Oct. 16, 1945. G. A. BRONSON 2,386,839

BOMB DISPLACING GEAR

Filed Dec. 1, 1942 3 Sheets-Sheet 1

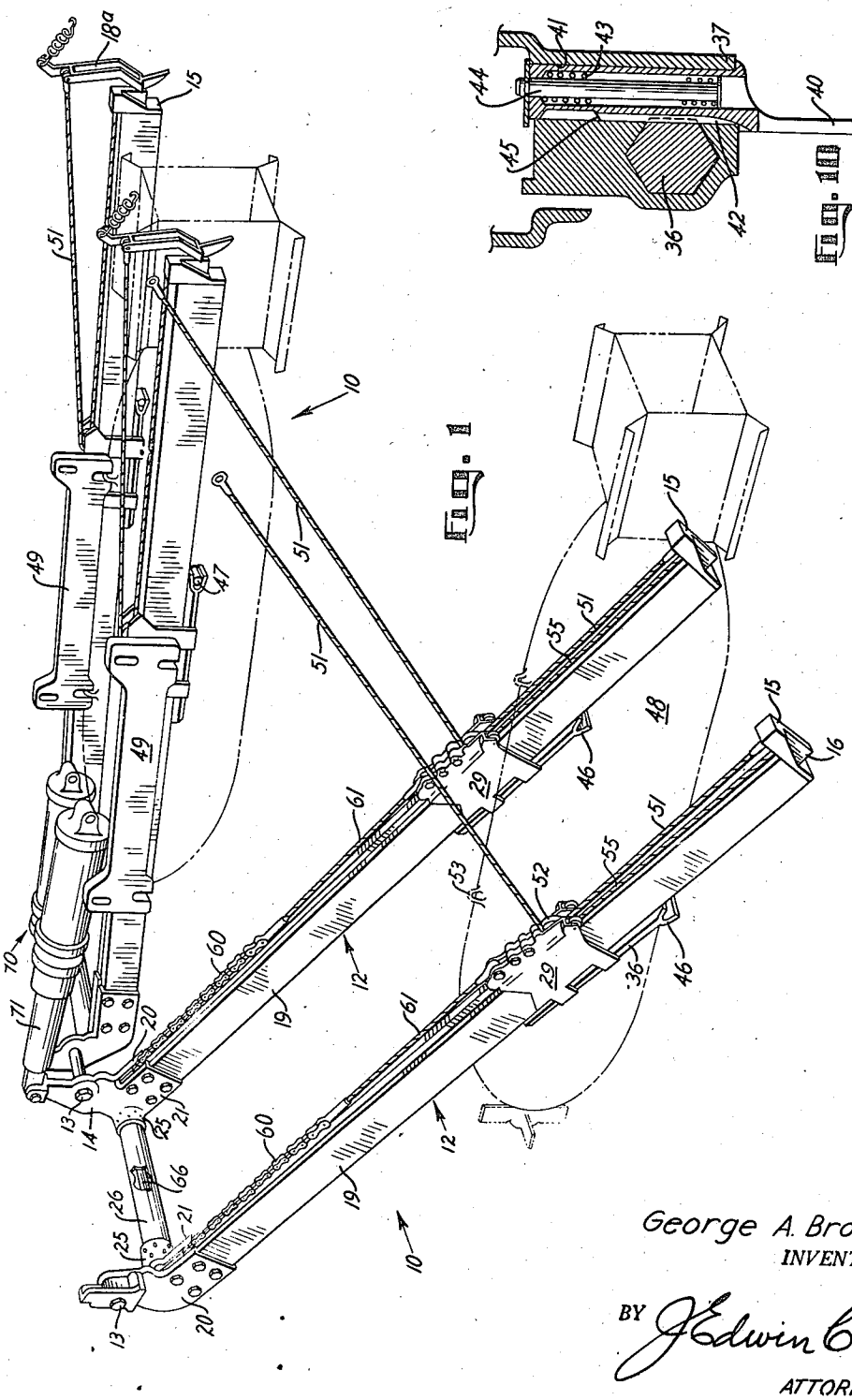

Fig. 1

Fig. 1a

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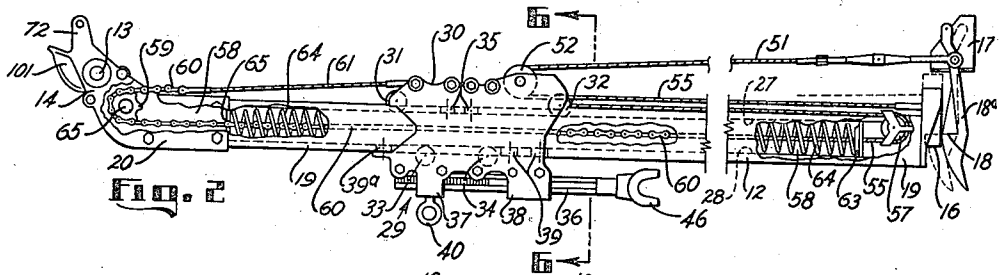

