No. 621,364.

Patented Mar. 21, 1899.

L. OBRY.

DEVICE FOR STARTING TORPEDOES.

(Application filed May 28, 1898.)

(No Model.)

3 Sheets—Sheet 1.

Fig. 1

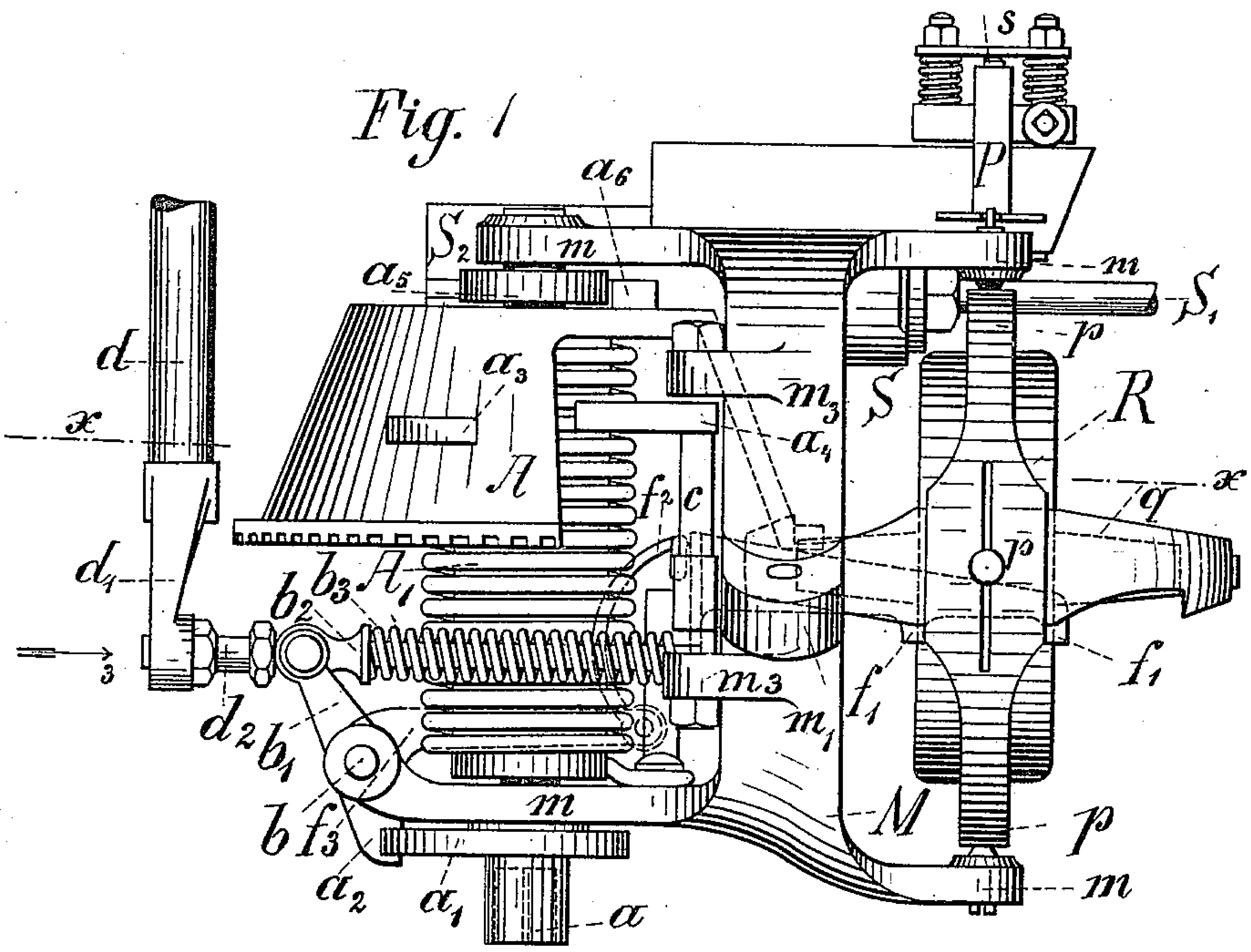
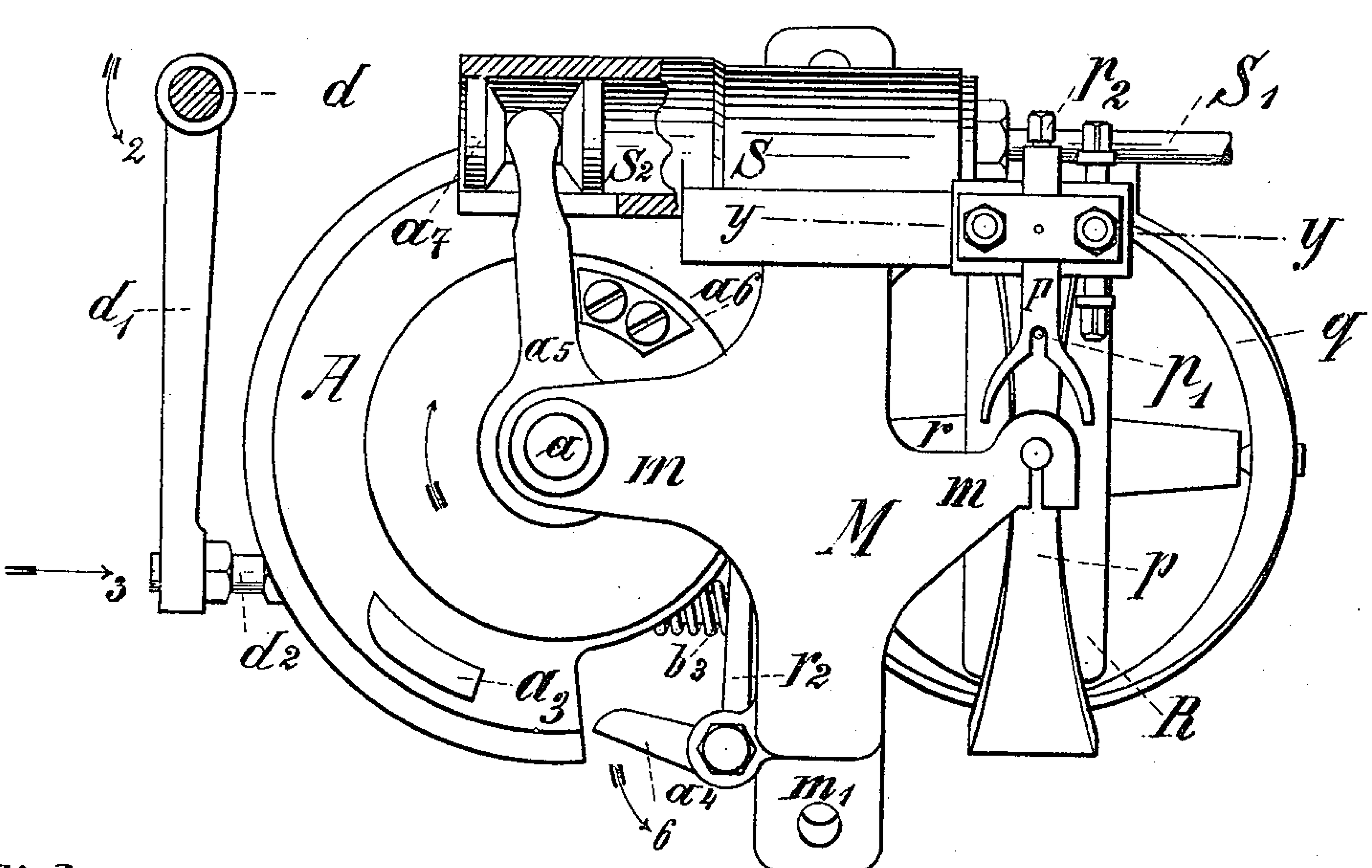


