

1,296,303.

4 SHEETS—SHEET 1.



A. J. Miller.
L. F. T. Norton

by *Charles M. Manly* **Inventor:**
W.B. Morlon, his **Atty.**

C. M. MANLY.
POWER DRIVEN ADJUSTING MECHANISM.
APPLICATION FILED JULY 23, 1912.

1,296,303.

Patented Mar. 4, 1919.
4 SHEETS—SHEET 2.

Fig. 2.

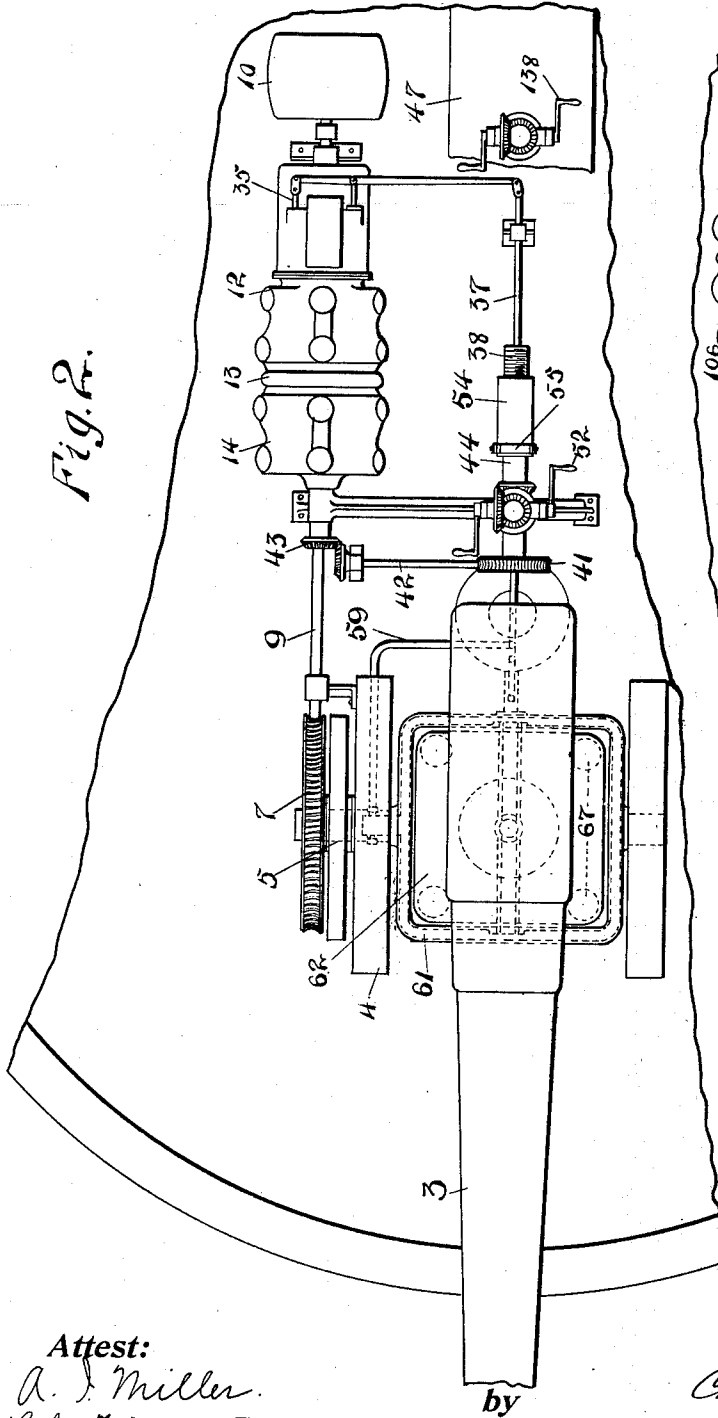
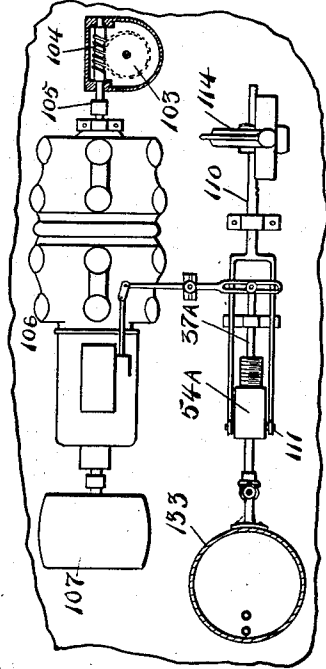


Fig. 3.



