

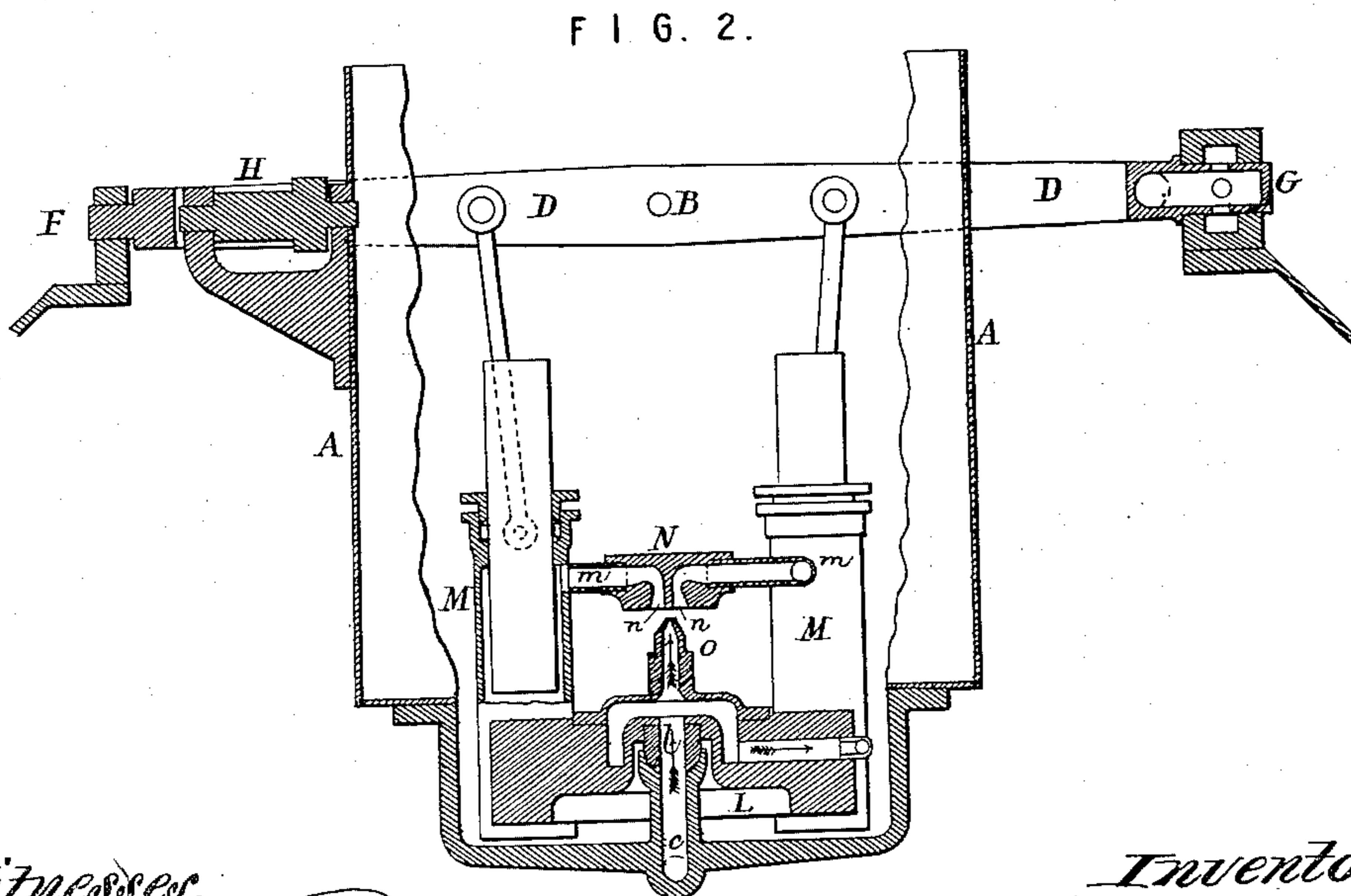
