

May 7, 1963

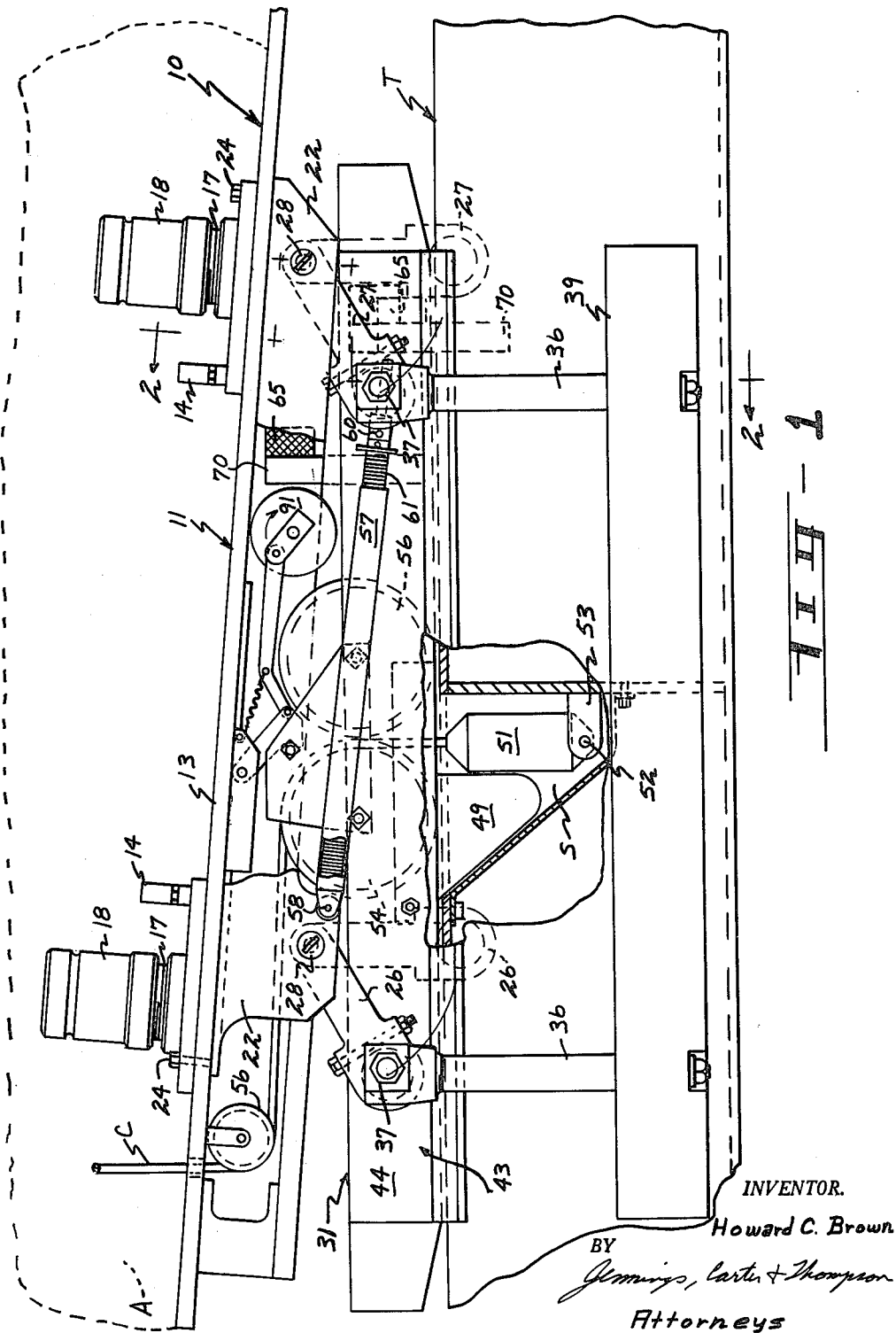
H. C. BROWN

3,088,693

TOWED TARGET LAUNCHING AND RETRIEVAL APPARATUS

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4 Sheets-Sheet 1



INVENTOR.