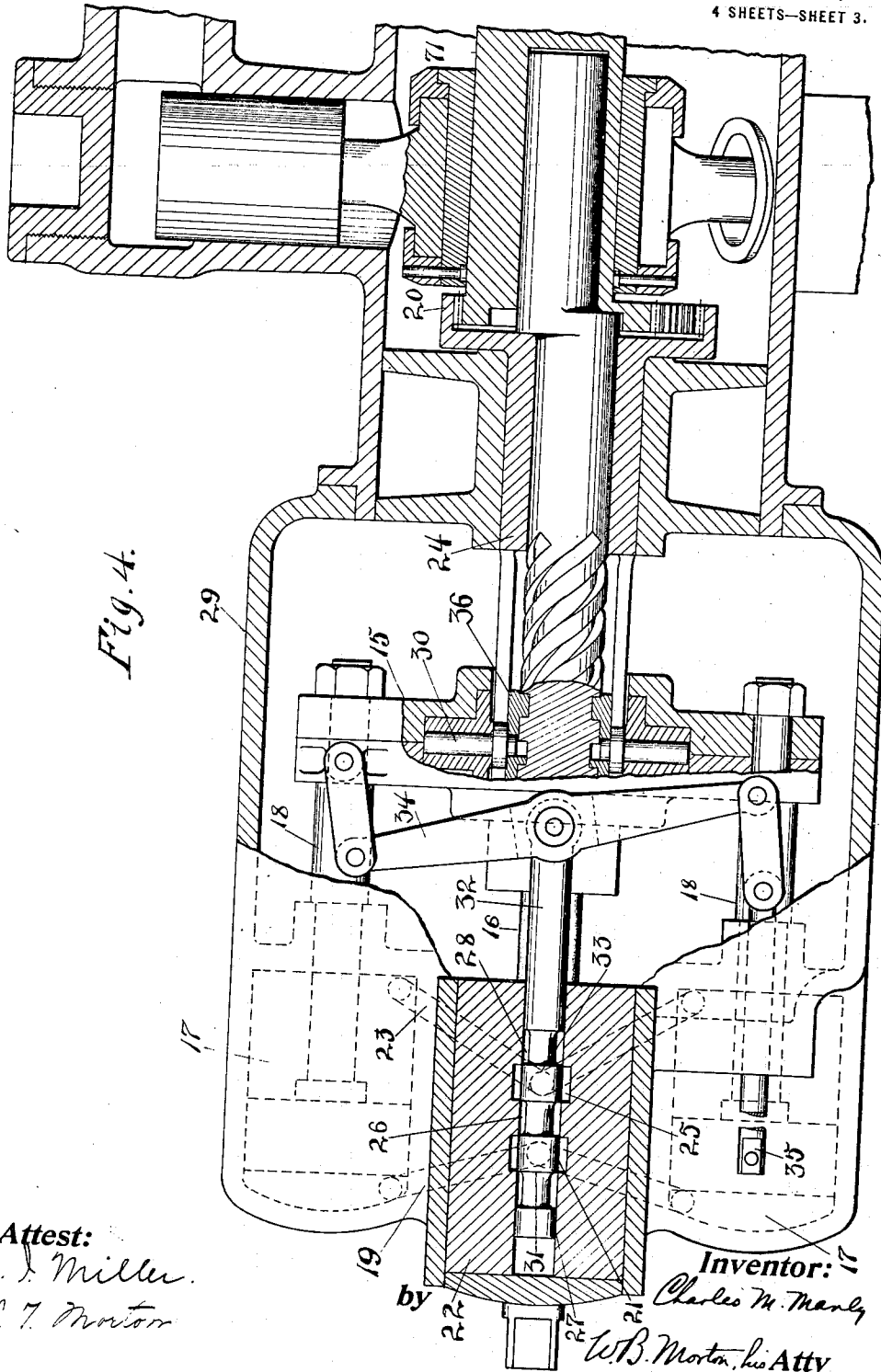
Attest:
A. J. Miller.
L. F. J. Morton

Inventor:
Charles M. Manly
W. B. Morton, his Atty.

1,296,303.

C. M. MANLY.
POWER DRIVEN ADJUSTING MECHANISM.
APPLICATION FILED JULY 23, 1912.

Patented Mar. 4, 1919.
4 SHEETS—SHEET 3.



Attest:

A. J. Miller.
L. L. T. Morton

Inventor:

Charles M. Manly

W. B. Morton, his Atty

1,296,303.

C. M. MANLY.
POWER DRIVEN ADJUSTING MECHANISM.
APPLICATION FILED JULY 23, 1912.

Patented Mar. 4, 1919.
4 SHEETS—SHEET 4.