Fig. 2

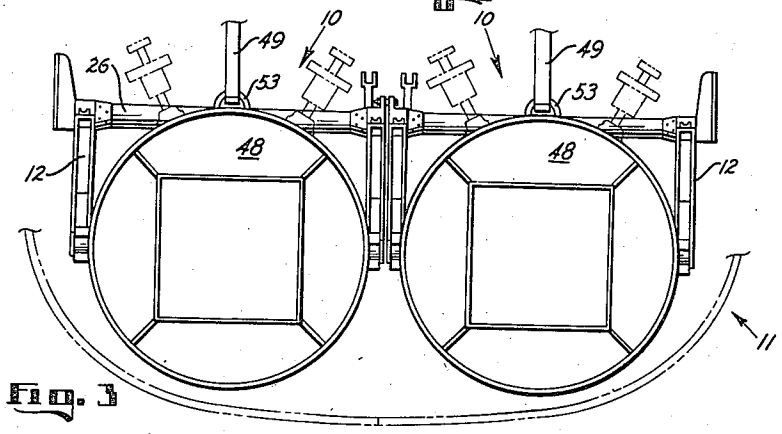

Fig. 3

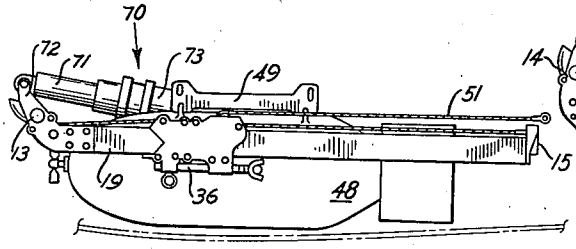

Fig. 4

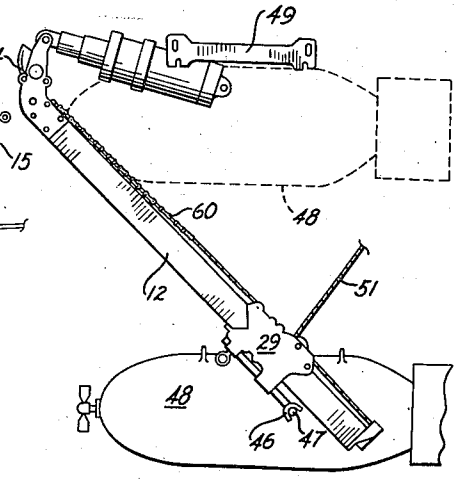

Fig. 5

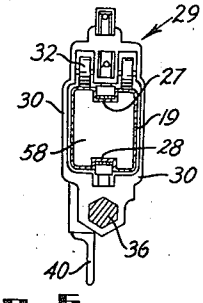

Fig. 6

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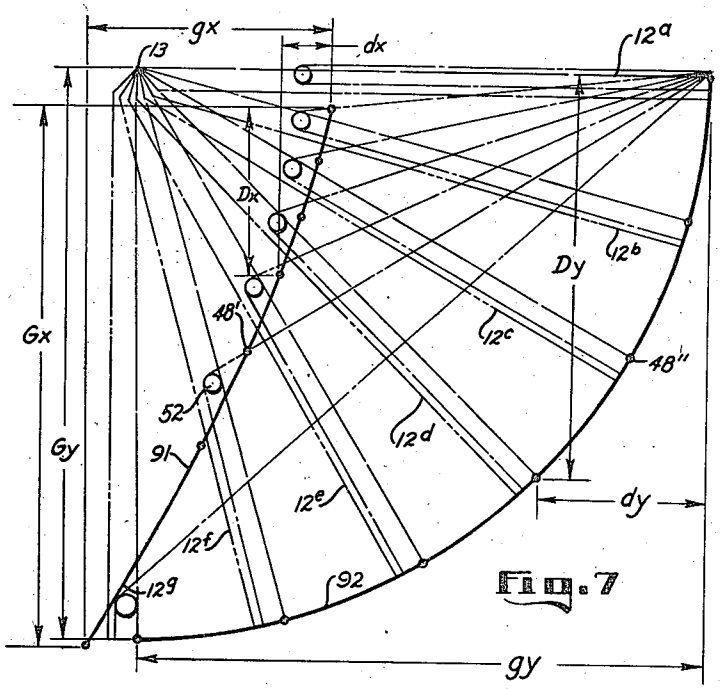

Fig. 7

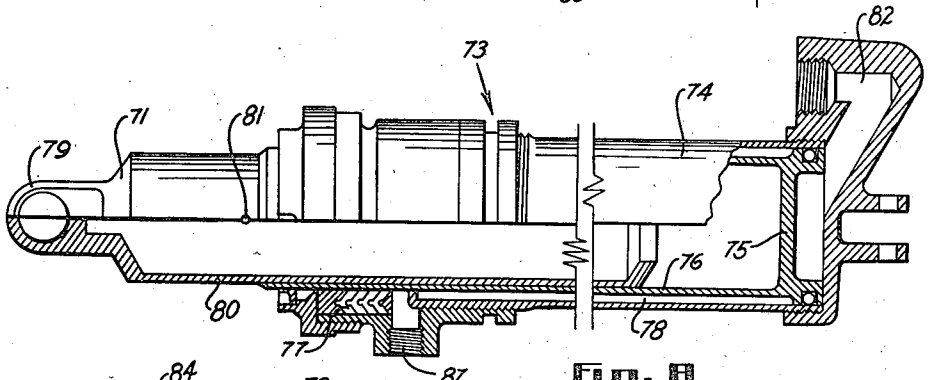

Fig. 8

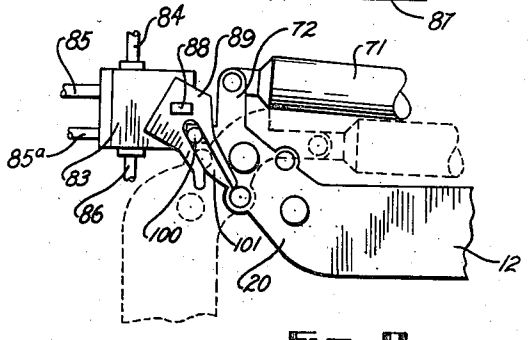

Fig. 9

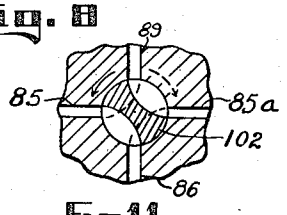

Fig. 11

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Patented Oct. 16, 1945

2,386,839

UNITED STATES PATENT OFFICE

2,386,839

BOMB DISPLACING GEAR

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Application December 1, 1942, Serial No. 467,549