Fig. 3



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3 Sheets—Sheet 2.

Fig. 2

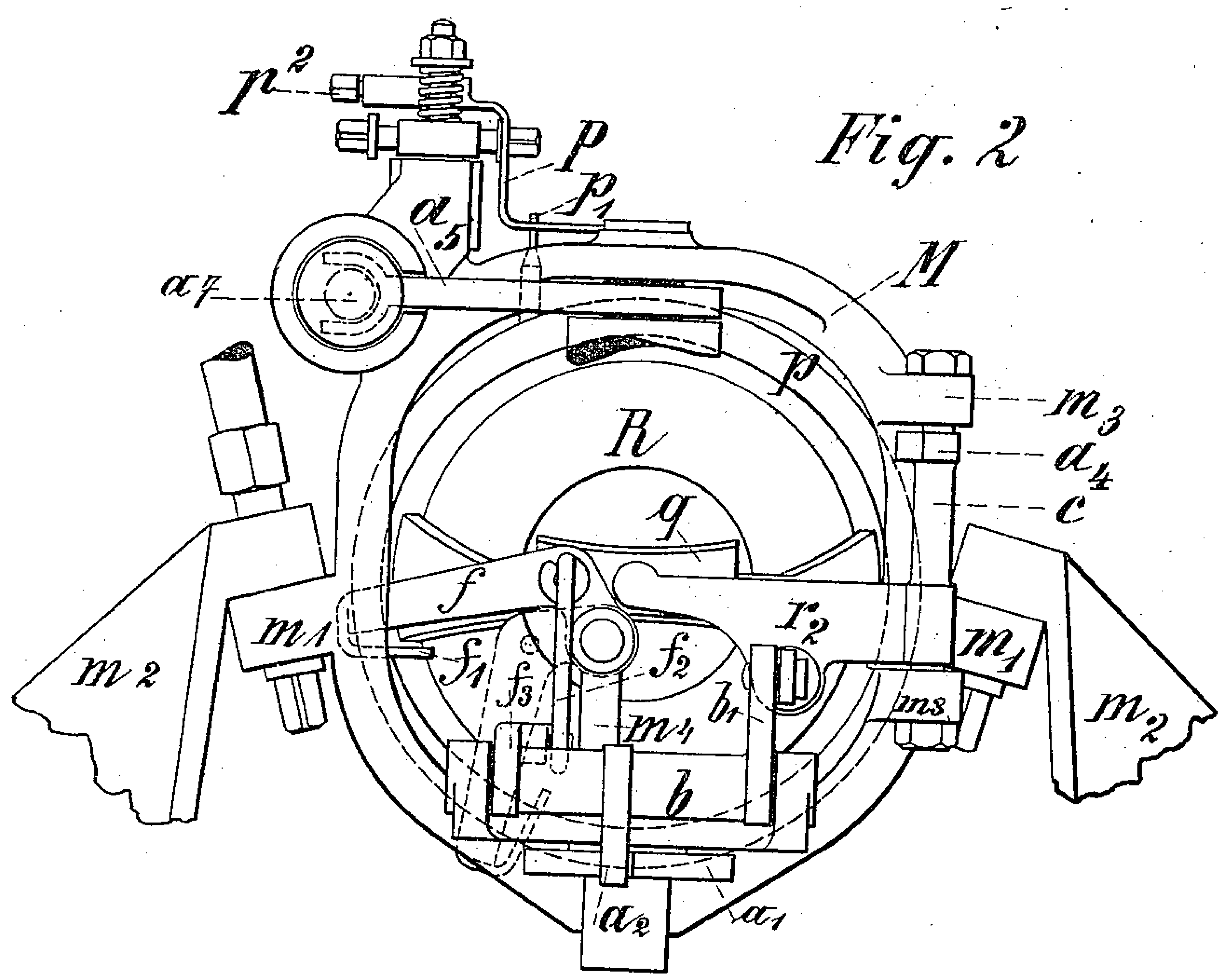
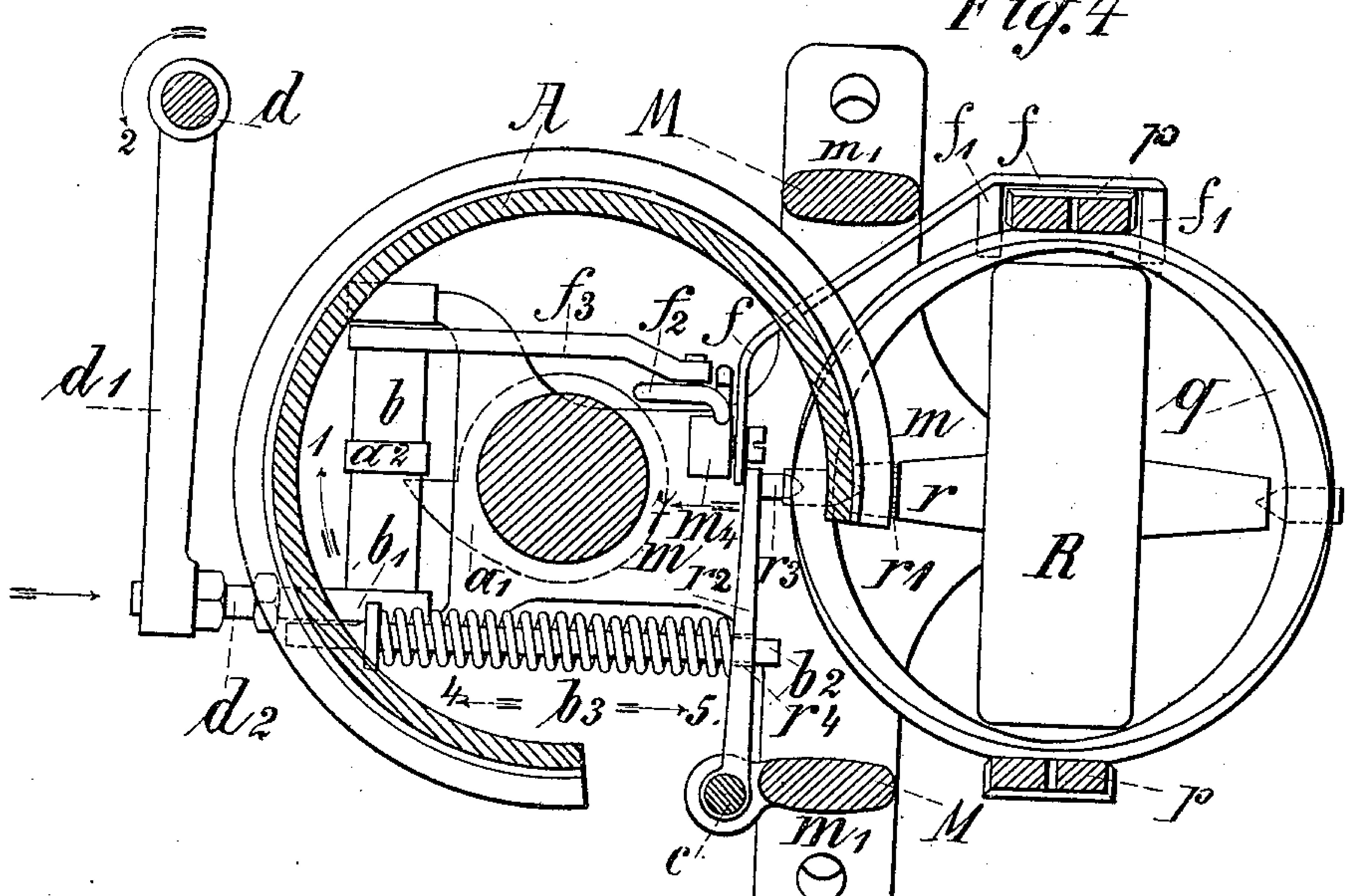