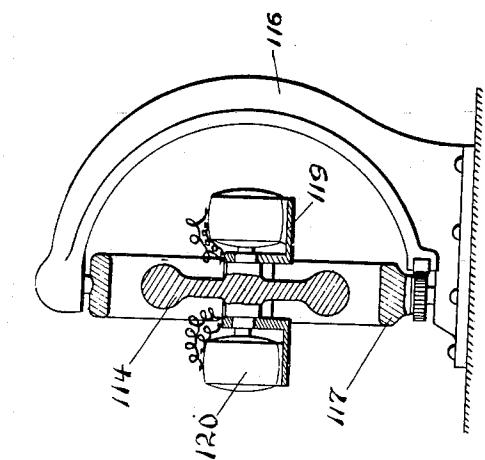


Fig. 6.

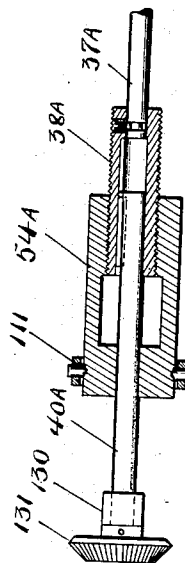


Fig. 8.

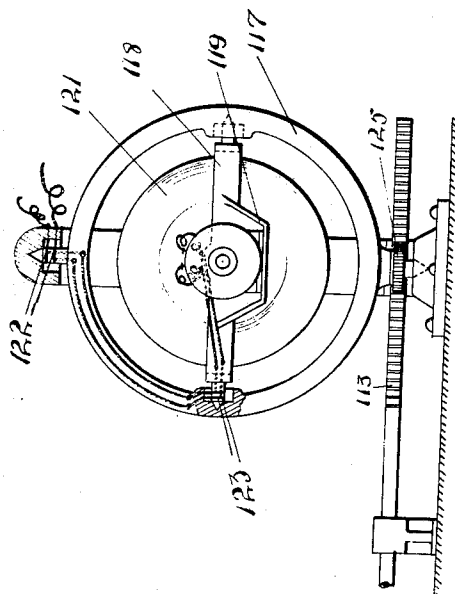


Fig. 5.

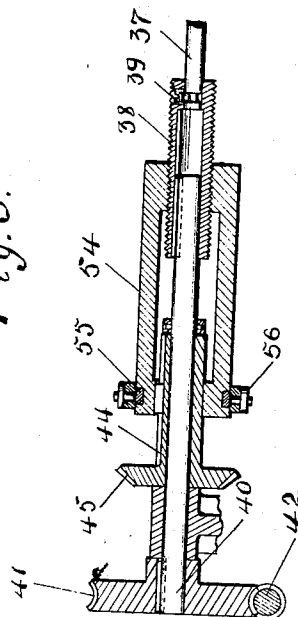


Fig. 7.

Attest:
A. J. Miller
L. F. Y. Morton

by

Inventor:
Charles M. Manly
W. B. Morton, his Atty

UNITED STATES PATENT OFFICE.

CHARLES MATTHEWS MANLY, OF FREEPORT, NEW YORK.

POWER-DRIVEN ADJUSTING MECHANISM.

1,296,303.

Specification of Letters Patent.

Patented Mar. 4, 1919.

Application filed July 23, 1912. Serial No. 711,189.

To all whom it may concern:

Be it known that I, CHARLES M. MANLY, a citizen of the United States, residing at Freeport, Long Island, N. Y., have invented a new and useful Improvement in Power-Driven Adjusting Mechanisms, of which the following is a specification.

This invention relates to power driven adjusting mechanism for training guns on shipboard, and particularly to power operated training mechanism such as employed for the large caliber guns of modern naval vessels.

The principal object of my invention is to provide a training mechanism of the class described with an automatic governing mechanism which will so control the power operated mechanism as to cause the axis of the gun to remain in a fixed line or a fixed plane irrespective of the motion of the ship on which it is mounted.

In modern naval vessels the large guns are almost universally mounted on carriages on rotatable turrets, and the guns themselves are adjustable on horizontal trunnions in their carriages. The turret and the gun have suitable power operated mechanism for effecting their adjustment as the parts are too heavy to be directly operated by hand, so that by suitably combining the two adjustments the guns may be pointed in any desired direction. However, in practice, the objects at which such guns are intended to be fired are usually in substantially the same horizontal plane as the gun and the range of the gun is such that it requires very little angular adjustment of the turret to compensate for the movement of the object, once the gun is brought to bear on it.

It will be clear, therefore, that the chief work of the gun crew to keep the gun trained on the object to be hit is to compensate for the rocking and turning movements of the ship on which the gun is mounted, in other words, to operate the training mechanism to move the gun in exact opposition to the movements of the ship. Hence, if the training mechanism be automatically controlled to maintain the gun in a fixed line in space, it is only necessary for the gun crew to operate the training mechanism sufficiently to compensate for the slight relative bodily movements of the vessel and

target and to correct such slight inaccuracies as may be present in the adjustment of the automatic control mechanism. By my improved mechanism the work of the gun crew is so greatly reduced, that niceties of adjustment and consistent accuracy of shooting heretofore thought impossible, are easily obtainable.