20 Claims. (Cl. 89—1.5)

This invention relates to a bomb displacing gear for use on an airplane in conjunction with a bomb rack or other bomb carrier which is constructed to release the bomb at the will of the aircraft operator, and particularly to a bomb displacing gear for use on dive bombing airplanes.

The bomb rack is usually placed in a bomb bay formed in the under surface of the fuselage, both to keep the plane aerodynamically clean, and to bring the weight of the bombs nearer the level of the center of gravity of the plane.

In dive bombing, the diving angle is preferably between 70 and 90 degrees to reduce to a minimum the gravity deviation of the bomb trajectories from the direction of the dive and the consequent need for allowing for this deviation in sighting the airplane for the dive. The bombs released at the end of the dive, being aerodynamically cleaner than the airplane, tend to fall more rapidly than the plane. In high angle dives the bomb trajectory after release is nearly parallel to the flight path of the airplane.

If the trajectory begins at the undersurface of the airplane, there is danger of the bombs falling into the propeller blades and breaking them or being exploded. Accordingly, devices have been employed to move the bomb upon its release from the bomb rack to a position sufficiently displaced outwardly from the fuselage that the bomb trajectory will clear the path of the propeller even in 90° dives.

One such device consists of a swinging structure pivoted to the underframe parts of the airplane on a transverse axis which is in advance of the position in which the bomb is carried by the plane. Its free end is held in the bomb bay by the bomb trunnions in position to carry the bomb upon its release from the bomb rack. Upon release of the bomb this free end swings downwardly and forwardly, carrying the bomb in a circular arc to a position substantially displaced below the fuselage where the bomb begins its fall to earth. Since the swinging structure acts like a sling, it gives the bomb an outward throw, further displacing it from the fuselage.

The position of the bomb bay longitudinally of the plane is determined by the consideration that the bombs, particularly the larger bombs, because of their weight must be located adjacent the transverse axis of the airplane so as to keep the airplane in proper balance for flight control. When a displacing gear of the above described type is used there is an additional reason for locating the bomb bay longitudinally near the center of gravity of the plane. This position avoids the unbalancing effect which would be caused by the displacing movement of a heavy bomb mounted near the tail or nose of the airplane and the resulting lightening of the weight of these portions.

However, the understructure of a dive bombing plane is often such that the hinge axis of a displacing structure which is positioned with its free end opposite a bomb rack disposed centrally of the plane and which is of a length to sufficiently displace the bomb, would be at a location occupied by other equipment. This difficulty is more troublesome in the smaller planes having a short fuselage. Thus, a nose wheel may operate across a space which the pivoted end of such a swinging bomb displacement structure would have to occupy to satisfy the above stated conditions, i. e. that the bomb cannot be carried aft of the center of gravity of the plane, that the bomb should be carried in a bomb bay or close to the body of the fuselage, and that the radius arm of the swinging structure must be long enough to displace the bomb clear of the propeller.

It is one object of this invention to provide a bomb displacing gear which is relatively short longitudinally of the airplane with reference to the degree of bomb displacement which it effects, so that the gear may be pivoted or otherwise secured aft of a nose wheel or other interfering plane parts.

It is another object of this invention to provide a bomb displacing gear which will place the bomb in the air stream with its longitudinal axis stabilized in a position lying in or parallel to the vertical plane of symmetry of the airplane, to prevent lateral trajectory deviations which might cause the bomb to collide with other bombs of a salvo.

It is another object of this invention to accomplish the aforesaid objects by a structure which is safe, dependable and readily operated.

It is another object of this invention to provide a structure which may be used with similar structures in a battery of two or more without operatively affecting each other in a way to prevent the accomplishment of the aforesaid objects.

It is another object of the invention to provide for dependable and effective retraction of the displacing gear and resetting of its parts after its operation and for its proper securement in retracted position.

It is another object of the invention to provide a displacing gear which in normal position will act as a sway brace and will remove the

bomb from the bomb bay with a minimum of lateral movement of the bomb, thus permitting the use of a bay but slightly wider than the bomb.

Other objects and advantages of the invention will be brought out in the following description taken in connection with the accompanying drawings and appended claims.

In the drawings which are for illustrative purposes only:

Figure 1 is a perspective view of a two unit displacement gear embodying the invention showing one bomb in position in a bomb rack with one displacement gear unit in normal position beneath it and the other bomb about to be released from the other displacement gear unit.

Figure 2 is a side elevation of one of the arms of the displacing gear showing a portion of the arm cut away to expose the mechanism therein.

Figure 3 is a rear elevation of the two unit gear with bombs in position, showing the bomb bay in phantom lines.

Figure 4 is a side elevation showing a one unit displacement gear in retracted position, the hydraulic retracting motor and the bomb rack associated with the gear.