Howard C. Brown

BY

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Gemings, Carter & Thompson

Attorneys

May 7, 1963

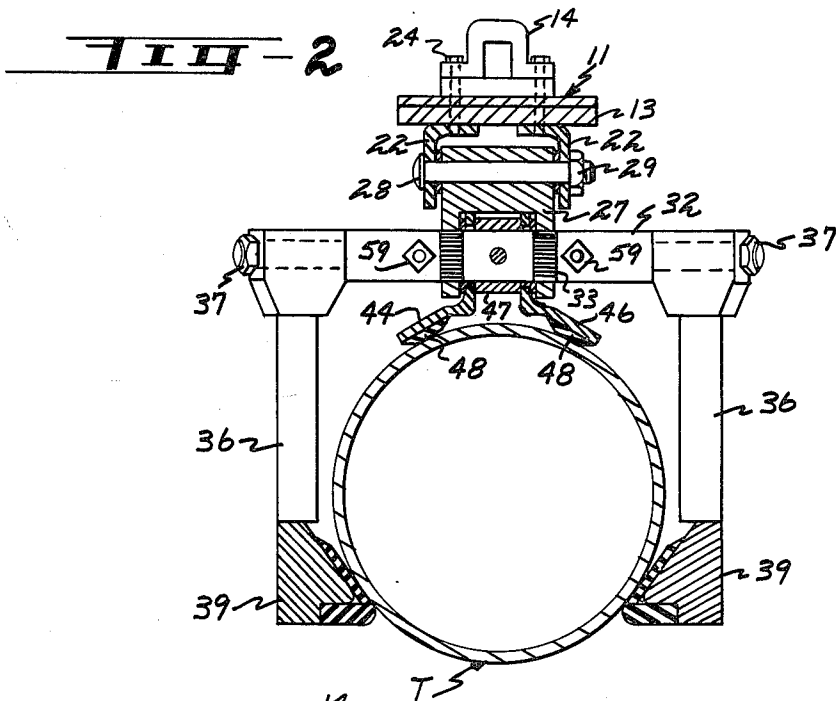
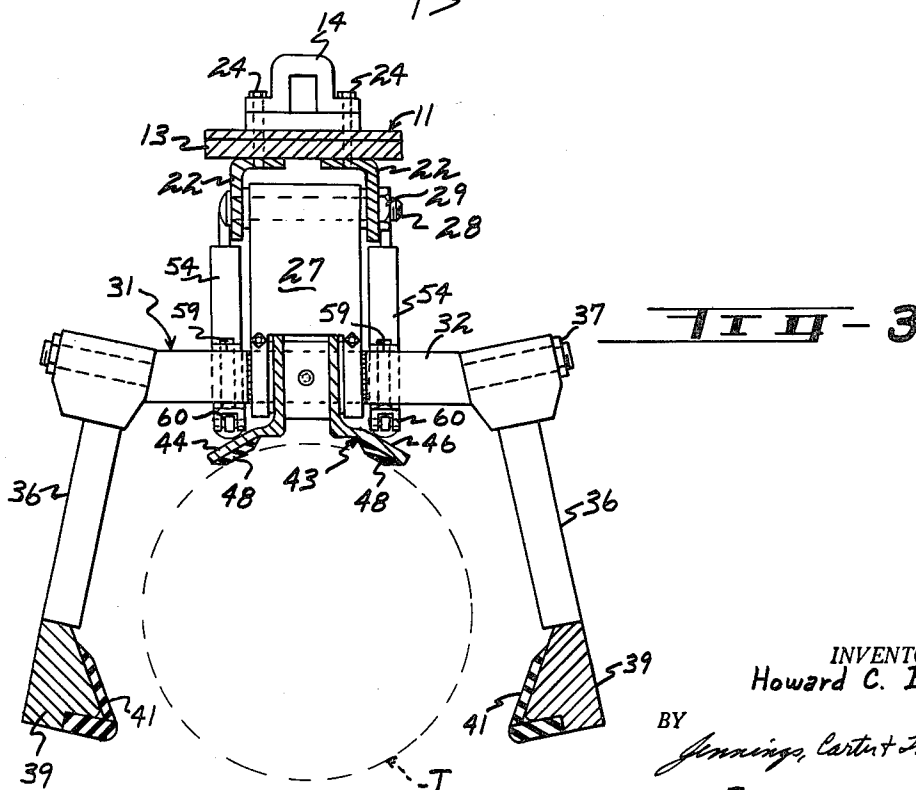
H. C. BROWN