In the accompanying drawings I have illustrated my improved adjusting mechanism as applied both to the turret turning gear and also to the elevating gear on the gun carriage, but it is to be understood that said automatic mechanisms may be applied to either of said gears without being applied to the other. It is to be also understood that my invention is not limited to the details of construction here shown or to its use in connection with gun training gear, for so far as I am aware I am the first to provide a power operated adjusting mechanism for any purpose with an automatic controlling device which maintains the thing adjusted in a fixed plane irrespective of varying movements of its support.

In the said drawings:—

Figure 1 is a vertical section through a gun turret in which both the turret turning mechanism and the gun elevating mechanism are equipped with my improved automatic control mechanism.

Fig. 2 is a plan view of a portion of the turret with the upper portion of the armor removed showing the operating and control mechanism for adjusting the gun on its trunnions.

Fig. 3 is a partial plan view of the floor below the turret showing the turret turning mechanism.

Fig. 4 is a sectional view of a portion of the hydraulic variable speed gear employed for operating the gun and turret, the control of which is effected by the mechanism forming the subject-matter of this application.

Figs. 5 to 8 inclusive are detail views of portions of the mechanism which will be later described.

Referring now to the drawings, in which like characters represent like parts throughout the several views, 1 indicates a portion of the frame of the vessel on which the turret 2 is rotatably mounted in the usual manner. The gun 3 is mounted by means of trun-

nions on a gun carriage 4 fixed to the floor of the turret at its center.

One of the trunnions projects beyond its bearings as shown, and is provided with a gear segment 5 meshing with a pinion 6 mounted on a short shaft carried by the gun carriage, to which shaft is also attached a worm wheel 7 meshing with a worm 8 on the driven shaft 9 of the power operated adjusting mechanism. This mechanism, for which I make no claim of novelty in this application, comprises an electric motor 10, which may be run continuously if desired whenever the gun crew are at drill, as a prime mover, and a hydraulic variable speed gear indicated generally by the numeral 11, intermediate the electric motor and the shaft 9. The hydraulic gear here disclosed is of the type covered in my prior Patent No. 801,097 dated October 3, 1905, and more specifically of the construction disclosed in my co-pending application Serial No. 639,434 filed July 19, 1911, and comprises briefly a multiple radial cylinder pump 12 connected by intermediate fluid transmitting passages 13 with a hydraulic motor 14 of generally similar construction. The pump, passages and motor form a closed fluid circuit so that the fluid pressure generated by the pump operates the motor, the exhaust side of the motor being connected to the intake side of the pump whereby the same fluid is used over and over again as a power transmitting mechanism. In order to vary the speed and direction of rotation of the motor relative to the speed of the constantly driven pump, the shaft of the pump is provided with a variable throw crank whose crank pin is adjustable from a maximum through the center of rotation, or zero, and again to a maximum, and as the valve mechanism of the pump is so arranged that when the stroke is adjusted through zero the direction of flow of the fluid in the connecting passages 13 is reversed, the direction of rotation of the hydraulic motor will also be reversed at this point in the adjustment.

In the application above mentioned I have disclosed a fluid pressure operated mechanism for adjusting the eccentric bushing around the crank pin in the manner described, and in Fig. 4 I have shown such portions of this pump as directly cooperate with the automatic control mechanism of my present invention. As there shown, 15 indicates a yoke slidably mounted on the pump shaft 16 and connected to the eccentric bushing by means of a gear 20 on a sleeve 24 having slots through which pass pins 30 carried by the yoke and attached to a nut 36 mounted on a thread on the shaft 16 so that longitudinal movement of the yoke from one extreme position as shown, to the other, varies the speed of the hydraulic motor from full speed in one direction of rotation