Fig. 4



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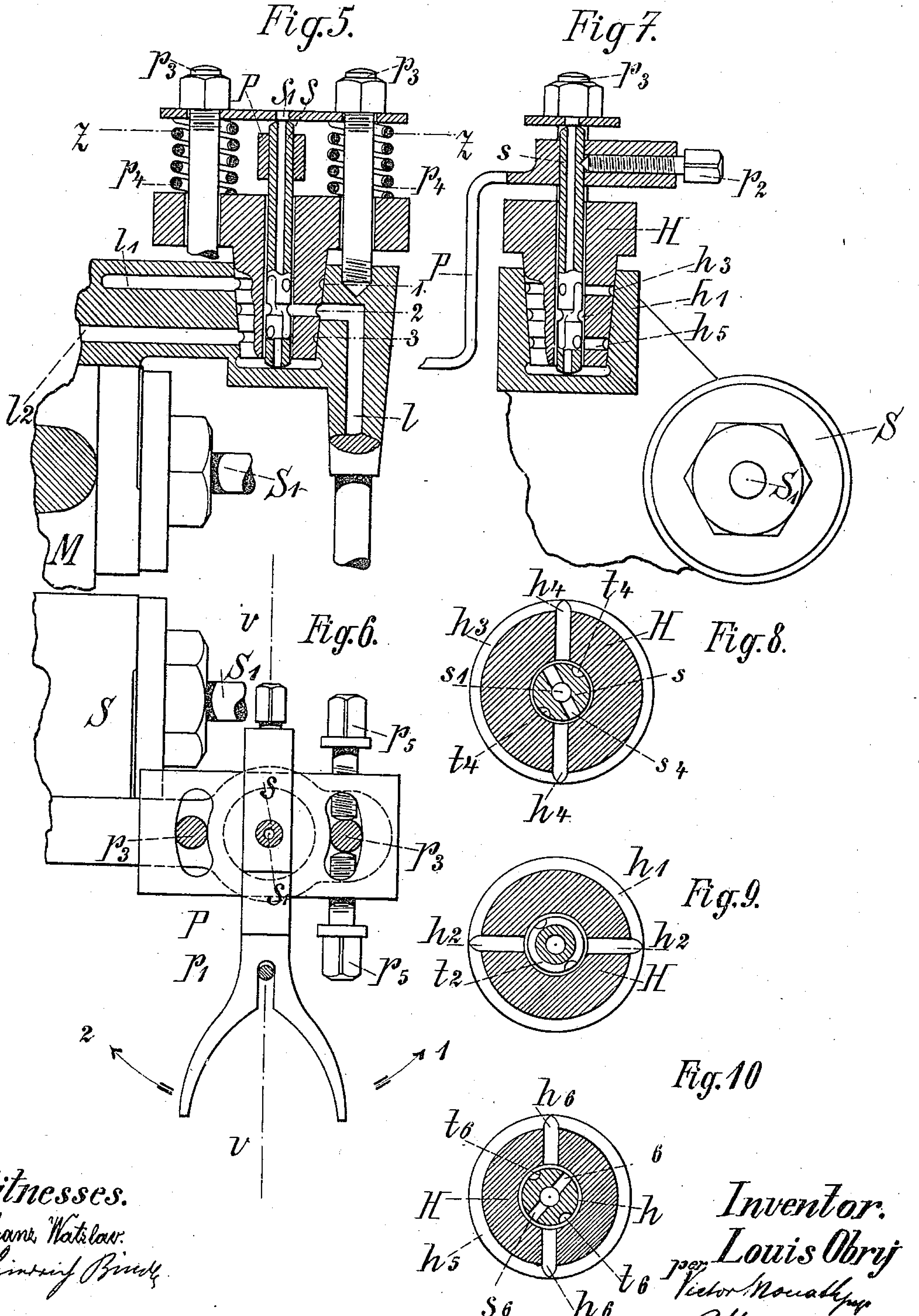

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UNITED STATES PATENT OFFICE.

LUDWIG OBRY, OF POLA, AUSTRIA-HUNGARY.

DEVICE FOR STARTING TORPEDOES.

SPECIFICATION forming part of Letters Patent No. 621,364, dated March 21, 1899.

Application filed May 28, 1898. Serial No. 682,064. (No model.)

To all whom it may concern:

Be it known that I, LUDWIG OBRY, a subject of the Emperor of Austria-Hungary, residing at Pola, Empire of Austria-Hungary, have invented certain new and useful Improvements in Devices for Starting Torpedoes, of which the following is a full, clear, and exact description.

This invention relates to certain improvements in the device for steering torpedoes protected by my United States Patent No. 562,235, granted June 16, 1896.

These improvements have reference to a novel arrangement for adjusting the fly-wheel shaft in its normal position before starting, retaining such shaft in place while in operation, and releasing the same after the rotary impulse has been imparted to it, and, furthermore, these improvements extend to a novel air-distributing mechanism for the "servomotor."