Figure 5 is a view like Figure 4, showing a bomb about to be released from the gear.

Figure 6 is an enlarged end view of one of the carriages showing the arm in cross section.

Figure 7 is a graph showing the performance characteristics of the gear of this invention in comparison with those of another type of displacing gear.

Figure 8 is a side elevation partly in section of one of the hydraulic retracting motors.

Figure 9 is a fragmentary side elevational view showing the valve operating mechanism of the hydraulic retracting motor and associated parts.

Figure 10 is a fragmentary sectional view taken along the line 10—10 of Figure 2, showing the construction of the device for locking the bomb engaging rod of the displacing gear.

Figure 11 is a sectional view illustrating the internal construction of the valve mechanism employed in conjunction with the retracting motors.

A two unit displacement gear is shown in Figures 1 and 3. It is mounted in a bomb bay which is indicated in phantom in Figure 3 and designated by the numeral 11. Each unit 10 comprises a pair of arms 12, disposed longitudinally of the bay and pivoted at 13 by means of ears 14 on the forward ends of the arms to the frame structure of the aircraft adjacent the forward end of the bay 11. The rear end of each arm has secured thereto a bumper 15 which is formed with a catch 16 which engages a latch face 18 of a latch arm 18a. The latch arm is pivoted to a bracket 17 secured to the frame structure of the aircraft adjacent the rear end of the bay. The latch face 18 engages the catch 16 when the arm 12 is in its uppermost position in which it is inclined slightly upwardly from its pivoted front end to its rear latched end, the latch and catch occupying the position shown in dotted lines in Figure 2.

Each arm consists of a tubular rail 19 of box-like cross section (see Figure 6) with a pair of fittings 20 and 21 at its inner end and the bumper 15 at its outer end. The fittings 20 and 21 are bolted to the rail 19 and to each other, the fitting 20 being extended inwardly to provide the hinge ear 14. The fittings 21 are each formed with a hub 25 extending laterally toward the other arm of the unit. The hubs 25 are riveted to the ends of a hollow shaft or tubular housing 26 which thus rigidly unites the arms 12.

As may be seen in Figures 2 and 6 each rail 19 is formed with grooved runways 27 and 28 in the upper and lower horizontal walls thereof and has slidable thereon a bomb supporting carriage 29 comprising side plates 30 bolted together and providing bearings for a pair of upper rear side vertical rollers 32, an upper front vertical roller 31 traveling in the runway 27, a lower front vertical roller 33 and a lower intermediate central vertical roller 34 traveling in the runway 28, two upper intermediate central horizontal rollers 35, two lower rear central horizontal rollers 39, and one lower front horizontal roller 39a, these five horizontal rollers traveling in the runways 27 or 28. The rollers are so arranged as to hold the carriage parts spaced from the rail surfaces and prevent canting of the carriage longitudinally or transversely.

A hex rod 36 is slidably supported in two nether lugs 37 and 38 on the carriage and may be locked in any longitudinal position of adjustment by a slide locking pin 40 in a vertical passage 41 in the lug 37 as shown in Figure 10 of the drawings. The pin 40 has a key rib 42 the upper end 45 of which is spaced from the upper end of the pin 40. This rib engages fluted serrations on the juxtaposed face of the hex rod 36, the pin being manually retractable against the action of a compression spring 43 on a key-mounting rod 44 for the purpose of freeing the hex rod from the rib 42 for longitudinal adjustment with respect to the carriage 29.

The rear end of the hex rod 36 is formed to provide a rearwardly opening fork 46 with an upper and lower jaw between which may be received a trunnion 47 of a bomb 48. To prepare an aircraft for flight with a bomb load a bomb is secured in the bomb rack above a unit 10. Then the pins 40 of the unit 10 are pulled out, the rods 36 are moved forwardly of the aircraft, the arms 12 are unlatched from the latch arms 18a by manually swinging the latch arms outwardly, and the arms 12 are then manually slightly depressed to the fully horizontal position shown in Figure 1 and in full lines in Figure 2. The fork 46 is then at a level to engage the trunnions 47 of a bomb 48 suspended from a bomb rack 49 in the bomb bay 11. The carriage 29 is manually held approximately at the level to afford this engagement of the trunnions with the forks 46 and the rods 36 are moved rearwardly of the aircraft to seat the trunnions properly in the fork openings, after which the pins 40 are released for spring retraction to lock the rods 36 in position.

Each cable 51 is anchored at one end to the cable attachment bracket 17, loops around a pulley 52 carried by the carriage 29 and is fastened at its other end to the bumper 15. When a bomb 48 is released from the bomb rack 49 by disengaging bomb attaching loops 53 therefrom, the weight of the bomb is applied to the arms 12 and the unit swings downwardly, the increasing distance between the carriage 29 and bracket 17 causing the cable 51 to pull the carriage toward the free rear end of the unit. The length of the cable is so designed that when the unit has swung through an arc of approximately ninety degrees the carriage is at the extreme limit of its outward travel adjacent the bumpers 15 and the cable length is substantially all disposed in a straight line from the carriage to the bracket 17. The hinge axis at 13 is so located that cables of a length as above determined will.

when the arms are horizontal, position the forks 46 for engagement with the bomb trunnions, the position of which is prescribed by the position of the bomb rack and bomb bay.

