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2,389,997

GUN TURRET

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3 Sheets-Sheet 1

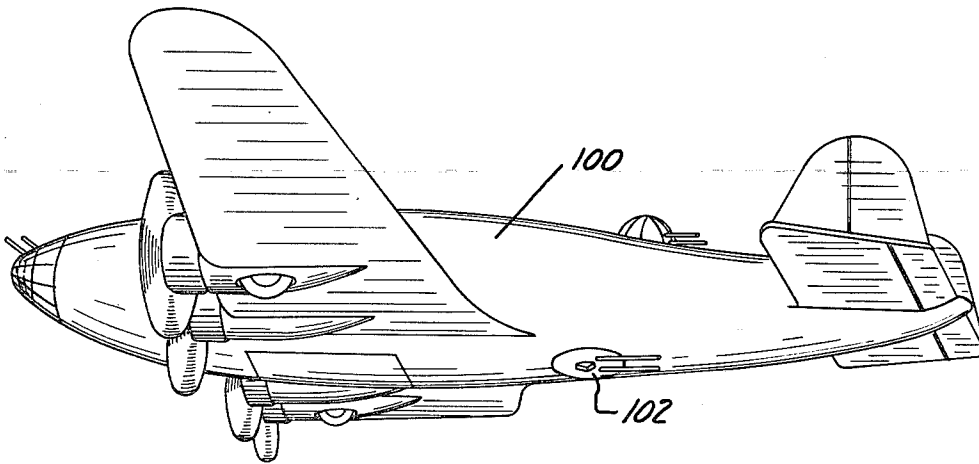


FIG. 1

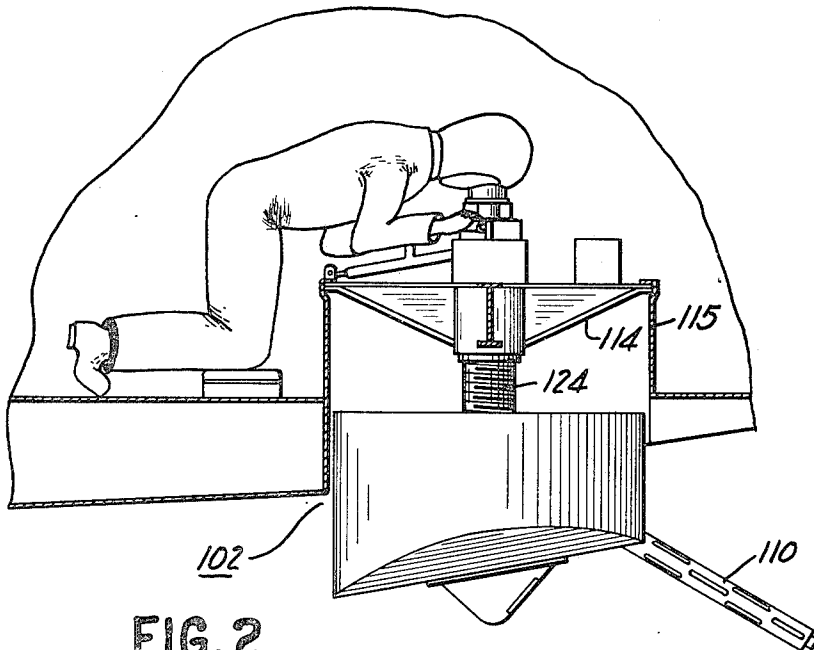


FIG. 2

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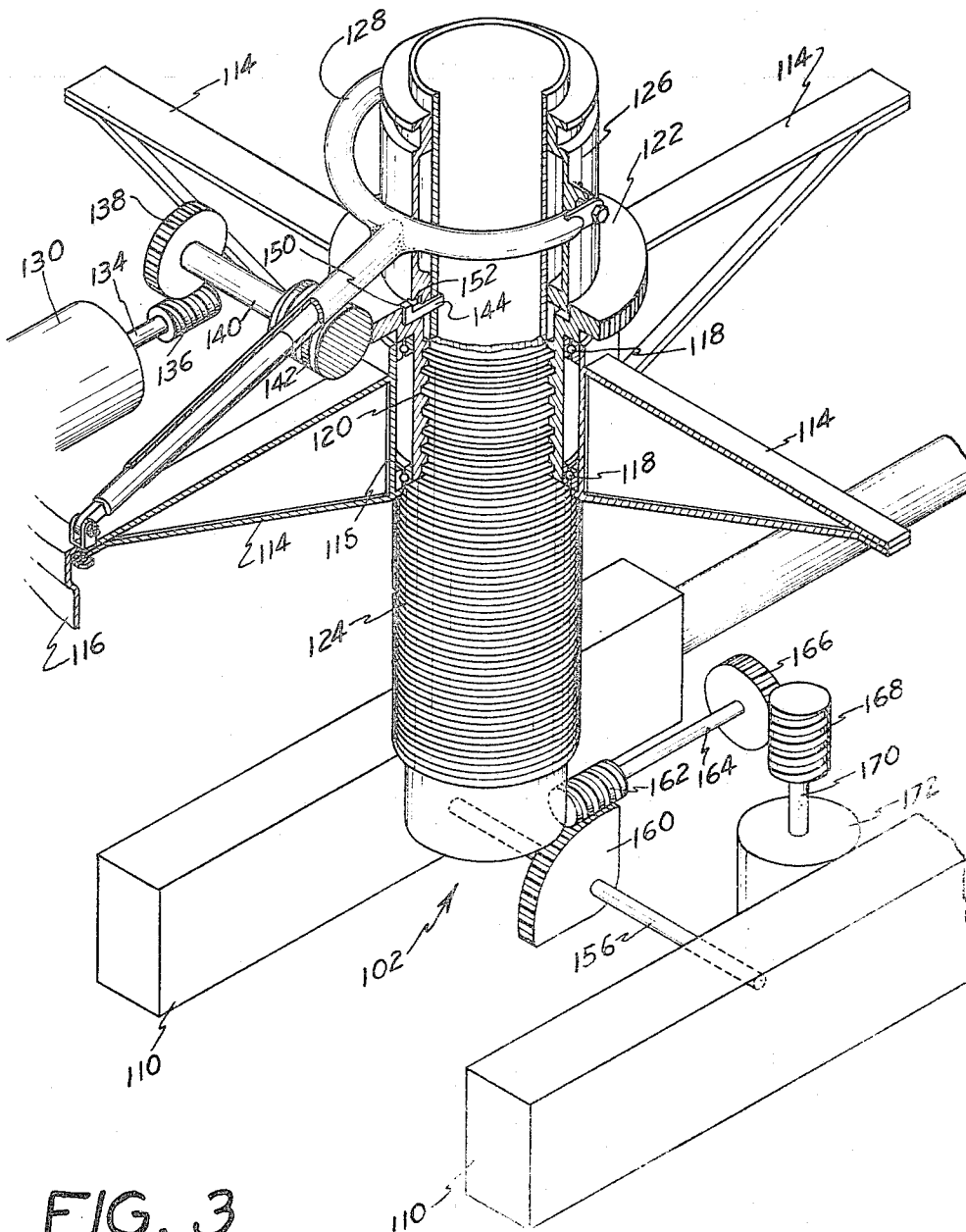