An apparatus provided with these improvements is shown in the accompanying drawings, in which—

Figure 1 is a side elevation of the apparatus. Fig. 2 is a corresponding side elevation thereof viewed from the left-hand side of Fig. 1, the spring-barrel and spring and the bell-shaped driving-segment wedged thereon being omitted for the sake of clearness. Fig. 3 is a plan corresponding to Fig. 1. Fig. 4 is a section along line $x\ x$ of Fig. 1. Fig. 5 represents the air-distributing mechanism in a position corresponding to that in which the apparatus is shown in Fig. 1, being a vertical section along line $y\ y$ of Fig. 3 on larger scale. Fig. 6 is a corresponding horizontal section on line $z\ z$ of Fig. 5. Fig. 7 is a vertical section on line $v\ v$ of Fig. 6. Figs. 8, 9, and 10 are enlarged sections on lines 1 1, 2 2, and 3 3 of Fig. 5, respectively.

As will be seen from Figs. 1 to 4, the whole of the apparatus is mounted in an annular frame M, which is firmly held in position on the rests or brackets $m^2\ m^2$, secured within the torpedo, by means of two lugs $m'\ m'$, Fig. 2. In Figs. 1, 3, and 4 the brackets $m^2\ m^2$ are not shown. Integral with the annular frame M there are cast two pairs of arms $m\ m\ m\ m$, extending at right angles to the plane of the ring. Between one pair of arms is supported the vertical gimbal-ring p of the gyroscope system, which at two points situated in a diameter at right angles to its pivotal axis carries adjustable points or centers which serve for supporting the horizontal gimbal-ring q, which ring in its turn supports in the well-known manner between adjustable centers the shaft r of the fly-wheel R, which also carries a small bevel driving-wheel r'. Between the other two arms m, projecting at right angles to the plane of the ring M, there is supported the shaft a of the driving mechanism, whereon a hollow conical segment A is keyed, which is worked at its annular basis and is there in gear with the driving-wheel r' of the fly-wheel. This engagement, however, only takes place when the shaft r occupies the position shown in Figs. 1 to 4 and while the toothed segment A is turning its full part toward the said shaft r.

An engaging pin p', provided on the upper side of the vertical ring p, enters between the two prongs of the fork P, Figs. 2 and 3, which is clamped by means of a screw p^2 upon the shaft of the circular slide-valve s, serving to control the servomotor by means of a screw p^2, so that the strokes of the vertical ring p directly control the way in which the air is distributed in the cylinder S of the servomotor, and also consequently the direction of the stroke or swing of the side rudder operated by the said cylinder through the medium of the piston-rod S', Figs. 1 and 2. The manner in which the turns of the arm p or the circular side valve s influence the air distribution shall be described farther on—to wit, in paragraph 3—while what is hereinafter dealt with first of all are the following parts: first, the device which serves to wind up the spring-spindle to hold the same securely in the wound-up condition and to release it, and, second, the device serving to turn the gryoscope-rings into their normal position prior to commencing to wind up the spring, to retain such rings in place until the spring runs out, and to release them after it has run out in such a manner that the gyroscope shall remain solely dependent upon the free display of the forces acting upon the unrestrained fly-wheel shaft.

1. *The spring-motor and the means for winding up and releasing the same.*—The spring-motor consists of a shaft a, supported

between two arms m of the ring M and carrying a spring A′, one end of which is in the well-known manner secured to the shaft a, while its other end is attached to the lower arm m. Onto the shaft a there is keyed the hollow conical segment A, the toothed lower edge of which, as before mentioned, is in gear with the bevel-pinion r', Fig. 4. The lower end of the shaft a carries the toothed disk a', upon which there is adapted to slide a tappet a^2, rigidly secured upon a shaft b, supported between two fork-shaped ends of one of the arms m. Upon the shaft b there is further keyed an arm b', to the end of which a horizontal pin b^2 is pivoted, the extremity of which pin protrudes through the perforation r^4, Fig. 4, of a horizontal arm r^2, which is wedged or keyed upon a vertical spindle c, supported between two projections m^3, cast integral with the ring M, Fig. 2. Between the pivoted end of the pin b^2, which is fitted with a collar or flange, and the arm r^2 there is interposed a spring b^3, which tends to turn the arm b' to the left, as indicated by the arrow 4 in Fig. 4, and the arm r^2 to the right in the direction of the arrow 5. Owing to this tendency the tappet a^2 takes up its position in front of the tooth of the disk a', as shown in Figs. 1, 2, and 4, and while in this situation hinders the spring-arbor from turning in the direction of the arrow, Figs. 3 and 4. On the vertical shaft d, Fig. 1, which when the air-valve lever is pulled off is turned in the direction of the arrow 2, there is keyed an inclined arm d', Figs. 3 and 4, at the end of which there is provided a set-screw d^2, the head of which abuts against the end of the arm b' of the shaft b. The said screw d^2 is so adjusted that it will touch the lever b' in the position where the arm a^2 is at rest when the air-valve lever (not shown) and which controls the shaft d is in its closing position.