To effect retraction of the carriages 29 on the rails 19 when the unit swings back to its normal initial position after release of a bomb from the forks 46 on its downward swing, two cables 55 are employed, each of which is fastened at one end to the carriage 29, extends along the upper grooved runway 27 to the free end of the rail 19 where it passes through an aperture in the rail wall and around a pulley 57 mounted in the interior chamber 58 of the rail and thence extends within the rail chamber toward the pivoted end of the arm.

Near the free end of rail 19, it is connected to a sprocket chain 60 which extends to the pivoted end of the arm 12 where it passes around a sprocket wheel 59 mounted between the fittings 20 and 21, leaves arm 12 through an opening between these fittings and is connected to another cable length 61 which extends to and is secured to the forward end of the carriage 29. A collar 63 fixed on cable 55 near the pulley 57 and a stop disk 65 fixed within the rail 19 form abutments for a compression spring 64 which resists movement of the carriage 29 toward the free end of the rail 19 during outward movement of the unit and retracts the carriage to its initial position as the unit returns to its initial position.

The sprocket wheels 59 of the two arms of a unit are fixed upon a connecting shaft 66 rotating in the hollow shaft housing 26 to ensure the two carriages 29 occupying at any moment the same relative positions longitudinally of the rails 19. Any inclination of the axis of the bomb trunnions from a position perpendicular to the longitudinal axis of the unit is thereby prevented.

Consequently, and since also the unit arms are rigidly associated and held perpendicular to the pivot axis 13, the bomb must be held at all times as it moves outwardly, with its longitudinal axis steadily perpendicular to the direction of the transverse axis of the airplane and lying in or parallel to the vertical plane of symmetry of the airplane depending on whether the bomb is initially transported on the airplane in, or laterally displaced from, the plane of symmetry of the airplane. Stabilized in this position, the axis of the bomb is less apt to wobble and depart from a smooth curved trajectory lying in a single plane and consequently less apt to collide with other bombs released approximately at the same time in a salvo.

The displacing gear unit is retracted from its outward pendent position by a hydraulically motivated device indicated in general by the numeral 70 (see Figures 4 and 8). A plunger 71 is automatically thrust forward by a hydraulic reciprocating motor 73 upon arrival of the displacing gear at its pendent position. This plunger pushes forward a lever arm 72 on the shaft housing 26 to elevate the unit until the catch 16 engages the latch face 18 of the latch arm 18a and holds the unit in its uppermost idle and unloaded position. The motor 73 and plunger 71 permit substantially free downward movement of the arms 12 when, after the bomb displacing gear is again placed in operative position with the bomb trunnions seated in the forks 46, the bomb is released from the bomb rack.

The motor 73 comprises a cylinder 74 and a piston 75. The piston 75 has extending therefrom an elongated pneumatic cylinder 76 concentrically spaced from and within the cylinder 74, the cylinder 76 having a sealed sliding joint with the cylinder 74 at 77. An elongated annular chamber 78 is enclosed between the cylinders 76 and 74.

As best shown in Figure 8, the plunger 71 comprises an outer end 79 pivoted to the lever arm 72 and a pneumatic cylinder 80 which telescopically slides within the cylinder 76, the cylinders 76 and 80 being of approximately the same length and the cylinder 80 having a small air escape aperture 81 near its outer end.

Fluid under pressure is admitted to and exhausted from the right end of cylinder 74 through an inlet opening 82. Fluid flows between the opening 82 and the valve casing 83, Figure 9, through a conduit 84. The valve casing 83 is supplied with fluid under pressure from a suitable source through conduit 85 and vented through a conduit 85a. Fluid under pressure is similarly conducted between the valve casing 83 and an inlet 87 communicating with the chamber 78, through a conduit 86.

A valve 102 shown schematically in Figure 11 within the valve casing 83 may be turned by means of a valve stem 88 to occupy either a first position (shown in full lines) in which conduits 84 and 85a, and conduits 85 and 86 are connected, or a second position (shown in dotted lines) in which conduits 85 and 84, and conduits 86 and 85a are connected. The valve stem 88 is turned by a Geneva movement mechanism 89, the pin 100 of which is carried by a projection 101 on the arm 72.

As the arms 12 drop, upon the release of a bomb, toward a pendent position, the arm 72 is moved to the right moving the plunger 71 from a normal position shown in full lines in Figure 9 to the transitional position shown in dotted lines in that figure, the latter position corresponding to that shown in Figure 8.

When the arms 12 in their downward swing have traveled a small angle which may be adjustably set between 10 and 25 degrees, the Geneva movement 89 turns the valve stem 88 admitting fluid under pressure to the right face of piston 75 and exhausting fluid from the chamber 78 causing the piston to move to the left. The cylinder 76 thereupon begins a leftward movement toward cylinder 80 which is moving to the right. The restricted size of inlet opening 82 prevents too rapid a movement of the cylinders toward each other. Obturation of aperture 81 further slows relative movement of the two cylinders toward each other, cylinder head 75 finally engaging the right end of cylinder 80, the two cylinders moving together to the right under the gravity action of the bomb. As soon as the bomb leaves the forks 46 of the displacing gear, the hydraulic pressure to the right of piston 75 moves both cylinders 80 and 76 to the left, the compressed air between the cylinders pushing cylinder 80 ahead of cylinder 76, and the cylinder 80 finally elevating the arm structure 10 to the position at which the latch arm 18a engages the bumper 15. The Geneva movement has by that juncture turned the valve stem 88 admitting fluid under pressure to the chamber 78 and exhausting fluid from the chamber to the right of piston 75 causing the piston 75 and cylinder 76 to move to the right. The cylinder 80 cannot follow the cylinder 76, being held by the arm 72 of the displacing gear arm structure. The partial vacuum thus created within the cylinders 80 and 76 is

slowly brought to atmospheric pressure by passage of air through the aperture 81.