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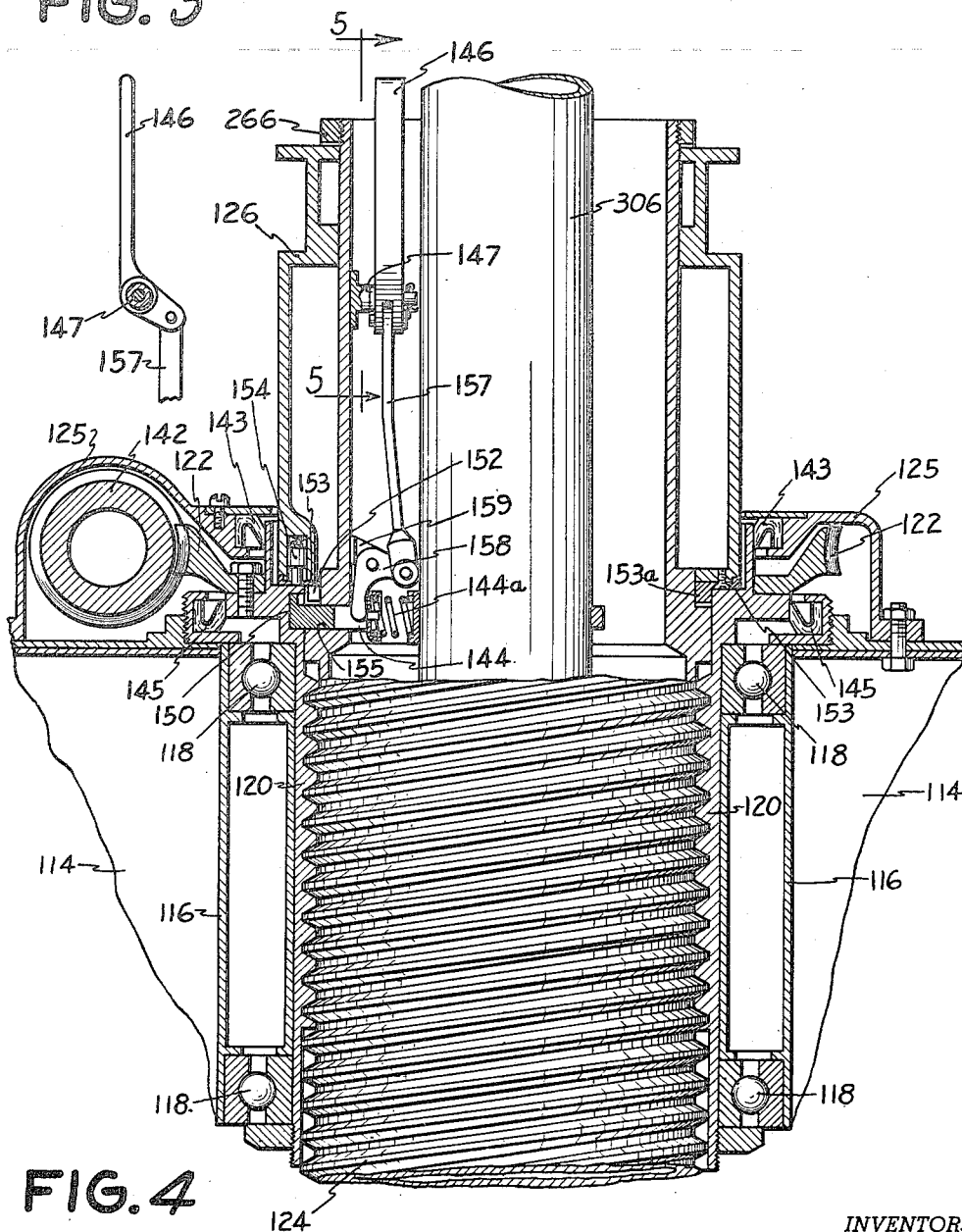
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FIG. 5