2. *The device for adjusting the gyroscope.*—The device which serves to bring back the fly-wheel R to its normal position prior to setting the apparatus in motion mainly consists of a lever f, Figs. 2 and 4, bent at several points and terminating in a fork, such lever being pivoted to a vertical arm m^4, integral with the supporting-ring M, while the prongs f' f', Figs. 2 and 4, of its fork, arranged parallel to its plane of rotation, engage one sectional area of the vertical ring p of the gyroscope, as illustrated in Fig. 4, at two points which are situated on a diameter perpendicular to its pivotal axis. The sectional area of the vertical gyroscope-ring p is limited laterally by parallel surfaces, Fig. 2, the distance between which equals the clear distance between the prongs f' f' of the lever f. Toward its axis of oscillation the section or width of the ring p becomes reduced, so that when the lever f is turned into the position marked in dotted lines in Fig. 2 it incloses the reduced portion of the said ring p and enables it to swing out of its normal position in either direction. When, however, the lever f is moved from its dotted depressed position, Fig. 2, into the raised position, one of the prongs f' f' of the fork (should the ring p happen to be out of its normal position) will strike one of the two sides of the ring p, whereby it will, in proportion to the extent of its upward turn or stroke, restore the said ring to its normal situation, wherein eventually it will retain the same. Inasmuch as the prongs f' f' of the forked lever f project inwardly beyond the sectional area of the ring p and extend into the space traversed by the horizontal ring q, Figs. 2 and 4, so that they are situated on opposite sides of the axis of rotation of such ring, they will at the same time as the ring p turns return the horizontal ring q also to its horizontal position, which it should invariably retain. When, on the other hand, it is desired to release the gyroscope system, it suffices to turn the lever f, just described, from its raised position (shown in full lines) to its dotted depressed position, Fig. 2. The arm f is turned by means of the arm f^3, keyed onto the shaft or spindle b, Fig. 4, the end of which arm f^3 is connected with the said arm f by a draw rod or link f^2. The spring b^3, which has been described above as acting upon the arm b' of the spindle b, imparts to the arm f^3 a tendency to swing outward in the upward direction. Accordingly the lever f will invariably take up its uppermost position, in which it is shown in full lines in Fig. 2, so long as the spindle b is not otherwise influenced; but when the air-valve lever is brought to the "open" position and when as a result of this movement, according to what has already been stated, the spindle d receives a turn in the direction of the arrow 2 the arm b' will be turned by the swinging arm d' in the direction of the arrow 3 and with it the adjusting-lever f also will be turned downward.

The parts f' f' hereinabove described merely serve, as already explained, for turning the gyroscope back to its normal position. They are retained in place while the shaft or spindle r is being operated by the arm r^2, already mentioned, with a point or center which while the gyroscope occupies its normal position engages in a corresponding recess in the horizontal gyroscope-ring q. (See the position shown in Fig. 4.)

Upon the vertical pivot or spindle c of the arm r^2 there is keyed a tappet a^4, Figs. 1, 2, and 3, which slides upon the outer surface of the "bell" or segment A. In the horizontal plane of the said tappet a^4 a lug or incline a^3 is formed on the said bell A in such a situation that it comes to be located underneath the said tappet a^4 and turns the same in the direction of the arrow 6, Fig. 3, when the bell A reaches the last stage of its unwinding motion, and thus moves out of gear with the pinion r, owing to the fact that the portion of the bell A which is cut away has come to be situated above the spindle r. In consequence of the turning of the tappet a^4 the spindle c, and with it the arm r^2, carrying the center point r^3, is made to resist or counteract the action of the spring b^3 and is pressed in the direction of the arrow 7, Fig. 4—*i. e.*, out of the center recess of the gyroscope-ring q, which is accordingly released.

Operation of the mechanism described in paragraphs 1 and 2.—To explain the operation, we will suppose that, as shown in Figs. 1 and 4, the spring A′ is wound up, the air-valve closed, and the two locking devices—viz., f and f' on one side and r^2 and r^3 on the other side—are in the operative position—in other words, that the torpedo is in readiness to be shot off. As the torpedo is launched the turning of the air-valve lever causes the spindle d and arm d' to turn in the direction of the arrow 2, so that the screw d^2 strikes the arm b'. Owing to the rotary movement thus imparted to the arm b', and also consequently to the spindle b, the following changes take place in the mechanism at the same time: first, the arm a^2 comes out of engagement with the toothed disk a', so that the spring-arbor a is released from its arresting device and the segment A turns in the direction of the arrow 1, Fig. 3, thereby imparting a rotary impulse to the spindle r; second, the arm f^3 swings downward and moves the locking or arresting lever ff' into the dotted position, Fig. 2, whereby the gyroscope system is released from engagement with the said lever ff'; third, the arm r^3 or the center r^3 is by the movement of the arm b' in the direction of the arrow 5, Fig. 4, under the action of the spring b^3 pressed with added force into center recess of the ring q and locks the spindle r in position while it receives the rotary impulse from the segment A. While the spindle r is being driven, no change takes place in the mechanism. When the cut-away portion of the bell A at length comes to take up its position over the pinion r', the tappet a^4 is turned by the incline a^3 in the direction of the arrow 6, and with it the arm r^2 in the direction of the arrow 6, Fig. 4, so that the center r^3 releases the ring q, with the result that the gyroscope remains fully exposed to the free action of the forces that are exercised upon it. At the same time with the incline a^3 the stop a^6, provided on the bell, comes into operation and strikes the arm a^5, loose upon the shaft a, the forked end whereof protrudes through a slot in the cylinder S^2 and grasps the piston provided in the latter. Under the action of the stop the piston a^7 is shifted to the right, and the air-cushion confined and compressed within the cylinder S^2 acts as a brake upon the bell A and brings the same to a stop without any concussion. To make the torpedo once more ready for launching, the air-valve lever is first of all moved to the closed position, whereby the swinging piece d' is made to return to the position shown in Figs. 1 to 4. This places the spindle b entirely under the influence of the spring b^3 again, so that the arm a^2 comes to lie in contact with the disk a', the lever f^2 swinging upward and restoring the gyroscope to its position of rest in the manner already explained. The lever r^2, however, continues in the position to which it had moved in descending since the tappet a^4 is still resting upon the incline a^3. Now when the spring A′ is compressed by means of a square key fitted into the spindle or arbor a, or, in other words, when A is turned in the direction opposite to that to which points the arrow 1, the tappet a^4 in the first place slides off the incline a^3, whereby the arm r^2 is conducted back to its stationary position. As the operation of winding up the spring on the arbor a is completed the arm a^2 slides over the tooth of the disk a' and retains the spring-arbor in the "wound-up" position.