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TOWED TARGET LAUNCHING AND RETRIEVAL APPARATUS

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4 Sheets-Sheet 2



INVENTOR.
Howard C. Brown

BY
Jennings, Carter & Thompson
Attorneys

May 7, 1963

H. C. BROWN

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4 Sheets-Sheet 3

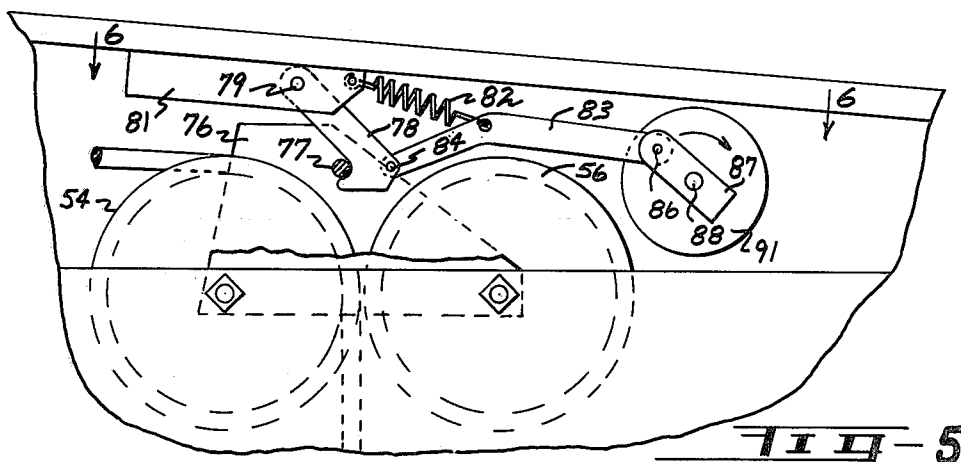
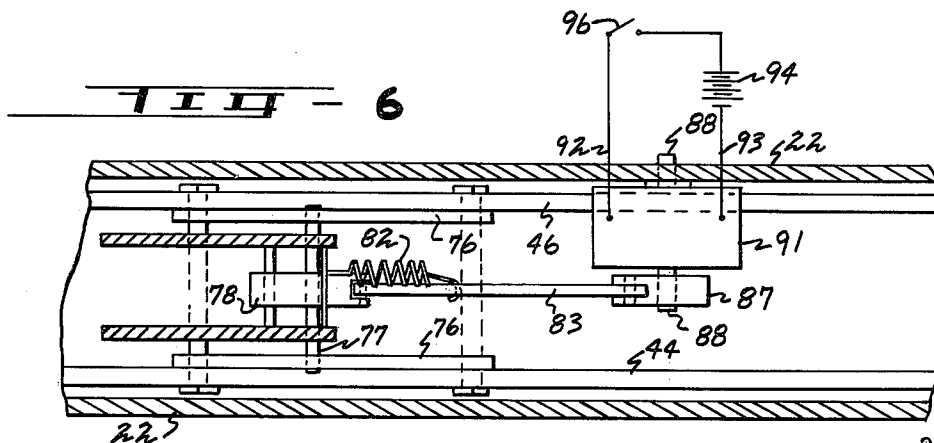
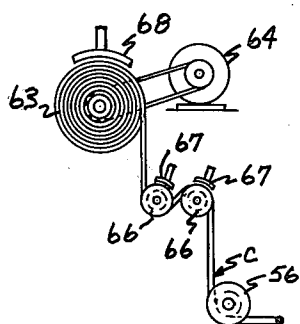
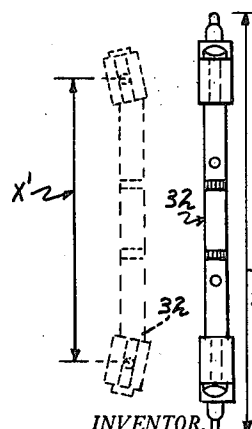


