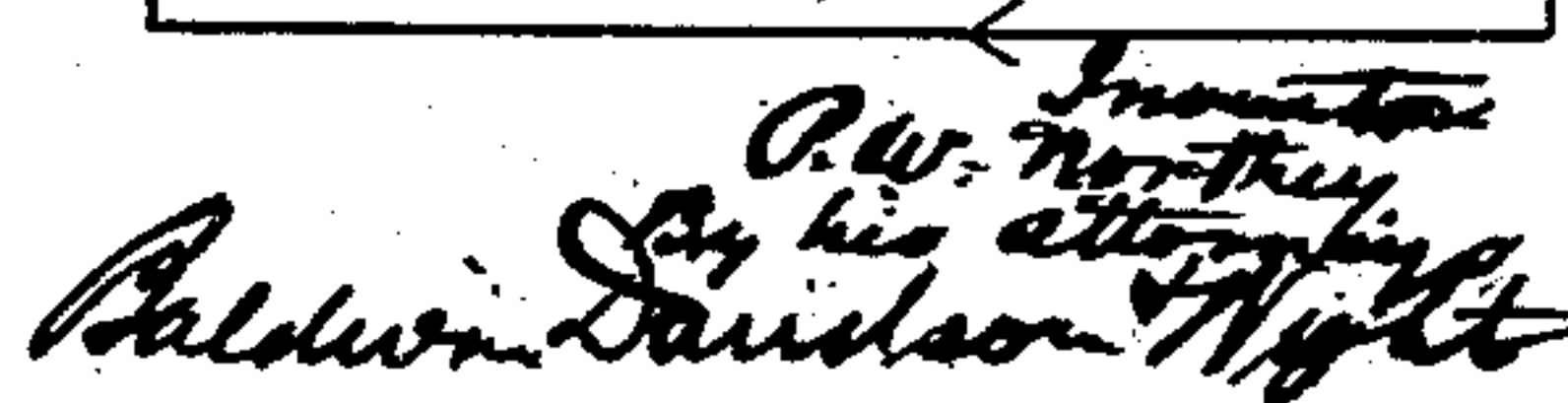
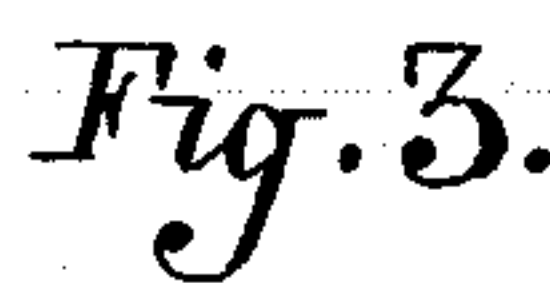


(No Model.)

(Application filed Dec. 20, 1897.)

2 Sheets—Sheet 1.



No. 655,105.

Patented July 31, 1900.

P. W. NORTHEY.
ENGINE GOVERNOR.

Application filed Dec. 20, 1897.)

(No Model.)

2 Sheets—Sheet 2.

Fig. 2.

