

Feb. 9, 1943.

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2,310,249

AERODYNAMIC RELEASE DRAG FOR TOW TARGETS

Filed May 26, 1941

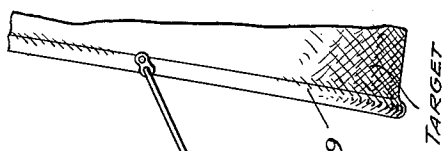


FIG. 1.

FIG. 2.

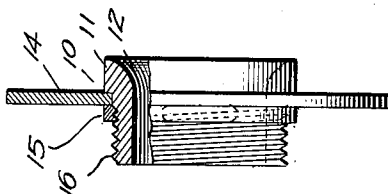


FIG. 3.

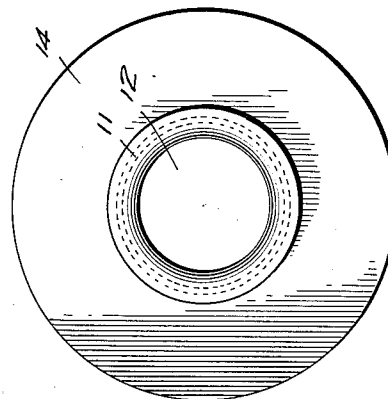
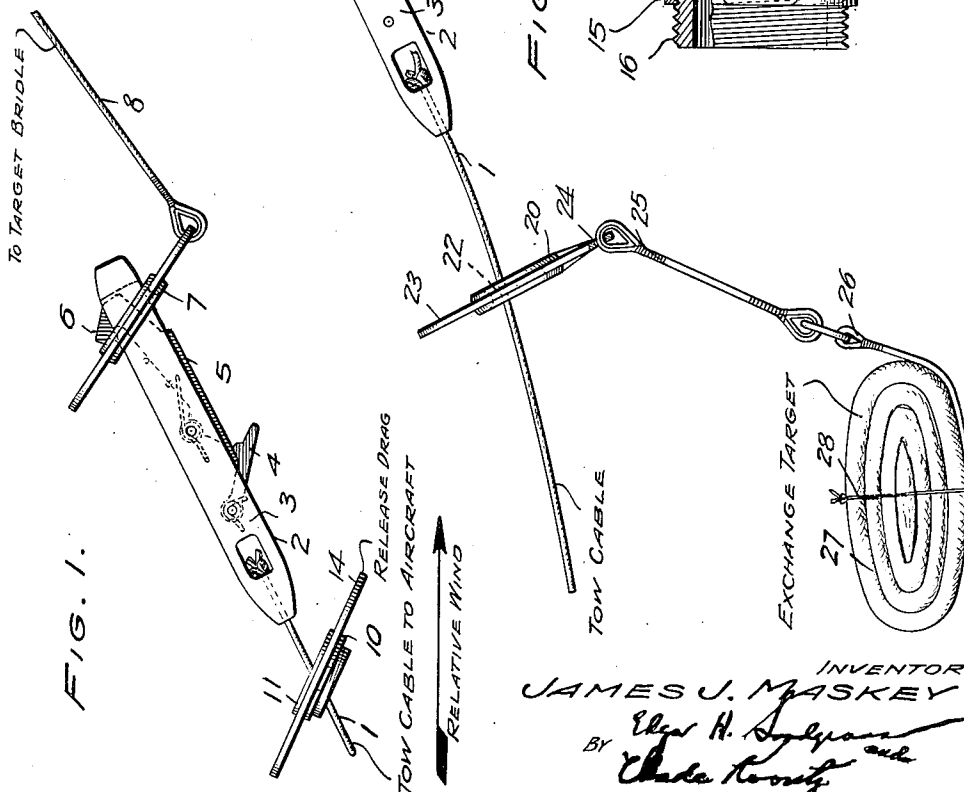


FIG. 4.

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2,310,249

AERODYNAMIC RELEASE DRAG FOR TOW TARGETS

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Application May 26, 1941, Serial No. 395,251

1 Claim. (Cl. 273—105.3)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to means for releasing targets towed by an aircraft for use in anti-aircraft gunnery practice.

It has heretofore been common practice in the art to employ a releasing device on the end of the target tow cable incorporating a latch and trigger mechanism such as illustrated in U. S. Patent No. 1,971,340 granted to Albert C. Foulk, the latch being operative to serve as a hook to engage a ring attached to the two target bridle to thereby tow the target. In order to replace the target being towed with a new target, the latter target, tied in a pack by a cord, is secured to a ring placed on the tow line and released to slide down the tow line, the ring engaging the trigger of the release device to release the latch and disconnect the target being towed and being reset to connect the exchange target, the trigger severing the pack cord to allow the exchange target to be inflated. In order to release the last target being towed a drag weight secured to a guide ring has been employed to slide down the tow cable and release the last target and furnishing enough drag to maintain the tow cable sufficiently taut to allow rewinding.