FIG. 9



INVENTOR.
Howard C. Brown

BY
Penning, Carter & Thompson
Attorneys

May 7, 1963

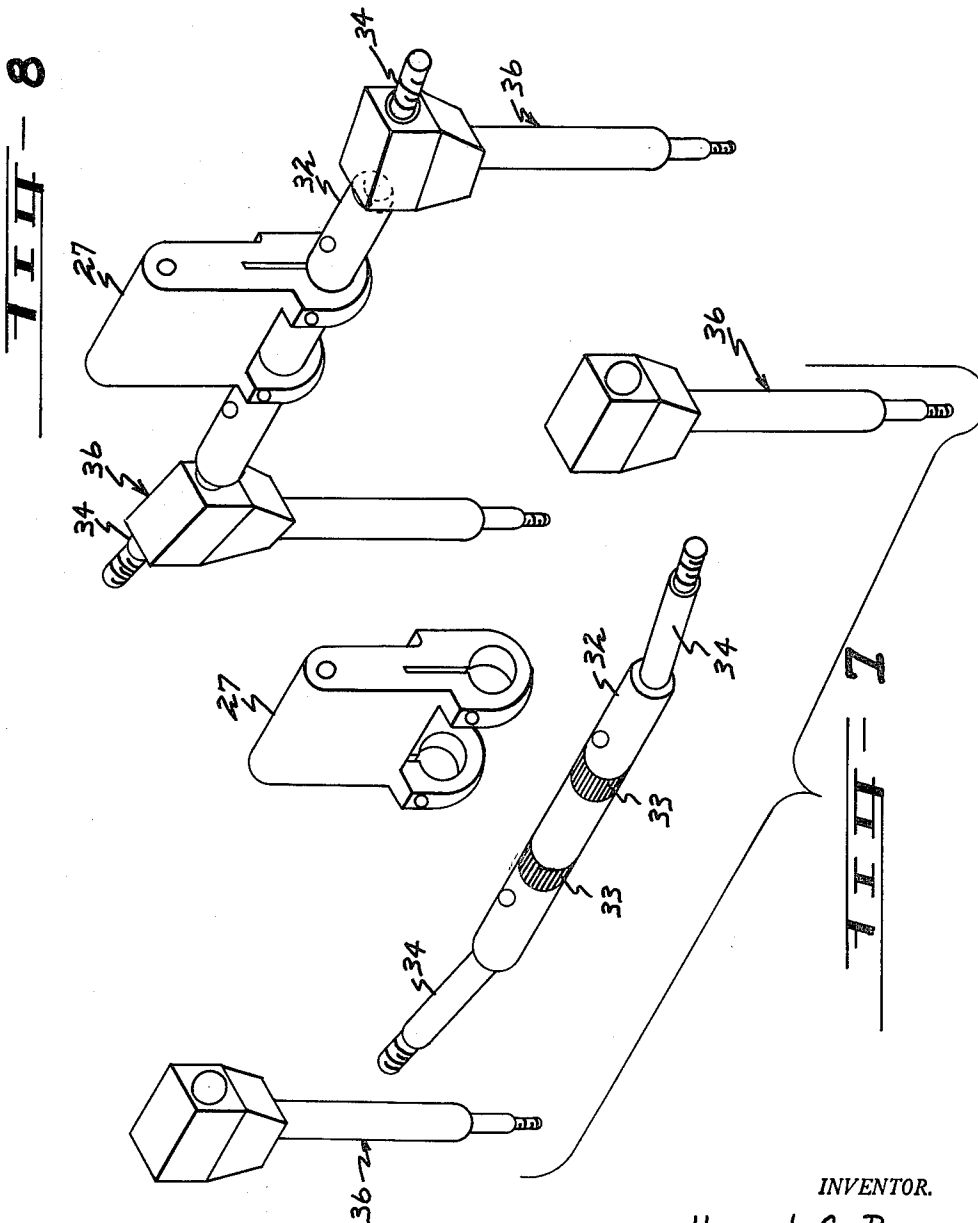
H. C. BROWN

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4 Sheets-Sheet 4



INVENTOR.

Howard C. Brown

BY

Jennings, Carter & Thompson

Attorneys

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TOWED TARGET LAUNCHING AND RETRIEVAL APPARATUS

Howard C. Brown, Birmingham, Ala., assignor to The Hayes Corporation, a corporation of Delaware

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11 Claims. (Cl. 244-3)

This invention relates to apparatus for launching and retrieving towed targets and more particularly to such apparatus for use with high speed aircraft for launching and retrieving targets used for practice in tracking, gunnery, counter-measure maneuvers and the like.

It is an object of the present invention to provide apparatus on the undersurface of aircraft for releasably holding and recovering an aerial tow target and having a pair of spaced, oppositely disposed gripping members adapted to move toward and away from each other to grip opposite sides of the target for holding the target therebetween.

It is a further object of this invention to provide a pair of generally parallel, oppositely disposed gripping members mounted for movement toward and away from each other, together with movable actuating means operatively connected to the gripping members and positioned therebetween to be contacted and moved by the target when it is retrieved, whereby the gripping members move toward each other upon final recovery of the target and grip it tightly therebetween.

An additional object is to provide a towing device for launching and retrieving a target from the underside of aircraft having a base frame secured to the underside of the aircraft, a target contacting cradle mounted on the base frame and adapted to move relative to the aircraft and the base frame, and a pair of oppositely directed gripping members positioned outwardly of the cradle and being operatively responsive to the movement of said cradle, whereby upon contact of the cradle by the target upon recovery or retrieval thereof, the cradle is moved and actuates the gripping members which converge toward each other and grip the target tightly therebetween.

Briefly described, my invention comprises a base frame adapted to be secured to the underside of the aircraft. A pair of parallel links are pivotally mounted on the base frame and support a target carrying frame. The target carrying frame is thus mounted for parallel movement relative to the base frame and the aircraft. The target carrying frame comprises a shaft secured intermediate its length to the outer end of each of the links with each shaft having a canted end portion of reduced diameter on the outer ends thereof. Oppositely disposed generally parallel gripping members are operatively connected to the canted ends of the shafts and are moved by rotation of the shafts toward and away from each other. A cradle carried by the shafts is positioned between and spaced from the gripping members inwardly toward the aircraft. The cradle is adapted to be engaged by the target when the target is reeled in and retrieved and causes the target carrying frame to move toward the base frame upon final retrieving movement of the target thereby rotating the shafts and moving the gripping members toward each other to grip the target. Means are provided to unreel the target from between the gripping members for launching and to reel the target to a position between the gripping members for retrieval thereof.