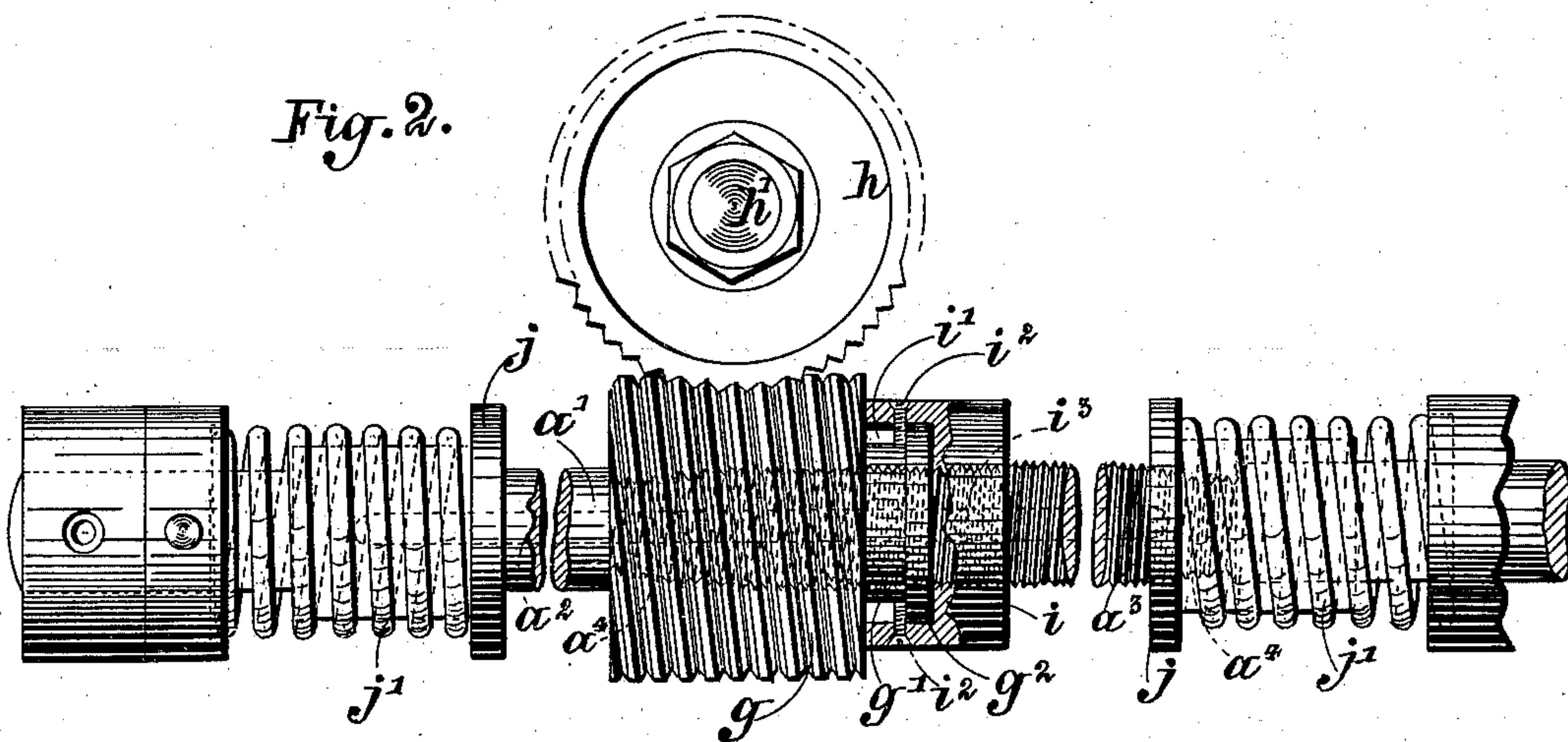


Fig. 5.