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GUN TURRET

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Application August 19, 1941, Serial No. 407,468

9 Claims. (Cl. 89—37.5)

This invention relates to gun turrets and particularly to turrets of the retractable type adapted for use in aircraft. Such a turret is described in Pontius application, Serial No. 391,911, filed May 5, 1941.

More particularly the invention relates to improvements in retractable turrets, and includes means for effecting retraction and rotative movement of such a turret, and comprehends the use of a single motor with said means to effect such movements. An important feature contemplates the prevention of rotative movement of such a turret until it has extended to the operating position.

It is, therefore, an object to provide a mechanism whereby a single power unit can selectively retract the turret or rotate it in azimuth.

It is another object to provide retracting means for a turret mounted on a single central column.

It is another object of our invention to provide a novel latch mechanism for connecting the central column of a turret selectively to a rotatable member and to a non-rotatable member.

It is a feature of our invention to provide automatic means to render the latch mechanism inoperative when the turret is in a retracted position.

These and other objects and advantages of the invention will appear in the following description and claims which may best be understood when considered in connection with the accompanying drawings, in which:

Figure 1 is a side view of an airplane having a retractable turret mounted in the bottom surface thereof, incorporating therein the improvements according to the present invention;

Figure 2 is an enlarged partly sectional view of the aircraft of Figure 1 in the region of the turret showing the turret in an extended or operative position;

Figure 3 is an isometric schematic showing of the turret in an extended position, partly in section and showing the mechanical parts and movements;

Figure 4 is a view in vertical section of the turret mechanism at the upper end of the central column showing the construction of the retract latch mechanism; and

Figure 5 is a detail view along the section 5—5 of Figure 4, showing the retract lever in profile.

Referring now to Figures 1 and 2 there is shown an airplane 100 having a turret 102 therein which incorporates the improvements forming this invention.

The mechanical parts relating to the move-

ment of the turret are shown in diagrammatic form in Figure 3 wherein the turret is shown in an extended position. The turret 102 is supported on a four-armed spider 114 which is secured to structural members such as 115 of an airplane and which has a central collar 116. Ball bearings such as 118 rotatably support an internally threaded sleeve 120 within collar 116, which sleeve has an upper ring gear portion 122. A threaded column 124 is threaded into sleeve 120 and is thereby supported within spider 114. A head unit 126 rotatably rides on the upper end of column 124 and is itself restrained from rotation by a telescoping yoke member 128 secured to the outer end of one arm of spider 114.

A single power source is used to rotate the sleeve 120 in order to rotate the turret in azimuth or optionally to retract and extend the turret. This power source is an electric motor 130 suitably secured to the spider 114. The motor 130 drives a motor shaft 134 to which is secured a worm screw 136. Worm screw 136 engages a worm wheel 138 which is secured to a drive shaft 140 having suitable bearings which will be later described. A worm screw 142 on shaft 140 engages ring gear 122, causing the sleeve 120 to rotate within spider collar 116. Through the gear train thus described, electric motor 130 is made to rotate sleeve 120. The motor 130 can be reversed by reversing the field current, thus reversing the direction of rotation of sleeve 120. The gear train provides a large reduction in rotation allowing the use of a very high speed motor, to provide a high power to weight ratio.

The column 124, and thereby the turret also, may be rotated in azimuth or retracted and/or extended, by selectively connecting column 124 with sleeve 120 or with non-rotatable head 126. This selective connection is performed by an L-shaped key 144 held in a hole through column 124 and selectively engaging an internal notch 150 in sleeve 120, or an external notch 152 in non-rotatable head 126. The mechanism for moving key 144 will be described later.

When key 144 engages notch 152 in non-rotatable head 126, column 124 is restrained from rotation. If motor 130 now rotates ring gear 122, and thereby sleeve 120, the column 124 will be raised or lowered according to the direction of rotation of sleeve 122. The head 126 is lowered or raised with column 124, and the yoke member 128 will telescope and extend and will act at all times to keep head 126 from rotating. In this way the extension and retraction of turret 102 is accomplished. When the turret 102 is ex-

tended the key 144 may be moved to engage notch 150 in sleeve 120 and the column 124 will rotate as sleeve 120 rotates, and thus provide the operative movement of rotation in azimuth. It will be noted that in such case the key 144 will be out of notch 152 and there is no restriction on the movement in azimuth. The column 124 can be rotated continuously in either direction for any given number of rotations.

Certain parts of the turret are fastened on the lower end of column 124. These parts include a rotatable shaft 156 to which the guns 110 are secured. A worm wheel sector 160 is secured to shaft 156 and is engaged by a worm screw 162 fastened to a drive shaft 164. Drive shaft 164 in turn is driven by a worm wheel 166 secured thereto, which is driven by a worm screw 168 secured to a motor shaft 170 of an electric elevation motor 172.