Apparatus embodying features of my invention is shown in the accompanying drawings, forming a part of this application, in which:

FIG. 1 is a side elevational view of my invention show-

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ing a launching and retrieval apparatus for aerial tow targets with a target being held in retained position by the apparatus, certain parts of the apparatus being broken away;

FIG. 2 is a sectional view of the apparatus shown in FIG. 1 taken generally along the line 2-2 of FIG. 1 and showing the gripping members in closed gripping relation to a target held therebetween;

FIG. 3 is a sectional view of my apparatus similar to that of FIG. 2 but showing the gripping members in open released position in which position the members are widely spaced while the target is being towed and before the recovery thereof;

FIG. 4 is a diagrammatic view of means on the aircraft to reel and unreel the cable by which the target is towed;

FIG. 5 is a fragmentary, side elevational view of the means to lock the gripping members releasably in closed position to hold the target in retained position tightly therebetween;

FIG. 6 is a sectional view looking generally along the line 6-6 of FIG. 5 and showing the locking means of FIG. 5;

FIG. 7 is an exploded perspective view of the actuating means for the gripping members showing the shaft with reduced diameter canted ends in the position with the gripping members being open;

FIG. 8 is a perspective view of the actuating means shown in FIG. 7 with the members secured to each other as in actual operation and with the shaft in the position it occupies when the gripping members are in the open released position of the target; and,

FIG. 9 is a top plan partly diagrammatic view of an actuating shaft with canted ends thereon, the dotted line position of the shaft showing the gripping position.

Referring now to the drawings for a better understanding of my invention, and more particularly to FIGS. 1-3, my launching and retrieval apparatus for towed aerial targets, particularly those towed from a connection adjacent the center of gravity, is indicated generally by the numeral 10 and comprises a base frame 11 which is adapted to be secured to the underside of aircraft shown in fragmental manner by the letter A. A base plate 13 of frame 11 is adapted to engage the underside of the aircraft at the position occupied by a standard bomb rack and handles 14 secured to base plate 13 are likewise adapted to engage portions of a bomb rack. Extensions 17 on base plate 13 are mounted within members 18, all of which aid in securing the apparatus to the bomb rack.

Side angle members 22 are secured to the underside of base plate 13 by suitable means 24. A pair of links 26 and 27 are mounted on pins 28 which extend between and are secured to side members 22. Links 26 and 27 are mounted for free relative movement on pins 28 and nuts 29 secure pins 28 to angle members 22.

A target carrying frame indicated generally by the numeral 31 is carried by and mounted on the lower ends of links 26 and 27. Shafts 32 having knurled surfaces 33 thereon (see FIG. 7) are secured onto links 26 and 27 and rotate when links 26 and 27 are pivoted. Shafts 32 extend outwardly from links 26 and 27 and have on each end thereof canted end portions 34 of reduced diameter, and set at an angle of approximately 12 degrees to the longitudinal axis of shafts 32. An arm 36 is mounted for relative rotative movement on each reduced diameter canted end 34 and nuts 37 retain arms 36 onto the threaded outer ends of canted ends 34. Gripping members or plates 39 extend between and are secured to the lower ends of a pair of arms 36 on each side of the target carrying frame 31. Resilient material 41, such as rubber or the like, is placed on the inner or gripping surface of mem-

bers 39 and is adapted to contact target T to grip and hold the target. Material 41 preferably has a high coefficient of friction so as to assure a firm grip on the target.

FIG. 7 shows in exploded a view a shaft 32 with canted ends 34 thereon and arms 36 removed from the canted ends which are shown in the position they occupy when gripping members 39 are spread and target T is released therefrom. It is understood that target T is a streamlined tow target and is generally cylindrical in shape. FIG. 8 shows the shaft 32 with arms 36 thereon in assembled relation. Upon rotation of shaft 32 arms 36 move inwardly and outwardly as shown in FIG. 9. Arms 36 are mounted on canted ends 34 for free rotation but rotation of canted ends 34 causes arms 36 to move inwardly and outwardly relative to each other. FIG. 9 shows arms 36 in the position they occupy in closed gripping position after shaft 34 has been rotated approximately 60° from the open position of gripping members 39. The distance X in FIG. 9 shows the spacing of the outer ends of arms 36 when in spaced relation and distance X' shows the spacing of the outer ends of arms 36 when in closed relation. Thus, upon rotation of shafts 32 from the vertical position of links 27 as shown in FIGS. 3, gripping members 39 move inwardly toward each other tightly to grip the target T therebetween. It is understood that gripping members 39 retain arms 36 in a normal relation thereto even though arms 36 are mounted for free rotative movement on canted ends 34, since gripping members 39 extend between pairs of arms 36.