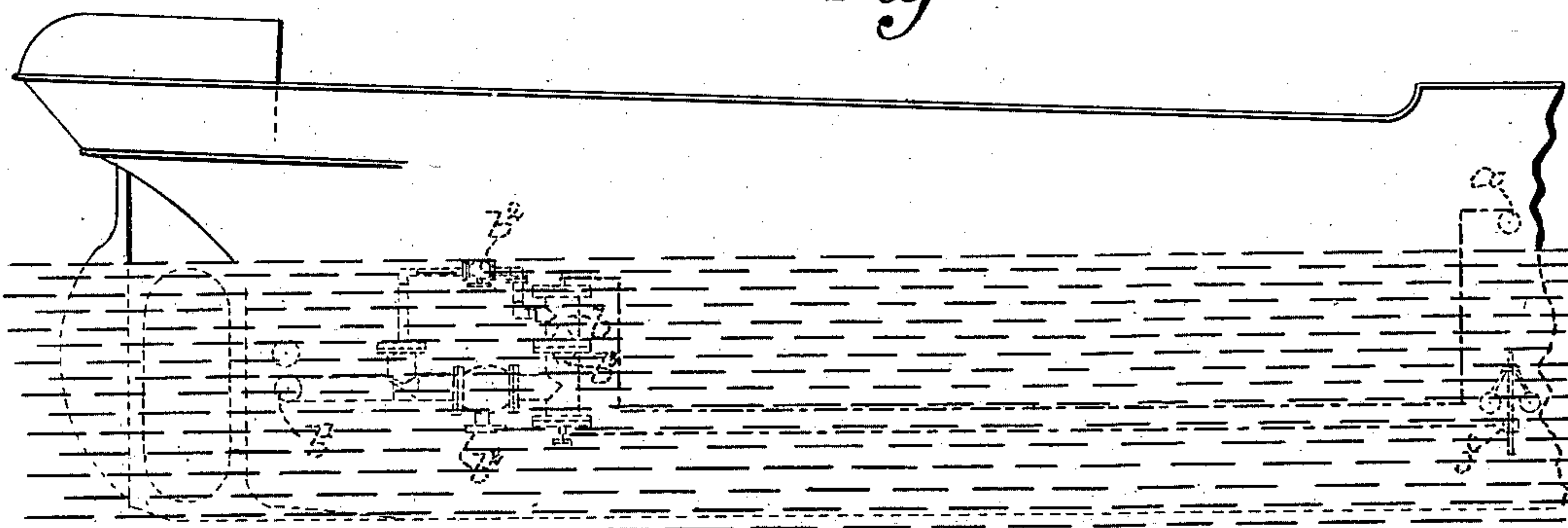
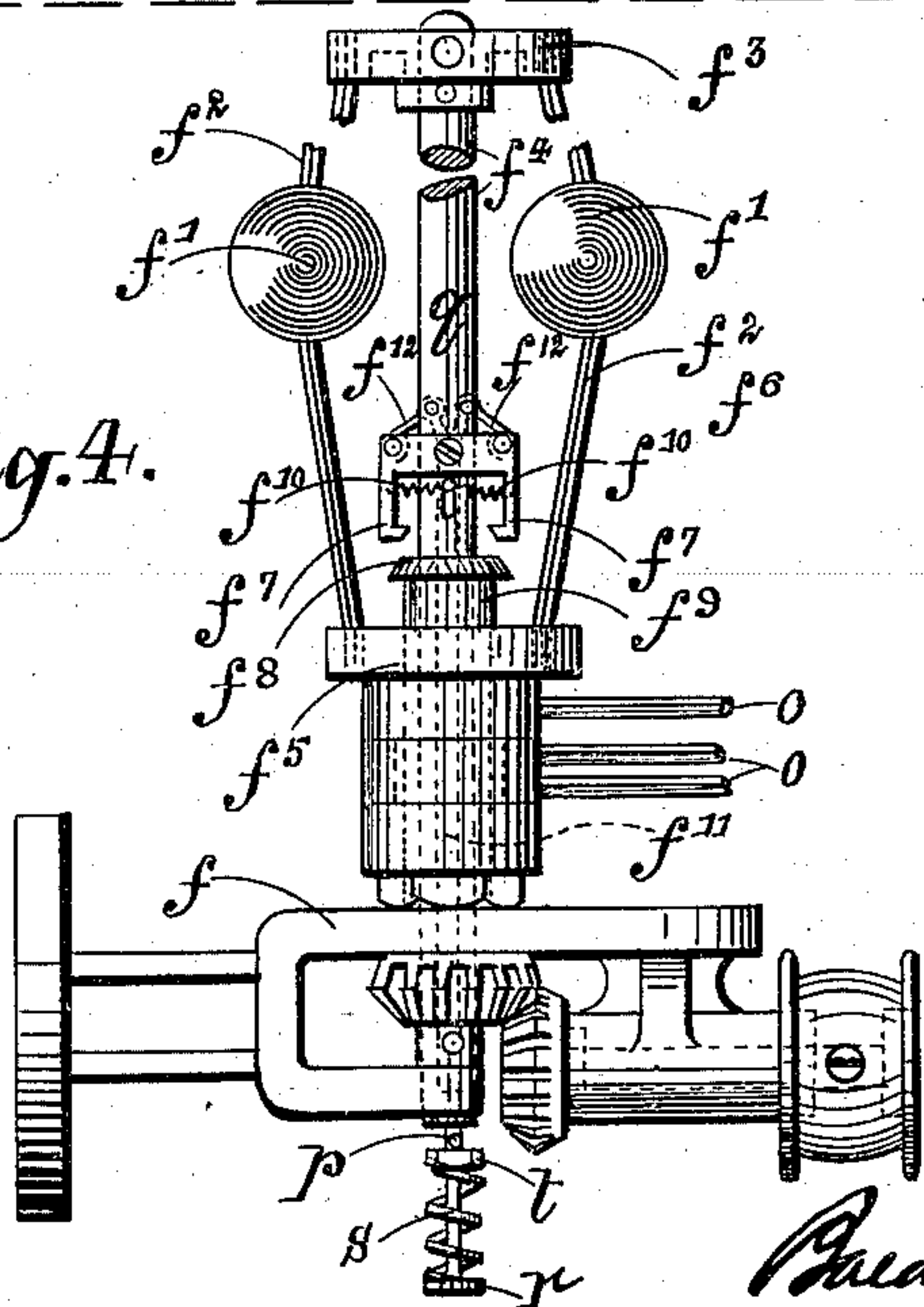


Fig. 4.