The exchanging of targets and releasing the last target by a release drag, as above described, has been satisfactory where the length of the tow line is between five hundred and one thousand feet, but in order to facilitate the firing at targets at high altitudes and to insure safety to the towing aircraft, it is necessary to tow the targets at distances as great as fifty-five hundred feet from the towing aircraft. With tow cable lengths of this amount, the weight of the cable causes the same to sag in the form of a catenary having a steep upward slope adjacent to the tow target such that the exchange target and release drag, when carried by rings slidable on the tow cable, as above explained, would not negotiate the upward slope of the tow cable, necessitating the hauling in of the tow cable in order to exchange targets, or to release the last target.

The above-noted difficulties encountered with the use of long tow cables have been overcome in accordance with the principal object of the invention by the provision in combination with a target towing cable and target release mechanism therefor, of a traveler slidably mounted on the tow cable adapted to slide over the body of the release device to actuate release mechanism

to thereby release a target secured thereby, the traveler being provided with a surface acted on by the air stream to propel the traveler along the tow cable, the said surface being acted upon by lifting forces when traversing upwardly inclined portions of the tow cable.

A further object of the invention is the provision in combination with a target tow cable and target release mechanism therefor of a traveler slidably mounted thereon and adapted to transport an exchange target to said target release mechanism, said traveler being provided with propelling means acted on by aerodynamic forces.

Other objects of the invention will become apparent to those skilled in the art by reference to the detailed description hereinafter given when taken in conjunction with the appended drawing in which:

Fig. 1 illustrates an aerodynamically propelled release drag or traveler in accordance with the invention advancing along a target tow cable to release a target towed thereby, and

Fig. 2 is a side elevation sectional view of the release drag or traveler illustrated in Fig. 1, and

Fig. 3 is a front elevation of the release drag illustrated in Fig. 2, and

Fig. 4 is a view illustrating the use of an aerodynamically propelled release drag or traveler for transporting an exchange target along the target tow cable.

Referring now to Fig. 1, the reference numeral 1 indicates a portion of the tow cable for towing targets, one end of which passes through a guide tube associated with a windlass (not shown) mounted in the towing aircraft, and the other end of which is secured in a target release member generally indicated by the reference numeral 2 and similar in design to that illustrated and described in the aforementioned U. S. Patent No. 1,971,340 granted to Albert C. Foulk, the specific structure of which forms no part of the present invention. The release device 2 comprises a generally streamlined body portion 3 having a trigger lever 4 fixedly mounted therein and adapted, when depressed, to tilt a pivotal lever 5 to lower a hook portion 6 thereof so as to release a guide ring 7 to which is attached a cable 8 secured at its outer end to the bridle of a target (not shown). As seen in Fig. 1, a release drag, generally indicated by the reference numeral 10, is shown as approaching the release device 2 under the influence of aerodynamic forces created by the moving air stream acting thereon, and as seen in Figs. 2 and 3, the release drag comprises an annular sleeve or ferrule 11 provided with a curved cen-

trally disposed aperture 12 therein, which is adapted to surround the tow cable 1 of Fig. 1. The sleeve 11 is provided with a suitable shoulder which abuts against an annular disc 14 which is secured in clamped relation with the shoulder of the sleeve 11 by means of a nut 15 threaded on to the threaded portion 16 of the sleeve 11. The disc 14 is made of an outside diameter such that when released from the towing aircraft into the air stream at a velocity of ninety to one hundred miles an hour, the release drag 10 will be propelled along relative to the tow cable 1 with sufficient force so that it may climb the upwardly inclined portion of the cable which occurs when the tow line is, for example, the order of five thousand feet as previously noted. It will be noted, as seen in Fig. 1, the release drag will be inclined at an angle to the relative wind so that, in addition to the drag forces exerted by the air stream thereon, the drag will also be subjected to a lifting force, which thus enables the drag to climb the inclined cable and slip over the body portion 3 of the target release mechanism to trip the trigger 4 and release the guide ring 7 and target attached thereto. After the release drag 10 passes over the trigger 4, resetting springs within the body of the release mechanism 2 will cause the trigger 4 to return to the position shown and allow lever 5 to return to its initial position with the hook portion 6 thereof in the position as illustrated in Fig. 1 to thereby retain the release drag on the release mechanism 2 in the same position as the guide ring 7 is now indicated. When thus retained on the end of the release device 2, the drag member 10 will exert sufficient drag on the cable to maintain the same taut so that it may be reeled in by the windlass on the towing aircraft, and further, because of the disc or vane portion 14, sufficient lift will be exerted on the outer end of the cable to prevent the same from dropping and oscillating during the rewinding thereof.