A cradle indicated generally by the numeral 43 is carried by shafts 32 and comprises a pair of outwardly flanged members 44 and 46 which have openings therethrough for mounting these members on shafts 32 for free relative rotation. A bar 47 is mounted between members 44 and 46 to hold members 44 and 46 spaced from each other. Resilient pads 48 are provided on the outwardly extending surface of members 44 and 46 and are adapted to engage the outer surface of target T as shown in FIG. 2. When target T contacts pads 48 and moves cradle 43 with carrying frame 31 upwardly toward aircraft A, links 26, 27 pivot about pins 28 and shafts 32 rotate, thereby moving arms 36 and gripping members 39 thereon toward each other to grip the target. This results since arms 36 are mounted on canted ends 34 which rotate. Thus cradle 43 moves target carrying frame 31 in a direction toward aircraft A when target T is fully retrieved.

A target positioning tab 49 (see FIG. 1) is secured between members 44 and 46 and is adapted to engage a slot S within target T to position the target accurately with respect to the launching and retrieval apparatus 10. A cable C is secured to a swivel fitting 51 pivotally mounted at 52 to a bracket 53 on target T. Cable C is fed between a pair of pulleys 54 and 56 mounted between members 44 and 46 of cradle 43. Pulley 56 mounted on base plate 13 guides cable C and a suitable opening is provided in plate 13 so that cable C can pass therethrough.

Target carrying frame 31 is urged continuously away from base frame 11 in a direction to move gripping members 39 away from each other and move links 26 and 27 relative to aircraft A. One means of accomplishing this comprises a spring housing 57 pivotally secured at 58 to each angle member 22. The other end of housing 57 is pivotally connected at 60 (see also FIG. 3) to a bolt 59 extending through shaft 32 on link 27. A compression spring 61 within each housing 57 urges link 27 and hence carrying frame 31 to downward position viewing FIG. 1. A resilient stop 65 (see FIG. 1) is secured to the upper end of extension 70 which is secured between and mounted for movement with members 44 and 46 of cradle 43. As shown in dotted lines in FIG. 1, stop 65 engages link 27 in the open position of gripping members 39 to stop the pivotal movement of carrying frame 31 and to absorb the shock from the launching of the target and downward movement of members 39.

Referring now to FIG. 4, means is shown diagrammati-

cally to reel and unreel cable C attached to target T. A reel unit comprising a reel 63 is mounted within the aircraft and reversible drive means 64 is provided to rotate reel 63 and take in or pay out cable C therefrom. Pulleys 66 are provided to guide cable C. Brakes 67 are provided adjacent pulleys 66 to slow down the rate of pay-off of cable C and brake 68 is provided for reel 63. Control means (not shown) may be provided to control the reeling and unreeling of the cable. It should be noted that cable C upon launching of the target pulls pulley 54 on the carrying frame 31 away from base frame 11 thereby moving carrying frame 31 to open released position. Also, upon reeling in of the target before the target engages cradle 43, cable C urges pulley 54 and frame 31 away from the base frame to keep gripping members 39 in open position.

Referring now to FIGS. 5 and 6, means are shown for releasably locking the target carrying frame 31 in position with gripping members 39 engaging and holding target T in retained position. Extension plates 76 are secured to members 44 and 46 on target carrying frame 31. A catch pin 77 extends between and is secured to plates 76. Catch 78 is pivotally mounted at 79 to a bracket 81 on base plate 13. A lever 83 is pivotally connected at 84 to catch 78 and spring 82 urges catch 78 to engaged position with catch pin 77. Lever 83 is pivotally mounted at 86 to an actuating lever 87 secured to shaft 88 on a rotary solenoid 91. Upon energizing solenoid 91 shaft 88 rotates which thereby actuates lever 83 and removes catch 78 from engagement with catch pin 77. Solenoid 91 may be deenergized after the target is launched. The electrical circuit for solenoid 91 is shown diagrammatically in FIG. 6. Lines 92 and 93 run to the aircraft and a source of power such as a battery 94 on the aircraft provides electrical energy. A switch 96 preferably on the control panel of the aircraft allows the pilot to control solenoid 91 and the launching and retrieval of the target. It is understood that upon release of catch 78 from pin 77, the weight of target carrying frame 31 and target T therein is normally carried by cable C and the reel unit as tension is applied continuously to cable C by the reel unit in the retrieved position of the target. Therefore, the latch 78 may be easily released by solenoid 91 and frame 31 moves away from frame 11. Links 26 and 27 pivot, rotating shafts 32 and spread gripping members 39 away from each other to release the target. Spring 82 urges catch 78 to engagement with pin 77 when the target is retrieved and solenoid 91 is deenergized by opening of switch 96.