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UNITED STATES PATENT OFFICE.

PERCY W. NORTHEY, OF BOX, ENGLAND.

ENGINE-GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 655,105, dated July 31, 1900.

Application filed December 20, 1897. Serial No. 662,678. (No model.)

To all whom it may concern:

Be it known that I, PERCY WILBRAHAM NORTHEY, a subject of the Queen of Great Britain and Ireland, residing at Box, in the county of Wilts, England, have invented certain new and useful Improvements in Engine-Governors, (for which I have obtained a patent in Great Britain, No. 23,698, bearing date October 24, 1896,) of which the following is a specification.

My invention relates to governors chiefly designed for use with marine engines, and comprises the improved apparatus hereinafter described.

An important part of my said invention consists in the provision, in manner hereinafter described, of a suitable electric motor so coupled or connected with the throttle valve or valves of the engine that it can be operated to close or open the same and arranged in connection with a circuit-closing device which will be so operated by the elevation of the ship's stern or propeller as to close a circuit or circuits and actuate the motor in one direction to shut down the throttle valve or valves and upon the return of the vessel to its normal position and the propeller becoming again submerged will close another circuit and actuate the motor in the obverse direction to raise or open the said throttle valve or valves. I am thus enabled to insure the steam being cut off from the engine when the propeller is temporarily raised out of the water in a heavy sea and to prevent the racing of the said engine that otherwise takes place by reason of the sudden reduction of load consequent upon this occurrence, and if necessary can anticipate this said racing and shut down the valves before the load is removed from the propeller.

Another important feature of my said invention consists in the provision of suitable means whereby should racing of the engine occur through any internal cause or mishap—such, for instance, as the sudden breaking of the propeller-shaft—an emergency-governor will so act as to either permanently or temporarily close a circuit and operate the electric motor to shut down the throttle valve or valves, being retained in the closed position in the first case by means of a suitable clutch or catch until such time as it may be released,

and in the second returning automatically to its normal position upon the speed of the engine becoming reduced. I also provide means whereby the above-mentioned clutch or catch can, when desired, be rendered inoperative, and the governor will then, upon the occurrence of any abnormal speed, after having closed the circuit and thus caused the electric motor to shut down the throttle valve or valves, return upon the cessation of the said abnormal speed consequent upon this action to its original position, break the said circuit, and close another circuit, by which the motor will be operated in the reverse direction and raise or open the throttle valve or valves.

My said invention comprises, moreover, the further improvements and apparatus hereinafter described.

In the accompanying drawings, Figure 1 is a diagrammatical view showing the general arrangement of my apparatus. Fig. 2 is a side elevation showing an automatic arrangement for disconnecting and reconnecting the electric motor with the throttle valve or valves. Fig. 3 is a side elevation, drawn to a reduced scale, showing an improved float or contact making and breaking device, hereinafter described. Fig. 4 is a side elevation, drawn to the same scale as Fig. 3, showing an improved emergency-governor for use with the above apparatus. Fig. 5 is a side elevation of a portion of a steamer, showing an application of the above electrical governing apparatus thereto.

Like characters indicate corresponding parts throughout the drawings.

a is a reversible motor of any suitable description.

b is the float or contact making and breaking device.

c c are solenoids or electromagnets with plungers or cores *d d*.

e represents an accumulator or other suitable source of electrical energy, and *f* is the emergency-governor.