When the displacing gear is next used to drop a bomb, the weight of the bomb overcomes the air pressure between the pneumatic cylinder ends, the displacing gear dropping under a measure of pneumatic load to a bomb-discharging pendent position, obturation of the aperture 81 cushioning the gear to an oscillatory stop at an angle of 90° or less to the longitudinal axis of the plane depending upon the position at which the bomb is discharged. Air is forced from the aperture 81 prior to obturation of that aperture and any residual air pressure within the cylinders 76 and 80 after obturation acts to assist the fluid pressure, which is at once brought to bear upon chamber 78, in elevating the now unloaded gear to its latched and idle position.

The displacing gear when in its horizontal operative position in which the bomb trunnions are engaged by the forks 46 acts as a supplementary sway brace for the bomb suspended from the bomb rack. The forks 46 prevent rotational movement of the bomb about its axis and the inner side faces of the fork arms of the two forks are proximately adjacent the sides of the bomb.

Figure 7 is a graph illustrating the path of movement of a bomb in the displacing gear. In this graph, different positions of the arms 12 of the gear are represented by the numerals 12^a, 12^b, 12^c, 12^d, 12^e, 12^f, 12^g. 12^a is the position of the arms in the initial latched position of the gear. 12^g is the extreme position of the arms at the end of the operative movement of the gear. Intermediate positions 12^b, 12^c, 12^d, 12^e and 12^f are approximately at the angles 15°, 30°, 45°, 60° and 75° respectively. The corresponding positions of the cable 51 are shown in the drawings. The hinge axis of the arms is lettered 13 as in the structural figures.

The curved line 91 represents the path of travel of the forks 46, of the bomb trunnion seated therein and of a bomb 48' carried thereby. The arcuate line 92 represents the quarter circle path of travel of the bumper 15 which is also the path of travel of a bomb 48'' in bomb displacement gears of presently used types in which the forks or other bomb carrying means are fixed in position longitudinally of the arms and at their outer ends, and in which the bomb is displaced in a circular arcuate path about the hinge axis of the arms as a center.

Comparing the travel path lines 91 and 92, the following similarities and differences are noted. The point of separation of the bomb from the trunnion forks for any given angle of dive is a little beyond that angular position of the arms with respect to the longitudinal axis of the plane at which the arms have a true horizontal position; for it is at that position that the jaws of the fork begin to incline downwardly. For a 45° angle dive this angular position of the arms is the 45° position for both types of displacing gear. Dx represents the lateral displacement and dx the forward displacement of the bomb 48' at the moment of separation from the forks on line 91 and Dy and dy the lateral and forward displacements of bomb 48'' at the moment of separation on line 92. Gx, gx, Gy and gy represent the corresponding displacements for a 90° dive.

A study of these displacement values shows that a gear of this invention gives an adequate lateral displacement for any given angle of dive and gives a forward displacement of substantially less extent than the present type of gear. The small forward displacement means that the bomb is released at a greater and safer distance aft the propeller blades and at a point nearer the center of gravity of the plane.

The line 92 being circularly arcuate with a small radius and the line 91 being curvilinear with a much longer radius means that bomb 48'' is given a strong outward centrifugal throw upon release especially at high angle dives whereas bomb 48' leaves the forks with a negligible outward movement. Obviously aiming at a target is a simpler matter in the latter case, since no allowance need be made for this centrifugal throw at the beginning of the bomb trajectory.

I claim:

1. In a bomb displacing device for use with a releasing bomb support on an aircraft, the combination of: an arm structure pivoted on an axis transverse of the air craft and forwardly of the position of the supported bomb to be angularly movable downward from and upward to a position adjacent said bomb support; a bomb carrying means movably carried by said arm structure; and means interconnecting said bomb carrying means and said airplane whereby said bomb carrying means is moved on said arm structure outwardly from and inwardly toward an inner position therealong adjacent the axis of said pivot in correlation with downward and upward movement respectively of said arm structure, said bomb carrying means being so constructed and arranged when at its inner position and when said structure is angularly adjacent said bomb support to receive said bomb upon release from said bomb support, and when at an outer position and when said structure is at an angular downwardly position to release said bomb.

2. In a bomb displacing device for use with a releasing bomb support on an aircraft, the combination of: an arm structure pivoted on an axis transverse of the aircraft and forwardly of the position of the supported bomb to be angularly movable downward from and upward to a position adjacent said bomb support; a bomb carrying means movably carried by said arm structure; and means interconnecting said bomb carrying means and said airplane whereby said bomb carrying means is moved inwardly and outwardly on said arm structure a major portion of the length of said arm structure in correlation with downward and upward movement respectively of said arm structure, said bomb carrying means being so constructed and arranged when at its inner position and when said structure is angularly adjacent said bomb support to receive said bomb upon release from said bomb support, and when said structure is at an angular downwardly position and said bomb carrying means is at an outward position to release said bomb.

3. In a bomb displacing device for use with a releasing bomb support on an aircraft, the combination of: an arm structure pivoted on an axis transverse of the aircraft and forwardly of the position of the supported bomb to be angularly movable downward from and upward to a position adjacent said bomb support; a bomb carrying means movably carried by said arm structure; and means interconnecting said bomb carrying means and said aircraft whereby said bomb carrying means is movable on said arm structure inwardly from and outwardly to a station substantially at the free end of said structure over a substantial portion of the length of said arm

structure in correlation with downward and upward movement respectively of said arm structure, said bomb carrying means being so constructed and arranged when at its inner position and when said structure is angularly adjacent said bomb support to receive said bomb support and when at an outward position and when said structure is at an angular downward position to release said bomb.