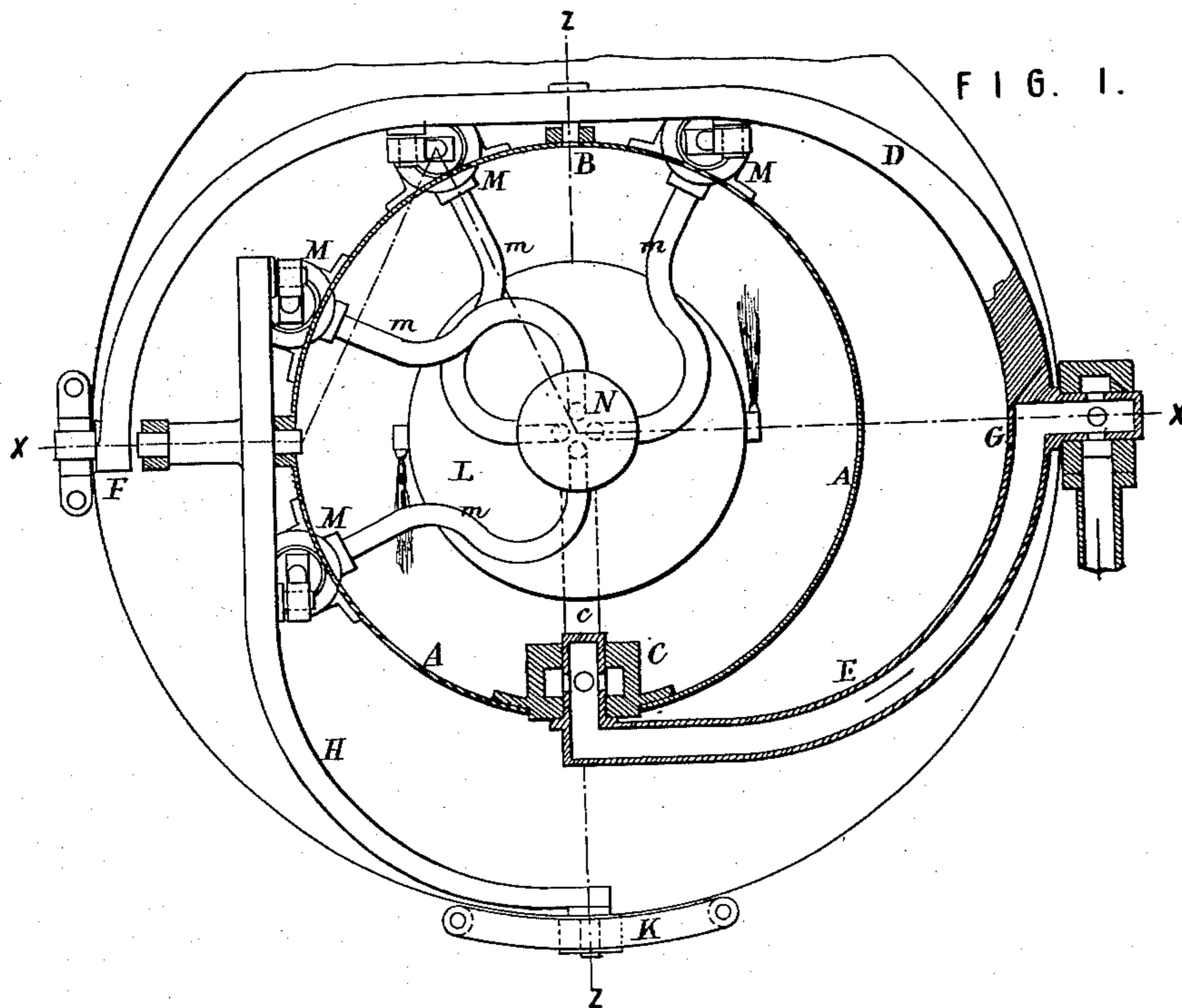
(No Model.)