Operation

In operation, and beginning with target T in locked-in position as shown in FIGS. 1 and 2, solenoid 91 is energized by actuation of controls within aircraft and closing of switch 96 which causes catch 78 to release pin 77. Also, cable C is paid off from drum 63 by release of brakes 67 and 68. The target and target carrying frame 31 are urged by compression springs 61 and cable C away from base frame 13 in a swinging movement extending in a plane generally parallel to the longitudinal axis of aircraft A. When links 26 and 27 pivot about pins 28 from the position shown in FIG. 1, shafts 32 rotate since links 26 and 27 are rotatably secured thereon. When shafts 32 rotate the reduced diameter canted ends 34 thereof likewise rotate and the outer ends of arms 36 move away from each other. Thus, gripping members 39 which are secured to the outer ends of arms 36 move away from each other and are thereby removed from engagement with target T. As cable C is paid out, target T is launched and slides from positioning tab 49. Cable C may be paid out from the aircraft as desired. In this position, compression springs 61 and cable C continuously urge target carrying frame 31 to outer position thereof with gripping members 39 spread.

When it is desired to recover or retrieve target T, reel

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63 is rotated by drive means 64 and target T is pulled by cable C between gripping members 39. Positioning tab 49 engages slot S in target T to position it accurately and the target then presses against members 44 and 46 of cradle 43. The pulling in of cable C thus causes target T to press against members 44 and 46 with sufficient pressure to rotate links 26 and 27 toward aircraft A about pins 28. Upon movement of parallel links 26 and 27, target carrying frame 31 is moved toward base frame 11 and shafts 32 are rotated. Rotation of shafts 32, which are fixed to links 26 and 27, causes canted ends 34 to rotate and the outer ends of arms 36 move toward each other due to the fact that arms 36 are mounted on canted ends 34. This causes gripping members 39 to move inwardly and thereby grip the target tightly. When target carrying frame 31 reaches its innermost position, pin 77 is engaged by catch 78, as spring 82 continuously urges catch 78 to retained relation with pin 77. When pin 77 is engaged, tension on cable C may be released as the target is now locked in retained position between gripping arms 39 and cradle 43. However, prior to launching, tension should be applied to cable C to remove the weight from latch pin 77.

From the foregoing, it will be understood that I have provided a launching and recovery apparatus for high speed, aerial streamlined tow targets which is characterized by a pair of spaced, oppositely disposed gripping members adapted to move toward and away from each other to grip opposite sides of the target for holding the target therebetween. Further, means are operatively connected to the gripping members to contact and to be moved by the target when it is retrieved and thereby to actuate the gripping members. The target carrying frame is carried by and mounted for movement relative to a base frame which is secured to the underside of aircraft. A parallel linkage carries the target carrying frame, and the target itself moves the target carrying frame toward the base frame upon final recovery. The gripping members are mounted on canted ends of the shafts and upon rotation of the shafts, the gripping members move toward and away from each other.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In a towing device for launching and retrieving a streamlined elongated tow target from the underside of aircraft, a base frame secured to the underside of the aircraft, a cradle mounted outwardly on said base frame and adapted to move relative to the base frame in a direction toward the aircraft, a pair of oppositely disposed gripping members positioned outwardly of the cradle and movable simultaneously toward and away from each other to retain and release a target positioned therebetween, said cradle being operatively connected to said gripping members to actuate the simultaneous movement of the gripping members toward and away from each other, and means to unreel the towed target from between the gripping members for launching thereof and to reel the target to a position between the gripping members for retrieval thereof, said cradle being engaged by the target upon retrieval thereof and being moved toward said base frame to actuate said gripping members for moving toward each other and gripping the target therebetween.

2. In a towing device for launching and retrieving a streamlined tow target from the underside of aircraft, a base frame secured to the underside of the aircraft, a cradle mounted outwardly on said base frame and adapted to move relative to the base frame in a direction toward the aircraft, a pair of oppositely directed gripping mem-

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bers positioned outwardly of the cradle on said main frame and movable toward and away from each other to retrieve and launch a target positioned therebetween, said cradle being operatively connected to said gripping members to actuate the movement of the gripping members toward and away from each other, means urging continuously the gripping members away from each other, releasable locking means to lock the gripping members in their innermost position toward each other with the target therebetween thereby to retain the target therein until the locking means is released, and means to unreel the towed target from between the gripping members for launching thereof and to reel the target to a position between the gripping members for retrieval thereof, said cradle being engaged by the target upon retrieval thereof and being moved toward said base frame to actuate simultaneously said gripping members for moving toward each other and gripping the target therebetween.

3. A device for use on aircraft for controlled release and retrieval of a streamlined tow target, comprising a base frame secured to the underside of an aircraft, a target carrying frame pivotally mounted to the base frame and adapted for pivotal swinging movement relative to the base frame in a plane generally parallel to the direction of travel of the aircraft, a pair of oppositely disposed gripping members on said carrying frame adapted to grip a tow target therebetween, and means operatively connected to said gripping members to move said members between gripping and non-gripping positions relative to the target, said means being actuated upon pivotal movement of said target carrying frame.