The motor *a* is connected by means of suitable shafting to the throttle valve or valves of the engine to be governed, and in order that when put in operation, as hereinafter described, it may, having first effected the closing or opening of the said throttle valve or valves, continue to revolve until it runs

down and comes gradually to rest I provide the device shown in Fig. 2 for automatically disconnecting it therefrom and reconnecting it thereto. Referring to that figure, upon the shaft or spindle a' of, or one connected with, the motor a is a worm or tangent screw g , adapted to gear with a worm-wheel h upon a shaft or spindle h' , operating the throttle valve or valves of the engine. This worm g is mounted upon the said shaft or spindle a' so as to be free to move lengthwise thereon, but is caused to rotate therewith by a pin or feather working in a longitudinal groove or feather-way a^2 in the said spindle a' . Upon one end of the said worm g is an extension g' , terminating in a flange g^2 or having a circumferential groove near the end thereof, which extension engages in a recess i' , formed in a nut i , adapted to screw upon a screw-threaded portion a^3 of the said shaft or spindle a' , and which nut i , while free to revolve independently of the said worm, is at the same time prevented from leaving the said flange g^2 by one or more screws or pins i^2 engaging behind the above-mentioned flange g^2 or in the circumferential grooves or by any other equivalent device, so as to retain it in place in the said recess i' . To admit of the worm-shaft or spindle a' revolving freely without actuating the worm-wheel h after it has been rotated through a certain angle or distance in either direction sufficient to close or open the throttle valve or valves, I form at each extremity of the screw-threaded portion a^3 on the said worm-shaft or spindle a' a screw-threaded taper, as indicated at a^4 , upon reaching which the above-mentioned nut i will cease to bite upon the screw-threaded portion a^3 of the said shaft or spindle a' and will admit of the latter rotating independently thereof. The nut i is prevented from rotating with the worm shaft or spindle a' while being freed to move in a lateral or longitudinal direction thereon by means of a pin, stud, or projection i^3 , arranged to engage with and slide in a slot or groove formed in the casting or frame of the motor or other convenient place. It will be seen that up n the rotation of the worm shaft or spindle a' in one direction the worm-wheel h will be likewise rotated by means of the worm g , and at the same time the said worm g will have an endwise movement upon the shaft or spindle a' imparted to it by the nut i until such time as the latter reaches the taper portion a^4 of the screw-thread at the end, when the said endwise movement will cease and the worm g be clear of the worm-wheel h in one direction. To cause the nut i to be retained sufficiently in engagement with the taper screw-threaded portions a^4 at either end of the screw-threaded portion a^3 of the shaft or spindle a' to bite therewith and to travel thereon to the opposite end upon a reversal of the direction of motion of the latter, I provide at each end a buffer consisting of a collar or washer j and a light spring j' or equivalent

device, which will at one extremity engage with and be slightly compressed by the worm g and at the other by the nut i . The length and the pitch of the thread a^3 upon the spindle a' and the worm g and the diameter of the worm-wheel h are so designed that the requisite movement in either direction will be imparted to the worm-wheel spindle h' to shut down or close or to open the throttle valve or valves with which it is connected.

In order that when the motor has done its work its circuit may be broken, it is necessary, or at any rate highly desirable, that the motor should be fitted with a self-contained arrangement for automatically cutting off or breaking the relay-circuit at such time as the necessary work or movement of the throttle valve or valves in either direction is completed. To effect this, I preferably employ a commutator consisting of a toothed or other quadrant k , gearing or engaging with a toothed or other wheel l , connected with the motor, as hereinafter described, and which quadrant k is connected to another quadrant k' , the central portion of the face of which latter is formed of some suitable good conductor of electricity and at the ends of which are provided pieces or blocks k^2 of any suitable non-conducting material. In contact with the face of this quadrant k' are suitable fixed contacts or brushes m , and the toothed or other quadrant k for operating the movement of the quadrant-contact k' relatively to the latter is so geared to the shaft or spindle operating the closing and opening of the throttle valve or valves that it will be caused to move through such an angle at each operation of the motor as to make electrical contact and close the circuit for the requisite time while the brushes are in contact with the conducting-face thereof and will break the said contact at the termination of its movement in each direction. It will be seen that the circuit will be thus automatically broken by the action of the motor a itself after the latter has operated sufficiently to close or open the throttle valve or valves, and that the contacts will be left in the proper position for the next or reverse movement of the said motor.