Referring now to Fig. 4, it is seen that an aerodynamically propelled traveler may be employed for the purpose of transporting the exchange target along an upwardly inclined tow cable to release a target then being towed and replacing the same by the exchange target. As seen in Fig. 4, the guide ring 7 is made in a form adapted to slide over the body portion of the target release mechanism and is adapted by means of the cable 8 to tow a target 9. A guide ring 20 of a construction identical with that of the previously mentioned guide ring 7, as shown, comprises a central hub portion or ferrule provided with an enlarged central aperture 22, which surrounds the tow cable 1 and is provided with a disc 23 identical in shape with the disc 14 of the drag member 10 as illustrated in Figs. 2 and 3, the only difference therefrom being that the hub portion and disc are formed in a single piece and the disc is provided near its outer edge with an aperture 24 through which the eye of a connecting cable 25 may be secured, the cable 25 being tied to the bridle 26 of the exchange target 27, the latter being maintained in a folded bundle by means of a linen thread 28 which is ruptured by impact of the guide ring 20 with the trigger 4 of the target release device 2.

The operation of the target exchange means illustrated in Fig. 4 is as follows: A number of guide rings, such as 7 and 20, are initially slipped on the cable guide associated with the windlass on the aircraft before the first target is secured to the drag member and released. After the first

target is pierced by anti-aircraft fire, and is required to be dropped to the battery below, the cable 25 secured to one of the guide rings, such as 7 or 20, is tied to an exchange target in the manner described and the exchange target dropped through a suitable opening in the bottom of the aircraft to slide along the cable. Upon ejection from the aircraft, the guide ring or traveler 20 is subjected to aerodynamic forces in the same manner as previously described with reference to the release drag member 10 of Fig. 1, and the combination of lifting and drag forces, due to the air stream acting on the disc portion 23, will propel the guide ring 20 and exchange target 27 along the cable and provide sufficient force to cause the guide ring and exchange target to climb the inclined portion of the tow cable when the latter is long, such as from one thousand to fifty-five hundred feet in length. Upon arrival of the target release device 3, the guide ring 20 slides therealong to trip the trigger 4 and to release the guide ring 7, which is secured by means of the hook portion 6 of the lever 5, thereby releasing the target 9 and allowing the hook 6 to return to its initial position to secure the guide ring 20 in towing relation in the same manner as at present indicated for the guide ring 7. The impact transmitted to the guide ring 20 by the trigger 4, when passing thereover, causes a sufficient force on the bridle 26 of the exchange target to rupture the threads 28 which maintain the target in a bundle and thus allow the target to unfold and become inflated. Any desired number of targets may thus be exchanged successively in a similar manner and after the last target has been exchanged and remains on the end of the tow cable, the same may be released by means of a release drag, such as illustrated at 10 in Fig. 1, to provide sufficient drag on the cable to allow the same to be drawn into the aircraft by means of the windlass.

In practice, a disc on either the release drag 10 of Fig. 1 or guide ring 20 of Fig. 4, of a diameter of approximately five inches has been found to provide all of the necessary force to either serve as a release drag or as a traveler for exchanging targets on tow lines up to fifty-five hundred feet in length, and obviously, any desired amount of force may be created by simply enlarging the disc 14 of the drag member 10 of Fig. 1 or the disc 23 of the traveler 20 of Fig. 4. When a drag or traveler of the character described and having a diameter of five inches is released into a relatively moving air stream of ninety miles or more per hour, the drag force exerted on the release drag or traveler is sufficient to accelerate the release drag or traveler even when transporting the targets so that the same has a high velocity relative to the tow cable by the time it approaches the upwardly inclined portion of the tow cable and this velocity coupled with the aerodynamic lift exerted on the disc portion of the traveler or release drag is sufficient to elevate the same up the inclined portion of the cable and cause the same to pass over the release mechanism 2 and by impact to trip the trigger 4 in the manner previously described.

The aerodynamically propelled traveler or guide ring such as indicated at 7 or 20 in Fig. 4 may also be employed as a release drag in the same manner as the release drag 10 of Fig. 1 and readily made of any suitable material, a suitable hard faced metal insert being employed in the aperture 22 to resist the abrasion caused by friction with a long tow cable.

While the preferred form of the invention has been illustrated and described, it is to be understood that other variations and modifications may be made therein falling within the scope of the invention as defined by the appended claim. 5

I claim:

In apparatus for exchanging an aerial target towed by an aircraft tow line with a replacement target comprising, in combination with said tow line, a target-release device secured to the towing end of said line including a trigger-actuated target-release mechanism operative upon actuation of said trigger to release a target being towed and to automatically reset to couple an exchange target in towing relation with said tow line upon release of said trigger, a traveler in the form of 10 15

a disk having a centrally disposed annular guide providing an enlarged central aperture providing for movement of the traveler along the tow line, and means for securing an exchange target to the traveler, the said disc forming the traveler having a diameter such that aerodynamic lift and drag forces acting thereon are sufficient to propel the target along the tow line and lift the same along the upwardly inclined portions thereof, and said traveler, by means of the aperture therein, being adapted to slide over the body of the target-release mechanism to actuate the target trigger to release the target being towed and to couple the exchange target to the tow line.

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