4. A device for use on aircraft for controlled release and retrieval of a streamlined tow target, comprising a base frame secured to the underside of an aircraft, a target carrying frame pivotally mounted to the base frame and adapted for pivotal swinging movement relative to the base frame in a plane generally parallel to the direction of travel of the aircraft, a pair of oppositely disposed gripping members on said carrying frame adapted to grip a tow target therebetween, and means on said carrying frame positioned between said members and spaced inwardly toward the base frame and engaging the target is being carried by said carrying frame, said means operatively connected to said members and swinging said carrying frame relative to the base frame upon engaging the target when the target is retrieved thereby to move the members in gripping relation to the target therebetween.

5. In a device for releasably retaining and recovering an aerial tow target and adapted to be secured to the underside of an aircraft, a pair of oppositely disposed gripping members adapted to move between an open position in which the target is released and a closed position in which the gripping members contact and grip the target, a linkage operatively connected to said gripping members to move said gripping members inwardly and outwardly with respect to the aerial tow target held therebetween, and movable actuating means operatively connected to said linkage and positioned between the gripping members to contact the target when the target is recovered, said actuating means being moved by said target when the target is recovered to actuate said linkage and gripping members thereby to move the members to gripping engagement with the target.

6. In a towing device for launching and retrieving a streamlined tow target from the underside of an aircraft, a target carrying frame, a pair of links mounting the frame to the underside of the aircraft for pivotal movement in a direction generally parallel to the longitudinal axis of the aircraft, a shaft secured intermediate its length to the outer end of each of the links and being rotated upon pivotal movement of the links, a pair of oppositely disposed generally parallel gripping members operatively connected to the shafts and being moved by rotation of the shafts between a closed target gripping position and

an open target released position, and means on said frame contacting the target when it is retrieved to pivot said links and rotate said shafts whereby the gripping members move to closed position to grip the target therebetween.

7. In a towing device for launching and retrieving a streamlined tow target from the underside of aircraft, a target carrying frame, a pair of parallel links mounting the frame to the underside of the aircraft for pivotal movement in a direction generally parallel to the longitudinal axis of the aircraft, a shaft secured intermediate its length to the outer end of each of the links and being rotated upon movement of the links, a pair of oppositely disposed gripping members extending between and mounted for eccentric movement on the outer ends of the shafts and moved toward and away from each other upon rotation of the shafts, and means carried by the shafts and contacting the target when it is retrieved to move the links and rotate the shafts whereby the gripping members move toward each other to grip the target therebetween.

8. In a device as defined in claim 7 in which means are provided to urge continuously the links to an outer position with respect to the aircraft in which position the gripping members are widely spaced to permit the target to be launched.

9. Is a towing device for launching and retrieving a streamlined tow target from the underside of aircraft, a base frame secured to the underside of the aircraft, a target carrying frame mounted to the base frame, linkage mounting the carrying frame for movement relative to the base frame and the aircraft, a pair of oppositely disposed generally parallel gripping members on said carrying frame operatively connected to the linkage and movable toward and away from each other upon actuation of the linkage, means urging continuously the gripping members away from each other to open position in which position the target may be launched, means to unreel the towed target from the carrying frame for launching thereof and to reel the target to the carrying frame for retrieval thereof, and means on the carrying frame positioned between the gripping members and spaced inwardly therefrom toward the base frame engaging the target

when the target is being retrieved, said last named means operatively connected to the linkage for moving the linkage and the gripping members when the target is reeled in and retrieved thereby.

10. In a towing device for launching and retrieving a streamlined tow target from the underside of aircraft, a target carrying frame, a linkage mounting the target carrying frame on the underside of the aircraft for swinging movement relative to the aircraft, a pair of oppositely disposed generally parallel gripping members on said frame movable between a closed target gripping position and an open target released position and operatively connected to said linkage for actuation thereby, and means on said frame to move said linkage by contact with said target when the target is retrieved thereby to move the gripping members from open position to closed target gripping position.

11. In a towing device for launching and retrieving a streamlined tow target from the underside of an aircraft, a target carrying frame, a parallel linkage mounting the target carrying frame on the underside of the aircraft for swinging movement relative to the aircraft, a pair of oppositely disposed generally parallel gripping members on said frame movable between a closed target gripping position and an open target released position and operatively connected to said linkage for actuation thereby, means on said carrying frame positioned between the gripping members and spaced inwardly toward the aircraft and engaging the target when the target is retrieved, said means being operatively connected to said parallel linkage and being moved toward the aircraft when the target is retrieved to move the linkage and thereby the gripping members to closed gripping relation with the target therebetween.

References Cited in the file of this patent

UNITED STATES PATENTS

2,585,030	Nosker	Feb. 12, 1952
2,780,422	Maglio	Feb. 5, 1957
2,843,337	Bennet	July 15, 1958
2,877,688	Markel	Mar. 17, 1959
2,953,442	Hopper et al.	Sept. 20, 1960
2,977,149	Burton	Mar. 28, 1961