In order to close the circuit and operate the motor—for instance, to shut down the throttle valve or valves at such times as a ship's propeller may leave the water and prevent racing of the engine consequent upon the reduction of load thus caused—I provide the contact-making device illustrated in Fig. 3. At or near the stern-post of the vessel, as shown in Fig. 5, or in any convenient and suitable position below the normal water-line I fix a cylindrical or other suitably-shaped casing b , having communication through branches or apertures b' , situated at or near its extremities, with the exterior of the vessel and admitting of free access of water to the interior of the said casing b through the said branches or apertures, which latter may, if desired, be governed by suitable valves b^2 ,

Fig. 5, so as to admit of the free access of water being cut off when desired. Within this cylindrical or other casing b I place a float b^3 , which is preferably formed round or egg-ended, and, moreover, is so shaped that it will present a more or less acute belt or surface centrally around the same, which surface only will come in contact with the walls of the cylindrical or other chamber during the movements of the said float, and thus minimize the chance of the said movements being affected by frictional contact therewith. Arranged centrally and at a suitable distance apart in the cylindrical or other chamber b are provided two small air and water tight cylindrical or other metal casings or boxes b^4 , having at their opposite ends cup-shaped depressions or concavities b^5 , corresponding to the convexities of the float b^3 , and with one or other of which concavities the said float b^3 is adapted to engage in accordance with the level of water in the main cylindrical or other casing b . Within the lower box b^4 is provided a contact-making device comprising an arrangement of levers in the form of what is usually known as a "lazy-tongs" or "toggle-levers," or other equivalent contact-making device—that is to say, to the short arms of two crossed pivoted levers b^6 is coupled by two links or connecting-rods b^7 a suitable contact b^8 , and at each of the free ends of the long arms of the said levers is provided a block of iron or other paramagnetic metal b^9 as an armature that will be readily attracted by a magnet. The upper box b^4 is provided with a similar arrangement. Arranged axially within the float b^3 is a powerful permanent or other magnet b^9 , the poles of which magnet protrude and form the convex or rounded ends of the said float b^3 . Consequently upon one of the said ends engaging in the socket, cup, or depression b^5 in the corresponding contact casing or box b^4 the magnet will act, through the thin skin or thickness of metal, to attract the above-mentioned armature blocks or pieces b^9 upon the free ends of the long arms of the levers b^6 , and thus through the short arms thereof and the links or connecting-pieces b^7 to move the contact b^8 to close an electrical circuit and energize one of the pair of electromagnets or solenoids c of a relay-switch, (the form I prefer to employ being that shown in Fig. 1,) so as to attract the corresponding plunger or core d , which is suspended from a centrally-pivoted beam n , which likewise carries the plunger or core d of the other electromagnet or solenoid c and is accurately balanced upon a bracket n' or any convenient support, the whole forming a relay-switch for connecting the motor a in circuit. At the ends or other parts of the beam n are provided contacts n^2 n^3 , which when the said beam is depressed, under the action of one or other of the electromagnets, will dip into mercury-cups or otherwise close the required circuits on the one or other side to operate

the motor a in the one or other direction to shut down or open the throttle valve or valves, as the case may be.

Under normal conditions the float b^3 will be maintained in engagement with the uppermost contact box or case b^4 , and the throttle valve or valves consequently remain full open.

In a device such as the present, which depends on the action of a float for its operation, the difficulty is present that the float must be spasmodically affected by the variations of sea-level, causing a corresponding alteration in the height of water above the float, any reduction of head causing a certain momentary outrush of water, which must, but for the device about to be described, have the effect of frequently pressing down the float, and thus closing the circuit when the water-level obtained is, perhaps, many feet above that at which the electrical circuit was designed to be closed. To avoid this, the lower aperture b' of the casing b is directly connected with a pipe b^* , and the upper aperture b' is likewise connected with the same pipe b^* through a smaller pipe b^{**} , fitted with a ball or other suitable valve b^{***} .

b^{****} is a baffle or check plate hinged at the point 1 and free to play between a seating 2 and stop 5; but there may, if necessary, be a spring 3 to assist in raising the plate b^{****} from its seating 2.