The following is a description of the air-distributing mechanism operated by the motion of the ring r:

3. *The air-distributing mechanism.*—As will be seen from the diagram Fig. 1, this mechanism is mounted in the most elevated position of the ring M, carrying the gyroscope mechanism, and mainly consists of a balanced valve or plug s, which, in the manner above indicated, is operated by a pin p', provided on the vertical ring p of the gyroscope. The plug or valve s is held in place in the valve-chest H by a cross-bar supported by springs p^4 and by two set-screws p^3, passed through the said fork. The valve-chest is in the shape of a truncated cone H, provided with an axial cylindrical perforation h and held in the depressed position by the springs p^4, such cone being fitted in a conical recess, on the inner surface of which terminate on different levels both the admission or inlet port l and the channels l' l^2, leading to the two sides of the cylinder. On the level of each of the three orifices l l' l^2 the cone H is provided on its outer surface with an annular groove h^3, h', and h^5, Figs. 8, 9, and 10, respectively. On the level of the central groove h', Fig. 9, there passes through the cone H a diametrical perforation h^2, and on the level of the upper and lower groove h^3 and h^5, respectively, there are similar diametrical perforations h^4 and h^6, respectively, which are situated at ninety degrees to the perforation h^2. Thus in the inner surface of the cylindrical perforation h of the cone H there are formed six apertures situated on three different planes or levels, on two of which levels, the one above and the one below the intermediate level, the apertures are situated in a plane at ninety degrees to the line connecting the two openings or the intermediate level. The perforations of the intermediate level communicate with the inlet l, while those on the two other levels are connected to the cylinder channels or ports l' l^2.

The plug s, which is tightly fitted in the cylindrical bore h of the cone H, is provided with an axial perforation s', open at the top and extending down nearly to the bottom of the plug, the lower end being closed by the material of the plug and on a level with the intermediate or central groove h' of the cone H. It is further provided with an annular groove t^2, formed on its outer surface, with which the channels h^2 are in constant communication. This groove t^2 is joined by four other grooves parallel with the axis of the plug, of which the two diametrically opposite grooves t^4 t^4, Fig. 8, extend in the upward direction to the level of the channels h^4, while the two others, t^6 t^6, Fig. 10, reach down to the level of the lower channels h^6. The grooves t^4 t^4, extending upward, are situated in a diametrical plane, forming a predetermined angle—say thirty degrees—to that of the downward grooves t^6 t^6. On a level with the perforation h^6 a diametrical perforation s^6 extends through the plug s, Fig. 10, the orifices of which perforation lie in the generatrices of the vertical grooves t^4. On a level with the perforation h^4 a diametrical perforation s^4 passes through the said plug s, Fig. 8. The orifices of this perforation lie in the generatrices of the vertical grooves t^6. As will be seen, therefore, the plug or distributing valve s is of a perfectly diametrical shape, its operation being as follows: The compressed air, traveling through the channel l, enters the annular groove h' of h, Fig. 9, and, through the two arms of the channel h^2, brushes into the central groove t^2 of the rotary distributing valve or plug s, and hence both into the two upward grooves t^4 t^4 and into the two downward grooves t^6 t^6, both of which pairs of grooves are formed on the circumferential surface of the said plug or valve s. So long as the valve s retains the intermediate position represented in the sections Figs. 8 and 10 the two channels h^4 and h^6, leading to the cylinder, remain covered; but the moment the said valve s is turned out of that position in the direction of the arrow 1 by the fork P, which takes part in the motion of the gyroscope-ring p, the grooves t^4 move into coincidence with the channels h^4, while the lower perforations t^6 come to coincide with the channels h^6. The compressed air accordingly now flows through the channels h^4 and the annular groove h^3 into the channel l', while at the same time the channel l^2 comes into communication with the atmosphere through the perforations h^6 h^6. Should the gyroscope swing in the opposite direction and thereby cause the circular slide-valve s to be turned in the direction of the arrow 2, the air would also be distributed in the opposite direction. Thus, according to the mode of air distribution or to the direction of the movement of the gyroscope p, the piston-rod s' will be moved either backward or forward, thereby operating the side rudder in the well-known manner. For the purpose of accurately adjusting the valve-chest H adjusting-screws p^5 enable the valve to be set as required. As will be understood from this arrangement, the compressed air is invariably admitted and discharged at diametrically opposite points of the valve s, so that the valve is entirely released from any pressure and no resistance interferes with its rotary motion.

