sliding wedge 20 capable of being moved by operation of a cable 21 between the jaws 19, so as to disengage them from the jaw-receiving slots 22 of the slip, against the pressure of a spring 23.

The attachment for the bomb or other load comprises two pincer-like jaw members 24, 25, pivoted upon a common axis 26 and cooperating when approached together so as to be capable of engaging a bomb shackle or the like, the loop 27 of such shackle being sustained upon the tips of the jaws 24, 25, which are so spaced apart as to set up certain forces tending to separate them when under load. The jaws 24, 25 are respectively provided with pincer-like extensions having co-operating plane bearing faces 241, 251 (Figs. 2

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and 3) arranged so that the insertion of a stop of roller form between such faces retains the jaws 24, 25 in the closed position; said faces 241, 251 are inclined to each other and the angle included between them so adjusted in accordance with the friction angles of the materials of the jaws and stop as to produce a resultant force which tends to eject the stop from between said bearing surfaces. It will be understood that by taking advantage of the frictional forces set up (a) between the bomb shackle 27 and the surfaces of the tips of the jaws 24, 25, and (b) between the jaws 24, 25 and their pivot pin 26, the ultimate ejective force imposed upon the stop can be restricted to a degree such that only a comparatively light contrary force need be exerted to retain the stop in the locked position, and that such retaining force may be still further geared down by the use of simple lever linkages in the locking mechanism.

In the arrangement which characterises the present invention, therefore, the majority of the disengaging forces imposed by the load are balanced by opposed reactions in the jaws 24, 25 through the roller-like stop 30, and only a sufficient component of such disengaging forces is utilised for the provision of the stop-ejective force as will overcome the friction between the stop and the jaw-faces. The magnitude of this component is determined by the inclination of the jaw-faces to each other.

The locking mechanism conveniently comprises a primary toggle linkage 28, 29 of which the end adjacent the jaw-members 24, 25 carries the aforesaid movable stop (which here consists of a roller 30) engaged between the inclined faces 241, 251 of the jaw-members 24, 25, the other end of the primary toggle being anchored to a fixed pivot. Linked to the central pivot of said primary toggle 28, 29 is one end of a secondary toggle 31, 32 of which the other end is anchored to a fixed pivot 33 whilst the link 31 is extended to form a catch 34 which is normally retained by a trigger 35 the resistance of which to the movement of the catch 34 is sufficient to withstand the ejective force imposed upon the movable stop 30 acting through the said toggle linkages 28, 29 and 31, 32. The said trigger may be released as desired by either mechanical or electro-magnetic means; appropriate forms of both mechanical and electro-magnetic release means are hereinafter described. Both toggles are arranged to work only on the "runway" side of their dead centres, so that when the trigger 35 is released the linkages are already free to move towards their collapsed positions illustrated by Fig. 3 under the ejective thrust imposed through the jaws 24, 25 upon the roller 30. A suitable tension spring 36 may be connected with the catch 34 in such manner as to counteract its inertia and to assist in the actuation of the toggles when the trigger 35 is released.

A finger-piece 37 may be connected to the catch 34 for the purpose of re-cocking and releasing the toggle mechanism by hand. If desired, the attachment may also include self-cocking mechanism arranged to come into operation automatically when the jaws are engaged with a load.

Fixed abutments 38, 39 are preferably provided in conjunction with the jaws 24, 25 for the purpose of absorbing fore-and-aft reactions imposed upon the attachment by possible swinging movements of the load. It will be understood that the double-toggle mounting of the movable stop 30 is such as to permit said stop to move

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laterally about the pivot connecting it to the toggle members 29, 31, the roller 30 being capable of sliding sufficiently between the surfaces 241, 251 of the jaws 24, 25. Thus, any tendencies of the load to move in a plane at right angles to the axis of the pivot pin 26 of the jaws are not resisted by the stop 30, and no force other than the light ejective force acting upon the stop itself is imposed upon the locking mechanism.