4. In a bomb displacing device the combination of: a downwardly and forwardly swinging structure pivoted to an aircraft on an axis transverse to the longitudinal axis of the aircraft; a bomb support means longitudinally movable on said structure; and means interconnecting said bomb support and the aircraft whereby said support means is longitudinally moved on said structure responsive to and simultaneous with downward movement of said structure, said longitudinal movement being from an initial position adjacent said axis and inwardly remote from the free end of said structure to a position radially outwardly therefrom over a distance which is a substantial portion of the length of said structure and which substantially displaces the centers of curvate movement of the bomb support with respect to the aircraft forwardly from said axis, said support being so constructed and arranged as to release a bomb as said structure swings downwardly and forwardly.

5. The combination defined in claim 4, and in which the interconnecting means comprises: a pulley means on said bomb support means: and a flexible strand means fixed at its one end to the aircraft at a level adjacent that of said axis at a point more remote from said transverse axis than the normal position of the pulley, looped around said pulley and fixed at its other end to the outer end of said structure.

6. The combination defined in claim 4, and in which the interconnecting means comprises: a pulley means on said bomb support means; and a flexible strand means fixed at its one end to the aircraft at a level adjacent that of said axis at a point more remote from said transverse axis than the normal position of the pulley, looped around said pulley and fixed at its other end to the outer end of said structure, said strand means being of a length to dispose said carriage at the outer end of said structure at an extreme position thereof substantially perpendicular to the aircraft axis.

7. The combination defined in claim 4 and in addition thereto; resilient energy storing means on said structure and connected to said bomb support for storing energy from said bomb support means as it moves outwardly on said structure during the fall of said structure when loaded with a bomb and for releasing said energy to return said bomb support means to its initial position on said structure after release of said bomb from said structure.

8. The combination defined in claim 4, and in which said interconnecting means comprises: a pulley means on said bomb support means; a flexible strand means fixed at its one end to the aircraft at a level adjacent that of said axis at a point more remote from said transverse axis than the normal position of the pulley, looped around said pulley and fixed at its other end to the outer end of said structure; and in addition thereto, resilient energy storing means on said structure and connected to said bomb support for storing energy from said bomb support means as it moves outwardly on said structure during the fall of said structure when loaded with a bomb and for releasing said energy to return said bomb support means to its initial position on said structure after release of said bomb from said structure as permitted by said flexible strand.

9. In a bomb displacing device for an aircraft, the combination of: a downwardly and forwardly swinging arm structure pivoted to the aircraft on an axis transverse of the longitudinal axis of the aircraft; a bomb support movably mounted on said arm structure; means interconnecting the support and said aircraft for moving said bomb support radially outwardly in a continuous synchronous relation with the angle of said downward swing of said arm structure as the same swings downwardly about its axis, said support being so constructed and arranged as to release the bomb when the arm structure is in a downward position.

10. The combination defined in claim 9 in which the bomb support comprises a pair of rearwardly opening forks each having vertically alined jaws for engaging the trunnions of a bomb.

11. In a bomb displacing device for use with a bomb releasing rack on an aircraft for supporting a bomb longitudinally of the aircraft and with a bomb on said rack provided with trunnions on opposite sides of the bomb: a pair of arms hinged on a transverse axis forwardly of the position of the trunnions; a rearwardly opening yoke carried by each arm in position to embrace the corresponding trunnion, when said arms are in an upper position; means for elevating said arms to said upper position, said means being arranged to permit downward swing of said arms, by the weight of a bomb released from said rack; a longitudinally movable carriage on each arm for mounting a corresponding one of said yokes; and control means for the carriages correlatively and progressively responsive to the radial position of the arms for positioning the carriages initially adjacent the said axis when the arms are adjacent the bomb rack and subsequently adjacent the free ends of the arms when the arms are directed outwardly from the aircraft.

12. In a bomb displacing device for use with a bomb releasing rack on an aircraft for supporting a bomb longitudinally of the aircraft and with a bomb on said rack provided with trunnions on opposite sides of the bomb; a pair of arms hinged on a transverse axis forwardly of the position of the trunnions; a rearwardly opening yoke carried by each arm in position to embrace the corresponding trunnion, when said arms are in an upper position; means for elevating said arms to said upper position, said means being arranged to permit downward swing of said arms, by the weight of a bomb released from said rack; a longitudinally movable carriage on each arm for mounting a corresponding one of said yokes; a pulley on each carriage; and a pair of flexible strands each connected at one end to the aircraft structure rearwardly of the position of said trunnions and at a point more rearwardly remote from the trunnions than the normal position of the pulleys, passing around the corresponding pulley and secured at the other end to the free end of the corresponding arm.

13. The combination defined in claim 12 and in addition thereto: a pulley at the free end of each arm; a transverse shaft rotatably mounted between said arms adjacent the pivoted end thereof; a sprocket wheel on each end of said shaft; and a pair of flexible strand connectors, each secured at one end to one of said carriages, passing

around one of said pulleys and one of said sprocket wheels and secured at its other end to the carriage, said connector having the form of a sprocket chain for that portion thereof which passes around said sprocket; and a spring connected to each said connector and arm for yieldably moving each corresponding carriage to its initial position.