through zero at its middle position to full speed in the opposite direction of rotation. To operate the yoke 15 in the manner described two horizontal cylinders 17 are formed in the pump casing and in each of these cylinders a piston is mounted, the rods 18 of which are connected to the yoke 15. Fluid passages 19 in the casing connect the front ends of both the cylinders 17 with a port 21 in a block 22 in which the control valve mechanism is mounted. The rear ends of both the cylinders are connected by passages 23 to a port 25 in the block 22. Between the ports 21 and 25, a port 26 is formed in the block 22 and this port is at all times charged with fluid under pressure from the passages 13 of the hydraulic gear or from any other suitable source, not shown; adjacent the port 21 is a port 27 and adjacent the port 25 is a port 28 and from these ports the fluid may exhaust into the casing 29 of the pump or elsewhere as desired. All the ports just described form a bore in which is mounted a control valve 32 having heads 31, 33, normally closing the ports 21 and 25. The end of the valve 32 projects beyond the end of the block 22 into the casing 29 and is connected to a floating lever 34 at a point intermediate the ends of the lever. One end of the lever 34 is connected to the yoke 15 and the other end is connected to a rod 35, which projects through the front wall of the casing. It will be understood that when the rod 35 is shifted in one direction or the other, say to the left as shown in Fig. 4, the lever 34 will turn on its connection with the yoke 15 as a pivot and move the valve 33 in the same direction thereby connecting the port 21 leading to the front end of the cylinders 17 with the port 26 containing fluid under pressure and at the same time connecting the port 25 leading to the rear ends of the cylinders with its adjacent exhaust port 28 thereby causing the yoke 15 to be shifted toward the right and, as previously explained, reducing the speed of the hydraulic motor. It will be obvious, however, that when the yoke is adjusted as described, the lever 34 will turn on its connection with the rod 35 as a fulcrum and will move the valve 33 to the right, closing the ports 21 and 25 when the yoke has moved a distance corresponding with the movement given the rod 35, and therefore for every definite position of adjustment of the rod 35 the yoke 15 has a certain definite position and the hydraulic motor has a definite speed relative to that of the electric motor.

Slidably mounted in suitable bearings parallel with the axis of the hydraulic gear is a rod 37 having one end attached by suitable link and lever connections to the end of the control rod 35 (see Figs. 1, 2 and 7). On the other end of this rod an external screw

threaded sleeve or nut 38 is rotatably mounted but held against longitudinal movement relative to the rod by means of a pin 39 engaging a circumferential groove near the end of the rod, as shown in Fig. 7. Aligned with the rod 37 and rotatably mounted in suitable bearings is a shaft 40 having a keyed connection with the nut 38 whereby the nut is rotated with the shaft 40 but is free to move longitudinally with the rod 37. Attached to the shaft 40 adjacent its opposite end is a worm wheel 41 whereby the shaft is rotated from the driven shaft 9 of the hydraulic motor through an intermediate shaft 42 having a worm engaging the worm wheel and connected by bevel gears 43 with the shaft 9. Freely rotatable on the shaft 40 but held against longitudinal movement is a sleeve 44 to which is keyed a second sleeve 54 having a threaded engagement with the nut 38. The sleeve 54 has a loose collar 55 near one end which is engaged by a "shipper" fork 56 formed on a bell-crank lever 57 fulcrumed in a standard 58 to rock in the same plane as the gun. Beneath the gun, at the center of the turret is a device known as a "tower steady table" which has the function of maintaining its upper surface in a horizontal plane irrespective of the rapidity or amplitude of the angular movements of its support. This device depends for its operation on the principle of the gyroscope, but holds its horizontal plane with greater accuracy than any other form of gyroscope of which I am at present aware. This mechanism is fully described in U. S. Patents Nos. 366,438, 464,806 and 640,051 and forms *per se* no part of my invention. I have therefore shown in the drawings only so much of the apparatus as necessary to illustrate its principle of operation. Referring particularly to Fig. 1 it will be noted that two pipes 59, 60 lead to the turret floor at its center, which pipes are connected by a double swivel joint with two similar pipes shown broken off but to be understood as extending to a suitable pump which delivers fluid under pressure to the pipe 59 and receives exhaust fluid from the pipe 60. The pipe 59 connects with a passage in the gun carriage which connects with the bearing of a hollow gimbal arm or square ring 61 trunnioned to oscillate on an axis parallel with the axis of oscillation of the gun as effected through the adjusting mechanism described.

The so-called table 62 of the apparatus is mounted on the arm 61 on trunnions at right angles to the trunnions of the arm and the fluid pressure in the pipe 59 passes through the trunnions and through suitable passages, to the socket of a ball joint 63 whereon the momentum wheel 64 of the gyroscope is rotatably mounted. A passage is formed in the ball of the joint which connects with a nozzle 65 in line with the axis of rotation of

the wheel and has radial branches extending to the periphery of the wheel and there ending in tangential nozzles 66, the reaction of the discharge from which maintains the wheel in rapid rotation.

At each corner of the table 62 a cylinder 67 is formed in each of which is fitted a piston whose rods are connected to standards 68 mounted on the floor of the turret by ball joints in the same horizontal plane as the joints of the gimbals. The greater portion of the fluid from the pipe 59 is discharged through the nozzle 65 against the under surface of the table 62. At the exact center of the surface passages in the table to the cylinders 67 meet in a circular opening which is divided by radial partitions into four sector-shaped orifices of equal area, so that when the plane of the table is exactly parallel with the plane of rotation of the gyroscope wheel each cylinder will receive the same amount of fluid and will be maintained in that plane. When the ship rocks and the plane of the floor moves out of the horizontal, the table 62 will tend to move with it, but as the gyroscope wheel maintains its horizontal plane the least movement of the table will take the center of the sector-shaped orifices out of line with the center of the nozzle 65 so that certain of the cylinders 69 will receive more fluid than the others and thereby shift the table until it is again parallel with the gyroscope wheel. It has been found in practice that the table of the mechanism described when mounted on shipboard will maintain itself within one degree of the horizontal even in rough weather.