I claim as my invention—

1. In a device for steering torpedoes, of the class specified, means for arresting and retaining in its normal position, the gyroscope, consisting of the gimbal-rings p and q, the former having an enlarged squared cross-section formed at each side of same intermediate of its pivots, and a lever f pivotally mounted in proximity to said rings, and having forked end f' to engage the said enlarged cross-section of the gimbal-ring p said forks being adapted to engage under the lower edge of the ring q, means for spring-pressing said lever against the said gimbal-rings and means in connection with the air-valve of the torpedo-motor to turn said lever and release said gyroscope when the said air-valve is opened, substantially as described.

2. In the device for steering torpedoes comprising a gyroscope, and being of the class specified, a device for arresting the fly-wheel shaft, at the moment when the gyroscope is set in motion, consisting of a pivotally-mounted lever r^2, having a point or pin r^3 to engage a depression in the end of the fly-wheel shaft of the gyroscope, when the latter is in its normal position, a spring-pressed rod b^2 to retain said lever in its operative position, a bevel-gear on the fly-wheel shaft and a bell-shaped segment, to engage said bevel-gear, means for rotating said segment, and a cam arranged thereon as at a^3, a pawl a^4 pivoted in the path of said cam, said pivot being also that of the lever-arm r^2, so that the said cam will retract said lever r^2 from engagement with the fly-wheel-shaft end when the gyroscope has been set properly in motion substantially as described.

3. In a device for steering torpedoes, of the class specified, having a spring-operated bell-shaped segment, a gyroscope operated thereby, means for retaining said gyroscope in its normal position and means for controlling said retaining mechanism from the air-valve of the torpedo-motor, a cam-disk a' on the shaft a of the bell-shaped segment, a shaft b mounted in proximity to said segment and having mounted fast thereon a pawl a^2 adapted to engage said cam-disk and means in connection with and operated by the air-valve of the torpedo-motor for releasing said disk when the air-valve is manipulated substantially as described.

4. In a torpedo-steering device of the class specified, comprising a gyroscope, having bevel-gear on its driving-shaft, a bell-shaped segment having teeth on its lower edge to engage said bevel periodically, said bell-shaped segment being operated by a spring-operated shaft, and means for setting said shaft in motion when the air-valve of the torpedo-motor is operated, the combination of a revolubly-

mounted shaft b having keyed thereon a lever b' and pawl a^2 and a lever-arm f^3, a spring-actuated shaft a for the bell-shaped segment mounted approximately at right angles to said shaft b, a disk thereon having stop-cam movable in the path of motion of the said pawl a^2 and adapted to be engaged by the same, a rod b^2 pivoted to the arm b', a pivotally-mounted lever r^2 through which said rod end passes said lever-arm r^2 having pin r^3 to arrest the gyroscope-shaft as specified, a spring b^3 encircling said rod b^2 and adapted to press the arms r^2 and b^2 apart, a fork-lever $f f'$ as specified to retain said gyroscope and means for connecting the said fork-lever to the lever-arm f^3 in the manner and for the purpose substantially as described.

5. In a torpedo-steering device of the class specified comprising a gyroscope and means for setting the same in motion, said means being operated by the movement of the air-valve of the torpedo-motor, and consisting of a bevel-gear on the gyroscope-driving shaft and a spring-operated bell-shaped segment in engagement with the same, a device for receiving the concussion caused by the sudden stoppage of the shaft, consisting of an arm a^5 loosely mounted on the said shaft an air-cylinder into which said arm projects a piston in said air-cylinder and means for connecting the said arm to same so as to allow of its swing in the manner and for the purpose substantially as described.

6. In a torpedo-steering device of the kind specified comprising a gyroscope and means for operating the same substantially as specified, the combination of a pin p' on the gimbal-ring p of said gyroscope, and a bifurcated lever P to embrace said pin, said lever being pivoted to a hollow stem an air-cylinder mounted in proximity to said stem, a spring-pressed plug mounted in the wall of same and having ports as specified, a series of ports as specified in said stem and leading to each end of said air-cylinder, means for conducting air-supply to said plug and means for leading off air from the interior of said hollow stem in the manner and for the purpose substantially as described and shown.

7. In torpedo-steering mechanism of the class specified, comprising a gyroscope, the combination of means for arresting said gyroscope in its normal position when the apparatus is out of action, means for starting the said gyroscope, for releasing the retaining means and for arresting the starting mechanism, controlled by the movement of the air-valve of a torpedo-motor, an air-distributing valve mounted on an air-cylinder and having hollow stem, by which the air-distributing mechanism is operated, a pin on the gimbal-ring p of the gyroscope and a bifurcated lever to embrace said pin, said lever being keyed to the said stem and governing the movements of the same in the manner and for the purpose substantially as described and shown and for the purpose specified.

In witness whereof I have hereunto set my hand in presence of two witnesses.

LUDWIG OBRY.

Witnesses:
FRANCESCO BUTTOK,
A. BRUNO.