The attachment may be released mechanically by the impingement of a spring-pressed member 40 against the finger-piece 37. Said member 40 is attached to the wedge-slide 20 so that a movement of this member to the left (as viewed in Figs. 2 and 3) under the pressure of the spring 23 against the abutment shoulder 41, would actuate the finger-piece 37 and release the toggles. To permit this action the stop 42 against which the slide 20 ordinarily abuts is made retractable, a cable 43 attached to said stop being operable so that by retracting said stop 42 the pressure of the spring 23 causes the slide 20 to move as aforesaid, resulting in the shackle 27 of the bomb or the like suspended from the jaws, 24, 25, being released.

A suitable form of electro-magnetic release mechanism for the attachment, shown in Figs. 2 and 3, comprises a housing 44 enclosing an electromagnet 45 capable of being energised as desired through a circuit which includes leads 46 and 47 connected to two spring contacts (of which one is shown at 48), fixed contacts 49 on the end-face of the slip (Fig. 5) and connections from said contacts to the magnet terminals at 50. Associated with the magnet are two pivoted armatures 51, 52 normally held in the open position by a common compression spring 53 which passes through the hollow centre of the magnet. The armature 51 has a lever 511 which, when the magnet is not energised serves as an abutment holding the armature 52 in the open position. The armature 52 is operatively connected with, or formed integrally with the trigger 35, and it will be seen that to permit the release of the trigger 35 it is necessary when the magnet 45 is energised, for the armature 51 first to be attracted towards it; this step removes the lever 511 from its position holding the armature 52 which thereupon itself moves to the closed position, as shown in Fig. 3. Thus the trigger 35 is raised from engagement with the catch 34 and the toggle mechanism is operated to release the jaws 24, 25. The double-check lever arrangement here described for controlling the magnet armatures 51, 52 effectively serves to prevent the inadvertent release of the trigger 35 by the movement of said armatures under inertia forces. In the case of a sudden surge of the aircraft in the direction of arrow A (Fig. 2), such as might normally tend to close the armature 52 and thus release the trigger 35, such movement of the armature 52 is prevented by the presence of the lever 511; a similar but oppositely directed force which might tend to close the armature 51 is prevented by the pressure of the spring 53 for which the armature 52 and trigger 35 then serve as an abutment.

In case it is desired for any reason to prevent the inadvertent release of a load, the mechanism can be locked by inserting a shaped stop 371 between the finger-piece 37 and a fixed part of the housing 16, as shown in Fig. 4; such stop 371 may easily be withdrawn as soon as it is required to release the load.

By reason of the arrangement whereby the reactive force exerted by the load upon the attach-

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ment is utilised to release the jaws 24, 25 and also to operate the toggle mechanisms which lock said jaws in engagement, it will be seen that the forces tending to release the jaws increase in proportion to the load. It is also an important feature of our improved attachment that the frictional forces due to the load act to relieve the release mechanism and not in opposition thereto as in certain known forms of attachment; for this reason it is found unnecessary to pay serious attention to the reduction of such friction between the working parts of the attachment.

What we claim as our invention and desire to secure by Letters Patent is:

A releasable load-attaching device for aircraft and the like, comprising a pair of load-gripping jaws pivoted on a common axis, opposed surfaces on said jaws adapted to receive therebetween a stop member, a movable stop member adapted to be engaged between said surfaces, means for locking said stop member in engagement between said surfaces, said stop member being movable with said surfaces upon common movement of said jaws about said axis, and means for releasing said locking means, the angle between said surfaces when the jaws are in load-engaging relation being such as to impose a slight ejective force

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on said stop member, said locking means comprising two links pivoted together to form a toggle, means connecting one link of said toggle and said stop member, means forming a fixed pivot for the other link of said toggle, a second toggle connected at one end to the first toggle, means forming a fixed pivot for the other end of said second toggle, a catch associated with said second toggle, a releasable trigger engaging said catch, means biasing said toggles toward collapsed position, and means for disengaging said trigger from said catch.

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REGINALD ARTHUR FIRMAN.

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