As water enters the pipe b^* it raises the plate b^{****} by impinging on its lower surface, and it is thus free to flow both upward into the pipe b^{**} and to continue its course along b^* . Upon the stern of the vessel rising, and thereby lowering the level of the outside water, the water and float in the casing b will be unaffected until the predetermined level is reached, by reason of the valve b^{***} at once closing and preventing the egress of water through the said casing b . Meanwhile the pressure of water in the pipe b^{**} will prevent the plate b^{****} from rising from its seat. Consequently water only passes through the aperture 4 until all water above the casing b has run out, whereupon the plate b^{****} , being relieved of downward pressure, will be forced upward by the pressure of water escaping from the casing b , (assisted, if necessary, by the spring 3,) and thus allow the float to fall. An important feature of this contact making and breaking device is that the contacts situated in the float-casing b are tightly inclosed within fluid-tight boxes or cases b^4 , and are consequently protected from the corrosion and other deleterious action of the water, which, especially in the case of salt water, would otherwise cause an uncertain and inefficient action and a rapid deterioration and destruction thereof by electrolysis.

The cylindrical or other casing b is so constructed that the contact boxes or cases b^4 can be rapidly removed in order to clear out any deposit that may have accumulated in the cup-shaped depressions or concavities b^5

therein, or at the same time to examine, if necessary, the float b^3 and permanent magnet b^9 in order to test its magnetic intensity. I find it highly desirable to electrolytically
 5 deposit a coating of copper on this steel permanent magnet, so that any salt water which may come in contact may have no action thereon.

According to the second part of my invention I provide for actuating the motor a to close the throttle valve or valves should racing of the engine take place from any cause other than, for example, the propeller coming out of the water. For this purpose I provide
 15 centrifugal governor f of any suitable form, but preferably of that description wherein, as shown in Fig. 1 and illustrated in detail in Fig. 4, the spherical or other weights f' f' are mounted centrally, or approximately so, upon springs f^2 f^2 , the upper or outer ends of which are secured to a collar f^3 , rigidly fixed to the top of the governor-spindle f^4 , and the lower or other ends whereof are secured to a collar or sleeve f^5 , free to slide or
 25 move longitudinally upon the said spindle f^4 and having the purpose of a commutator. In connection with this sliding collar or sleeve f^5 I so arrange three or other convenient number of contacts or brushes o that under normal conditions one set of the said contacts or brushes o will form electrical contact and be in series with the relay-circuit to so operate the motor a as to open the throttle valve or valves, while any undue acceleration of the speed of the engine by increasing that of the governor f and causing the spherical or other weights f' to fly outward will raise the
 35 hereinbefore - mentioned sliding collar or sleeve or commutator f^5 upon the spindle f^4 and by forming electrical contact with the other set of contacts or brushes o close a circuit to operate the motor to shut down the throttle valve or valves, and also, if required, at the same time to choke the exhaust. To
 45 retain the governor f in the latter position and the throttle valve or valves shut down, I provide upon the governor-spindle f^4 a fixed collar f^6 , to which are pivoted two or other suitable number of hooked catches f^7 f^7 , which
 50 when the governor acts to sufficiently raise or move the sliding collar or sleeve f^5 engage with a fixed collar or projection f^8 , provided upon an extension f^9 of the latter, and under the action of spiral or other springs f^{10} firmly lock
 55 the said sleeve or collar f^5 in that position.

To enable the sliding collar or sleeve f^5 to be released when desired, and thus allow the governor f to return to its normal position, I form the governor-spindle f^4 or a suitable
 60 portion of it hollow or tubular, as indicated at f^{11} , and within such hollow or tubular portion I arrange a rod p , the upper or one end of which is connected, by means of short links or connecting-rods q , with arms or projections f^{12} upon the above-mentioned hook-catches f^7 , so that by pulling or operating the other extremity of the said rod p , which

projects beyond the governor-spindle f^4 , the said hook-catches f^7 can be moved outwardly and disengaged from the collar or projection
 70 f^8 on the sliding collar or sleeve f^5 . To retain the hooked catches f^7 permanently inoperative when desired, I provide upon the lower or projecting end of the above-mentioned rod
 75 p a fixed or other collar or head r or a nut or the like inclosing a spring s , and I provide another nut or other convenient means whereby the said spring s can be compressed and rendered inoperative, but which will admit of the said spring s being released when desired
 80 and allowed to press against the end of the hollow or tubular governor-spindle f^4 or other convenient abutment. The strength of the spring s is such as to admit of its forcing down the rod p to permanently hold the
 85 catches f^7 out of engagement with the collar f^8 upon the sliding sleeve f^5 .