The arm 70 of the bell-crank 57 extends under the gun and is connected by a suitable arm 72 attached to the gimbal ring 61 at a point in line with the axis of the table 62. The arm 72 is in the plane of the axis of the gimbal ring 61, hence the movement of this point relative to the floor of the turret will exactly measure the angular deviation of the floor of the turret from the horizontal about the axis of the gimbal ring 61 and as the axis of the gun is parallel with that of the ring, this movement is an exact measure of the corrective movement that must be given the gun to maintain it horizontal.

Attached to the sleeve 44 is a bevel gear 45 in mesh with a similar gear on the end of the shaft 46 which projects upwardly through the gunner's platform 47 behind the gun carriage and has a bearing in a stand 48 in line with the gun. A gear 49 is attached to the end of the shaft 46 and engages a gear 50 attached to a transverse shaft 51 extending across the top of the stand and provided at each end with oppositely arranged handles 52 for operation by the gunner.

A brake may if desired be applied to the trunnion of the gimbal ring 61, said brake being operatable from the gunner's platform

by suitable means to lock the ring against movement for a purpose hereinafter set forth.

The operation of the mechanism will now be described. Let it be assumed that the pump of the hydraulic gear is at its zero position of adjustment and that movement of the rod 37 to the right as shown in Figs. 1 and 2 from its zero position puts the hydraulic motor in operation in a direction to depress the muzzle of the gun. Now, suppose the ship rocks in a direction to move the muzzle of the gun upward. The steady table will maintain its horizontal position and will thereby cause the end of the bell-crank 57 connected thereto to move away from the floor of the turret, shifting the sleeve 54 to the right and with it the nut 38 and rod 37 thereby setting the hydraulic motor in motion in a direction to return the gun to the horizontal. But the rotation of the motor shaft through the gears 43 and shaft 42 rotates the shaft 40 and nut 38 which through its threaded connection with the sleeve 54, assuming the sleeve to be held stationary by the gunner through the hand cranks 52, is drawn in to the sleeve 54 tending to counteract the effect of the bodily movement of the sleeve on the rod 37. The rate of movement of the sleeve is directly proportional to the rate of rocking movement of the boat, and hence to the speed at which the hydraulic motor must be driven to maintain the gun in a horizontal plane. It is not the position of the sleeve 54 which determines the position of the rod 37 and consequently the speed of the motor, for as soon as the movement of the sleeve begins the hydraulic motor is set in motion and begins to move the nut in opposition to the movement of the sleeve. If the speed of the motor is sufficient to cause the nut to move longitudinally of the sleeve faster than the sleeve is moved by the bell-crank the rod 37 will be moved toward its zero position, thereby reducing the speed of the motor and consequently the rate of movement of the nut until the rate exactly equals the rate of movement of the sleeve in which position the rod 37 will remain stationary and the motor will be driven at a constant speed.

In practice, however, it has been found that the rocking movements of a ship follow closely the laws of the pendulum, that is, assuming the ship to be in a position of maximum inclination relative to the horizontal, she rocks toward the horizontal with a constantly increasing rate of angular movement until the horizontal is reached and then in the same direction away from the horizontal with a constantly decreasing rate of movement until the opposite maximum inclination is reached. The direction of movement then reverses and the ship re-

turns to the horizontal with an increasing velocity and then continues with a decreasing velocity to her first mentioned position. Throughout what may be termed the "increasing" portion of the cycle of motion the rod 37 will be moved steadily away from its zero position, for, as fast as the rotation of the shaft 40 draws the nut back in the sleeve the acceleration of the sleeve causes it to move the nut and rod that much faster toward its full speed position. In the "decreasing" portion of the cycle the opposite movement takes place. The speed of movement of the sleeve being checked, the motor continuing for a fraction of an instant to run at its previous speed causes the nut to run back into the sleeve before the speed of the motor is checked to correspond to the rate of movement of the sleeve. As the rate of movement of the sleeve constantly decreases the nut is drawn farther and farther back into the sleeve until when the sleeve stops at the moment of reversing its movement the nut has drawn the rod 37 back to its zero position. The sleeve will now move in the opposite direction but the rod will continue to move in the same direction that it did during the "decreasing" portion of the cycle, for now the rate of movement of the sleeve is increasing and consequently the nut is moved bodily to the left faster than it is moved to the right by being screwed out of the sleeve by the reversed movement of the hydraulic motor as effected by moving the control rod from one side to the other of its zero position.