14. In a bomb displacing device for use with a releasing bomb support on an aircraft, the combination of: an arm structure pivoted on an axis transverse of the aircraft and forwardly of the position of the supported bomb to be angularly movable downward from and upward to a position adjacent said bomb support; a bomb carrying means movably carried by said arm structure; and means interconnecting said bomb carrying means and said airplane whereby said bomb carrying means is moved on said arm structure outwardly from an inner position adjacent the axis of said pivot in correlation with downward movement of said arm structure, said bomb carrying means being so constructed and arranged when at its inner position and when said structure is angularly adjacent said bomb support to receive said bomb upon release from said bomb support and when at an outer position and when said structure is at an angular downwardly position to release said bomb; means for returning said arm structure to its position adjacent said bomb support after said bomb has been released; and latch means for engaging said arm structure for holding the same in said position.

15. In a bomb displacing device for use with a releasing bomb support on an aircraft, the combination of: an arm structure pivotally supported on the aircraft to be angularly movable downward from and upward to a position adjacent said bomb support; means on said arm structure for engaging a bomb upon its release by the bomb support; an extensible pneumatic cylinder; power means for reciprocatively moving one end of said cylinder; a control for said power means; and motion transmitting means between the other end of said cylinder and said arm structure operative upon outward and inward movement of said other end to elevate and lower, respectively, said arm structure, said cylinder being formed to provide a slow acting air escape for said cylinder, the device being constructed and equipped to release the bomb when in downward position.

16. The combination defined in claim 15, and in addition thereto; an actuating connection between said other cylinder end and said control operative when said other cylinder end is being extended to actuate said control to apply power in a direction to move said one cylinder end away from said other cylinder end and when being retracted to actuate said control to apply power in a direction to move said one cylinder end toward said other cylinder end.

17. In a bomb displacing device for use with a releasing bomb support on an aircraft, the combination of: an arm structure pivotally supported on the aircraft to be angularly movable downward from and upward to a position adjacent said bomb support; means on said arm structure for engaging a bomb upon its release by the bomb support; a fluid pressure operated cylinder; a piston within said cylinder; a first extensible pneumatic cylinder end carried by said piston and opening away from said piston; a second extensible pneumatic cylinder end of approximately the length of said first pneumatic cylinder end and telescopically engaging and opening into said first pneumatic cylinder end and formed with a slow acting air escape near its closed end; a fluid pressure source; a selector valve for supplying effective fluid pressure from said source to either side of said piston; motion transmitting means between said second pneumatic cylinder end and said arm structure linking the reciprocative movement of said second pneumatic cylinder end with the angular swing of said arm structure operative upon outward and inward movement of said second pneumatic cylinder end to elevate and lower, respectively, said arm structure; and mechanical connections between said second pneumatic cylinder end and said valve for turning said valve to apply effective fluid pressure to move said piston toward said second pneumatic cylinder end during the inward travel of said second pneumatic cylinder end and for turning said valve to apply effective fluid pressure to move said piston in the opposite direction at least by the end of the outward travel of said second pneumatic cylinder end, the device being constructed and equipped to release the bomb when in a downward position.

18. In a bomb displacing device, the combination of: releasable means for transporting the bomb on an aircraft longitudinally proximate the center of gravity thereof in position to fall from the under surface of the aircraft; an arm structure pivoted on an axis transverse of the aircraft and forwardly of the position of the bomb to be angularly moved downward under the action of gravity from a position adjacent said releasable means; a bomb carrying means movably carried by said arm structure adapted to engage and carry said bomb upon its release from said releasable means; and means interconnecting said bomb carrying means and said airplane whereby said bomb carrying means is moved on said arm structure outwardly from an inner position adjacent said axis in correlation with downward gravitational movement of said arm structure, said interconnecting means limiting the movement of said bomb carrying means to a lateral displacement beyond the flight path lines of the aircraft propeller and limiting the longitudinal displacement of said bomb carrying means from said inner position to less than one-half the lateral displacement of said carrying means from said inner position.

19. In a bomb displacing device for use with a bomb releasing rack on an aircraft for supporting a bomb longitudinally of the aircraft and with a bomb on said rack provided with trunnions on opposite sides of the bomb; a pair of parallel, rigidly connected arms hinged on a transverse axis forwardly of the position of the trunnions; a rearwardly opening yoke carried by each arm in position to embrace the corresponding trunnion, when said arms are in an upper position; means for elevating said arms to said upper position, said means being arranged to permit downward swing of said arms, by the weight of a bomb released from said rack; a longitudinally movable carriage on each arm for mounting a corresponding one of said yokes; mechanism for maintaining the carriages at the same relative positions on the arms, comprising a pulley at the free end of each arm, a transverse shaft rotatably mounted between said arms adjacent the pivoted end thereof, a sprocket wheel on each end of said shaft, and a pair of flexible strand connectors, each secured at one end to one of said carriages, passing around one of said pulleys and one of said sprocket wheels and secured at its other end to said one carriage; said connector having the

form of a sprocket chain for that portion thereof which passes around said sprocket; and means for retracting said mechanism and carriages upon elevation of said arms.

20. The combination defined in claim 19, in which the retracting means comprises; a movable spring abutment secured to each of said connectors at a point between the associated sprocket wheel and pulley; a stationary spring abutment on each of said arms adjacent the associated sprocket wheel; and a compression spring seated between said movable abutment and said stationary abutment.

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