The hereinbefore-mentioned apparatus may be wired up in any suitable manner. I prefer, however, to employ the arrangement
 90 shown in Fig. 1, wherein u indicates the electromotor-circuit, v the relay-circuit, and w the common leads. The path taken by the electric current is indicated upon the diagram by the arrow-heads.

I am aware that it has before the date of my invention been proposed to utilize sea-pressure or head of water to effect the governing or prevent the racing of marine engines, and I do not claim such as my invention. Those methods lead to unreliable and inaccurate results, since the pressure on any given spot on a ship's hull can never be a certain sign of the height of water covering the propeller. In a stormy sea the pressure
 100 at any given point beneath the surface is never entirely proportional and due to the vertical height of water above that point, which point, though really but a few feet beneath the surface, may be surrounded on all
 105 sides by mountains of waves exerting many hundreds of tons pressure, which condition renders any governing arrangement that depends alone on pressure for its operation unsuitable. Again, in arrangements heretofore
 115 adopted wherein the said pressure or head of water has through mechanical devices been designed to make and break an electrical circuit the constant variation of such pressure has caused continual movements to occur in
 120 the governing device and which has resulted in the "worrying" of both engine and governing device. With this constant variation of pressure there is always the liability that any movement caused by such variation may
 125 only partially and not completely effect the making or breaking of such contact or fail by an infinitesimal amount to make or break contact at all. My governor, working solely
 130 by flotation and being unaffected by varying pressure, keeps normally dormant and only acts (and then with certainty) at the moment when the water surrounding the propeller has fallen to the prearranged depth.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In an electrical governing apparatus, a contact-making device comprising a casing, a float carrying a magnet retained within such casing but capable of movement therein when the water has reached the predetermined level, water-tight cases or boxes above and below such float, and one or more armatures attached to lazy-tongs or toggle-levers contained within said boxes whereby electrical contact is made or broken and the valves of the engine operated, substantially as set forth.

2. The combination, in a governing apparatus for marine engines, of a casing communicating with the exterior of the vessel below the water-line, a float and contacts within such casing, means whereby the incoming water is divided, part flowing into the casing beneath the float and the remainder into the pipe connected with the casing above the float, means to prevent the egress of water through said casing, means to admit of the discharge of water above said casing without passing through it, and means to prevent the outflow of water from said casing until such water as is above it has run out.

3. An electrical governor consisting essentially of a reversible motor fitted with an automatic circuit making and breaking device, and a contact-making device comprising a casing communicating with the exterior of the vessel, a float fitted with a magnet, and water-tight casings or boxes having suitable concavities or depressions adapted to receive the ends of the float and within each casing an arrangement of armatures actuating a contact-making device, substantially as set forth.

4. A governing apparatus comprising a reversible motor fitted with an automatic circuit making and breaking device, a contact-making device consisting of a casing having free access of water from the exterior, a round or egg-ended float fitted with a magnet and adapted to engage in one or other of corre-

spondingly-shaped depressions or concavities in water-tight casings or boxes, each fitted with an arrangement of armatures actuating a contact-making device and an electromagnet forming a relay-switch, substantially as set forth.

5. In a governing apparatus, the device for admitting of the motor continuing to revolve until it runs down and comes gradually to rest after having effected the opening or closing of the valves consisting essentially of a worm or tangent screw so mounted upon the motor-shaft, or a shaft connected thereto, as to rotate therewith, while at the same time the worm is moved longitudinally upon the said shaft by a nut rotatably connected to the said worm, which nut is itself prevented from rotating but is free to move longitudinally and is threaded upon, or engaged with, a screw-threaded portion of the said spindle tapered at each end, a suitable worm-wheel gearing with the said worm, and spring or other buffers, substantially as set forth.

6. The combination of the throttle-valve, an electric motor for operating it, an emergency-governor, circuit connections between the emergency-governor and the electric motor, a clutch or catch for holding the governor and another circuit controlled by the governor for opening the throttle-valve.

7. The combination of a throttle-valve, an electric motor connected therewith, a float, circuit connections controlled by the float for controlling the movement of the motor in both directions, an emergency-governor, and circuit connections controlled by the emergency-governor for controlling the movement of the motor, irrespective of the action of the float.

In testimony whereof I have hereunto subscribed my name.

PERCY W. NORTHEY.

Witnesses:

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