By means of the handles 52 the gunner may correct any inaccuracies in the training of the gun as effected by the "steady table." By turning the hand cranks in a direction to cause the sleeve 44 and consequently the sleeve 54 to rotate in the same direction as the nut 38 the effect of the bodily movement of the sleeve will be augmented to an extent proportional to the speed of movement of the hand cranks, whereas if the sleeve be turned in a direction opposite to that of the nut the effect of the bodily movement of the sleeve is nullified to just that extent. It is obvious also that the entire control of the speed gear may be effected through the hand cranks. Should the "steady table" be rendered inoperative either through accident or by means of a brake so that the sleeve 54 is held against longitudinal movement by means of the fork on the bell-crank, the rod 37 may be shifted longitudinally by the rotative movement of the sleeves 44 and 54. Whenever the hydraulic motor is in motion the nut 38 is rotated in a direction to cause the control rod of the hydraulic gear to return to its zero position so that when the sleeve 54 has no longitudinal movement, the hydraulic motor is kept in motion by continuously rotating

the hand cranks in the direction and at a speed proportional to the speed desired. It will of course be understood that the original aim of the gun as well as a change of aim from one object to another is effected by the handles 52.

In Figs. 1, 3, 5, 6 and 8 I have shown my automatic control mechanism applied to the gear for rotating the turret. Beneath the floor of the turret and rigidly attached thereto is a circular rack 100.

Mounted in suitable bearings adjacent this rack is a shaft 101 provided with a gear 102 meshing with the rack and at its lower end with a worm wheel 103 in operative engagement with a worm 104 formed on or attached to the motor shaft 105 of a hydraulic gear 106, similar in all respect to the gear employed for operating the elevating gear and driven in a similar manner by an electric motor 107. The hydraulic gear 106 is provided with a control mechanism generally similar to that provided for the gear of the elevating mechanism, but is provided with a different actuating mechanism as will now be described. Mounted on the frame of the ship adjacent the sleeve 54^A of the control mechanism is a guide 109 in which is slidably mounted for movement in a horizontal plane an L-shaped bar 110 having on one of its arms a fork 111 engaging pins on the sleeve 54^A, its other arm being provided with a rack bar 113 slidably mounted in a suitable bearing in the base of a gyroscope 114. This gyroscope may be of any suitable construction which enables it to maintain a fixed vertical plane. As shown, it comprises a semi-circular frame 116 in which is mounted, for rotation on a vertical axis, a ring 117, which in turn has bearings at right angles to its own bearing, in which is rotatably supported an elliptical ring 118. Brackets 119 are supported on the ring 118 at diametrically opposite points midway between the bearings of the ring and on these are mounted small electric motors 120 having a common shaft on which is mounted a gyroscope wheel 121, this shaft being at right angles to the axis of rotation of the ring 118. The current for operating the motors 120 reaches there from any suitable source through brushes 122 which are in contact with suitable rings on the shaft of the ring 117. Suitable conductors connect these rings with brushes 123 mounted on the ring 117 and in contact with rings on the shaft of the ring 118, the motors being connected by suitable conductors with the rings. A gear 125 is rigidly attached to the spindle of ring 117, and the teeth of this rack are in mesh with the teeth of the rack 113. The sleeve 54^A is mounted for longitudinal movement but held against rotary movement by the fork 111. Adjacent the sleeve is a bearing 130 in which is rotatably mounted

the shaft 40^A to which the nut 38^A of the control mechanism is attached as described in connection with the elevating mechanism. Attached to the shaft 40^A is a bevel gear 131, which gear is driven through suitable intermediate gearing from a large bevel gear 132 rotatably mounted on the stationary tubular shaft or casing 133 at the center of the turret. The gear 132 is provided with bevel gear teeth on its upper face which mesh with a spur gear 135 on the end of a shaft 136 mounted in suitable bearings under the floor of the turret, and the shaft 136 is connected by suitable gearing with a pair of control handles 138 similar to the handles 52 and mounted on a stand 139 on the gunner's platform behind the stand 48.

The operation of the turret control mechanism will be obvious from the description of the operation of the gun elevating mechanism given above. When current is supplied to the motors 120 the gyroscope wheel 121 will be maintained in rapid rotation and according to its well known laws it will maintain itself and consequently the ring 117 in the plane in which it happens to be when the motors are set in motion, the gimbal ring support for the gyroscope wheel permitting the axis of the wheel to remain horizontal irrespective of the rocking of the ship. Hence when the ship alters her course or is otherwise moved out of its line of direction the gear 125 will operate the bar 110 to actuate the control rod of the hydraulic gear and turn the turret in exact opposition to the movement of the ship. As the turret turns the bevel gear 132 is rotated in the same direction (it being assumed for the moment that the shaft 136 is held against rotation on its own axis by the gunner) and, through the described connections, rotates the shaft 40^A and nut 38^A in a direction to return the control rod to zero in opposition to the longitudinal movement of the sleeve 54^A.