The elevating gear train and its actuating motor are adapted to elevate or depress the guns, depending upon the direction of rotation of motor 172, which is reversed by reversing the field. The guns 110 can be elevated above horizontal as far as is permitted by the shape of the airplane in which the turret is mounted, and can be depressed to point straight down. The elevation arc as will be described for purposes of illustration, will be limited to a 90° arc from horizontal to straight down.

The details of the upper end of the central column 124 of the turret are shown in Figure 4. The parts described with reference to diagrammatic sketch Figure 3 are readily distinguishable in Figure 4. Spider 114 supports central collar 116 within which internally threaded sleeve 120 rotates in bearings 118. Ring gear 122 is bolted to sleeve 120 and drives it. Central column 124 is held in threaded sleeve 120 and in this way supports the lower end of the turret. Housing 125 is mounted on spider 114, and encircles ring gear 122 and retains the driving train including worm screw 142 which drives ring gear 122. Housing 125 is sealed to prevent leakage of lubricant and to keep out dirt by an upper annular seal 143 and a lower annular seal 145, both of which are held in casing 125 and wipe a portion of sleeve 120 on either side of ring gear 122. Non-rotatable head 126 is held on the top of the column 124 by nut 266.

Figure 4 also shows the mechanism for selectively connecting column 124 to non-rotatable head 126 or to threaded sleeve 120. A recess in the inner side of sleeve 120 near the top forms the notch 150 referred to in Figure 3. An annular end plate 153 having a downwardly projecting flange 153a is screwed to the bottom of non-rotatable head 126. A notch cut in the flange acts as the notch 152 described with reference to Figure 3. A spring pressed button 154 is held in a recess in the bottom edge of head 126 by end plate 153. However, end plate 153 has an opening allowing a reduced head of button 154 to protrude therethrough at times. The L-shaped key 144 is fitted into an aperture 155 in column 124. By moving key 144 into sleeve notch 150 or into contact with head notch 152, the column may selectively be rotated, or retracted and/or extended respectively.

The mechanism for moving key 144 is attached to the inside of column 124. At the upper end of column 124a retract lever 146 is mounted on a pivot 147 welded to the inside of column 124. Lever 146 is shown in profile in Figure 5,

where it is shown to be a bent lever pivoted at the bend. The top part of lever 146 projects beyond the top of column 124 where the gunner can manipulate it as desired. The bent end of lever 146 is connected by a link 157 to one end of a bell crank 158 pivoted on an ear 159 welded to column 124. The other end of bell crank 158 is fitted in a slot in connector key 144 and acts against a compression spring 144a to pull the key 144 inward to contact notch 152 in head 126.

In normal operation, spring 144a causes key 144 to engage notch 150 in sleeve 120, connecting column 124 to sleeve 120. Column 124 (and also bottom part of the turret) will rotate according to the rotation of sleeve 120. If the gunner should now desire to retract the turret, he rotates the guns to point toward the rear, bringing the retracting-lever 146 on the forward or gunner side of a periscope tube 306, into a position as shown in Figure 2. While slowly rotating the guns in azimuth toward the rear position, the gunner presses on the lever 146 tending to move key 144 out of sleeve notch 150 and into head notch 152. When key 144 rotates with column 124 to a position opposite notch 152 the key 144 will be able to move into it, stopping the turret from further rotation. Sleeve 120 will continue to rotate, however, and will screw column 124 up into airplane.

When column 124 and head 126 have been retracted a small amount, the head of button 154 will project below end plate 153. If retract lever 146 should now be released, spring 144a would move key 144 outward until it contacted button 154. In this way button 154 acts as a stop for key 144 while the turret is retracted.