If the automatic control needs correction the gunner can rotate his hand wheels in one direction or the other to accelerate or retard the gear 132 to the extent needed, and if it be desired to control the turret entirely by hand the fork 111 may be fixed against movement in any suitable manner.

While I have shown my improved automatic control mechanism applied to a hydraulic variable speed gear of the type shown and described in my prior Letters Patent and application, it is by no means limited to such use but may obviously be applied to any gun elevating or turret controlling gear susceptible of hand control. The hydraulic gear described is however particularly adaptable for use with my improved control mechanism for the reason that the actual work of adjusting is done by the fluid pressure of the gear; hence there is

no reaction or load on the parts shifted by the "steady table" or gyroscope to interfere with their accuracy of operation.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is—

1. In a mechanism of the class described, the combination of a support, an element movably connected to said support, power operated means for relatively adjusting said element and said support at varying speeds and a control mechanism for said power operated means operating automatically to cause said power operated means to maintain an axis of said element parallel with a fixed line irrespective of movements of said support in any direction and at varying speeds.

2. In a mechanism of the class described, the combination of a support, an element movably connected to said support, power operated means for relatively adjusting said element and said support at varying speeds and a control mechanism for said power operated means operating automatically to cause said power operated means to maintain an axis of said element parallel to a fixed vertical line irrespective of movements of a corresponding dimension of said support out of said plane and at varying speeds.

3. In a mechanism of the class described, the combination of a support, an element movably connected to said support, power operated means for relatively adjusting said element and said support at varying speeds and a control mechanism for said power operated means operating automatically to cause said power operated means to maintain an axis of said element in a horizontal plane and parallel with a fixed vertical plane, irrespective of movements of said support in any direction and at varying speeds.

4. In a mechanism of the class described, the combination of a support, an element movably mounted thereon, a power operated means for adjusting said element relative to said support and a control mechanism actuated by movement of said support for causing said power operated means to adjust said element relatively to said support at a speed and to an extent corresponding to the speed and extent of movement of said support.

5. In a mechanism of the class described, the combination of a support, an element movably mounted thereon, a power operated means for adjusting said element relative to said support, a control mechanism actuated by movement of said support for causing said power operated means to adjust said element relatively to said support at a speed and to an extent corresponding to the speed and extent of movement of said support, and means for varying the effect of said control mechanism.

6. In a mechanism of the class described,

the combination of a support, an element movably mounted thereon, a power operated means for adjusting said element relative to said support, a control mechanism actuated by movement of said support for causing said power operated means to adjust said element relative to said support at a speed and to an extent corresponding to the speed and extent of movement of said support, and manually operatable means for controlling said power operated means.

7. In a mechanism of the class described, the combination of a support, an element movably mounted thereon, a power operated means for adjusting said element relative to said support, a control mechanism actuated by movement of said support for causing said power operated means to adjust said element relative to said support at a speed and to an extent corresponding to the speed and extent of movement of said support, and manually operatable means for controlling said power operated means and for varying the effect of the movement of said support on said control mechanism.

8. In a mechanism of the class described, the combination of an element to be angularly adjusted, a power operated device for adjusting said element, said device having a movable control member whose speed and direction of movement determine the speed and direction of movement of the said element, a member carried by said support and adapted to maintain itself in a fixed plane irrespective of movements of said support, and connections between said control member and said last mentioned member whereby relative movement of said support and said last mentioned member actuates said control member to maintain said element to be adjusted in a plane parallel with the plane of said member.

9. In a power operated adjusting mechanism, the combination of an element to be adjusted, a support for such element, a power operated device for adjusting said element relatively to said support, said mechanism embodying a variable speed reverse gear, an automatic control means for said gear operated by angular movement of said support with relation to a fixed plane to cause said gear to adjust said element relatively to said support in an opposite direction to the direction of movement of said support and at a corresponding speed.

10. In a power operated adjusting mechanism, the combination of an element to be adjusted, a support for such element, a power operated device for adjusting said element relatively to said support, said mechanism embodying a variable speed reverse gear, an automatic control means for said gear comprising a movable control member whose speed and direction of movement determine the speed and direction of movement of said

element, said member being operated by angular movement of said support with relation to a fixed plane to cause said gear to adjust said element relatively to said support
5 in an opposite direction to the direction of movement of said support and at a corresponding speed.
In testimony whereof, I, CHARLES M.

MANLY, have signed my name to this specification in the presence of two subscribing witnesses, this 20th day of July, 1912.

CHARLES MATTHEWS MANLY.

Witnesses:

W. B. MORTON,

A. I. MILLER.