If, when the turret is retracted, the gunner wishes to extend it he merely reverses the direction of rotation of azimuth motor 130 from that required to retract the turret, and sleeve 120 will then screw the turret down. As the turret approaches the lower limit of extension, the outer end of key 144 will slide past the upper edge of sleeve 120 because button 154 keeps key 144 within that dimensional limit. At the same time button 154 will contact the top of sleeve 120 and be forced upwardly into its recess. At the lower limit of extension key 144 comes into alignment with notch 150 in sleeve 120 and is snapped into it by the action of spring 144a. Column 124 will then be at its lower limit of extension and will immediately start to rotate and the turret is ready for use.

Having described our invention fully, we do not intend to limit our invention to the embodiments shown or described, nor do we intend to limit our invention in any other way except by the terms of the following claims.

What is claimed is:

1. A turret for mounting guns in an airplane, means for extending said turret, means for preventing the extension of said turret beyond predetermined limits and for preventing unintended retraction of said turret comprising a notch, a key movable into said notch, and resilient means for moving said key into said notch whenever said turret is fully extended.

2. In an airplane, a bottom turret comprising a support, a rotatable internally threaded sleeve mounted in said support, a threaded column, a turret mounted on the bottom end of said column, power means to rotate said sleeve, a non-rotatable member adjacent to said column, and locking means on said column to lock said column to said

non-rotatable member and to automatically lock said column to said sleeve at the lower limit of extension of said turret.

3. In a gun turret adapted for use in an airplane and of the type which may be extended for operation or retracted to reduce wind resistance, a support secured to said airplane having an element mounted thereon for rotative and axial movement with respect to said support whereby the axially extending movement places said turret in operative position and whereby the axially retracting movement places said turret in a position to reduce wind resistance, means for effecting rotative or axial movement of said element, and means operable to cause rotative or axial movement of said element by the first said means, said means including a key and a notch associated with said key for insuring that said element is in proper rotational position before beginning retractive movement.

4. In a turret, a support, an internally threaded sleeve rotatable with respect thereto, a column threaded into said sleeve, a head mounted on said column and non-rotatable with respect to said support and rotatable with respect to said column, a telescoping connection between said support and said head, and means for connecting said column to said head or said sleeve.

5. In a turret, a support, an internally threaded sleeve rotatable with respect thereto and having a notch therein, a column threaded into said sleeve, a head mounted on said column non-rotatable with respect to said support and rotatable with respect to said column and adapted to contact said sleeve when the column is moved axially to one extremity of said sleeve, said head having a notch therein, a key held in said column, means to move said key inwardly and outwardly with respect to said column to engage the notch in said head and said sleeve respectively, and means contained within said head adapted to prevent the outward movement of said key while the column is moving axially with respect to said sleeve and adapted to permit the key to move outwardly when the head engages said sleeve whereby the key will engage the notch in said sleeve for rotative movement of said column.

6. In a retractible turret, a support having an element mounted thereon for rotative and axial movement with respect thereto, means for effecting rotative or axial movement of said element, and means operable to cause rotative movement or axial movement of said element by the first said means, wherein said second named means includes locking means to insure that the element has rotated to a predetermined position with respect to said support before axial movement of the element begins.

7. In a retractible turret, a support having an element mounted thereon for rotative and axial movement with respect thereto, means for effecting rotative or axial movement of said element, and means operable to cause rotative movement or axial movement of said element by the first said means, wherein said second named means includes means for precluding axial movement of said element beyond a predetermined limit.

8. A turret, adapted for use in an airplane, comprising a support, a rotatable mounting carried by said support, guns secured to the mounting for movement relative thereto, means for rotating said mounting, a well for housing said guns and mounting, means for retracting said guns and mounting into said well, and means comprising a notch and a key for engaging said notch to insure that the guns are properly positioned with respect to said well when said mounting is retracted.

9. A turret, adapted for use in an airplane, comprising a support, a rotatable mounting carried by said support and constructed and arranged to be extended and retracted, guns carried by said mounting, means for rotating said guns and mounting, a well for housing said guns and mounting, means for retracting said guns and mounting into said well, means comprising a notch and a key for engaging said notch to insure that the guns are properly positioned with respect to said well when said turret is retracted, and means for locking said guns against movement in azimuth until said mounting is fully extended.

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