2 Sheets—Sheet 1.

B. TOWER.
APPARATUS FOR MAINTAINING THE CONSTANT PLANE IN A FLOATING
VESSEL.

No. 366,438.

Patented July 12, 1887.



Witnesses:

J. A. Rutherford.
Robert Smith.

Inventor.
Beauchamp Tower.
By James L. Norris.
Atty.

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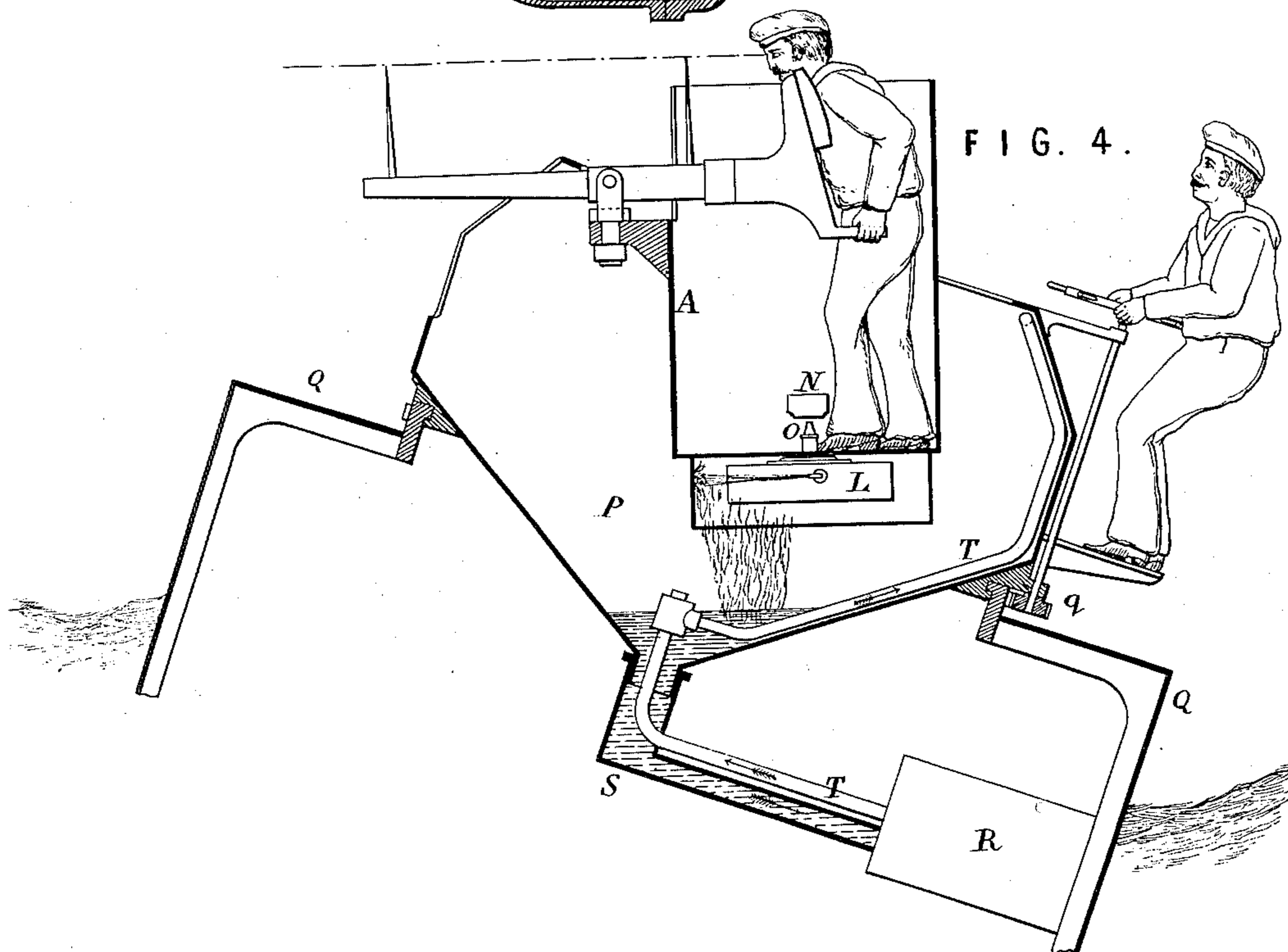
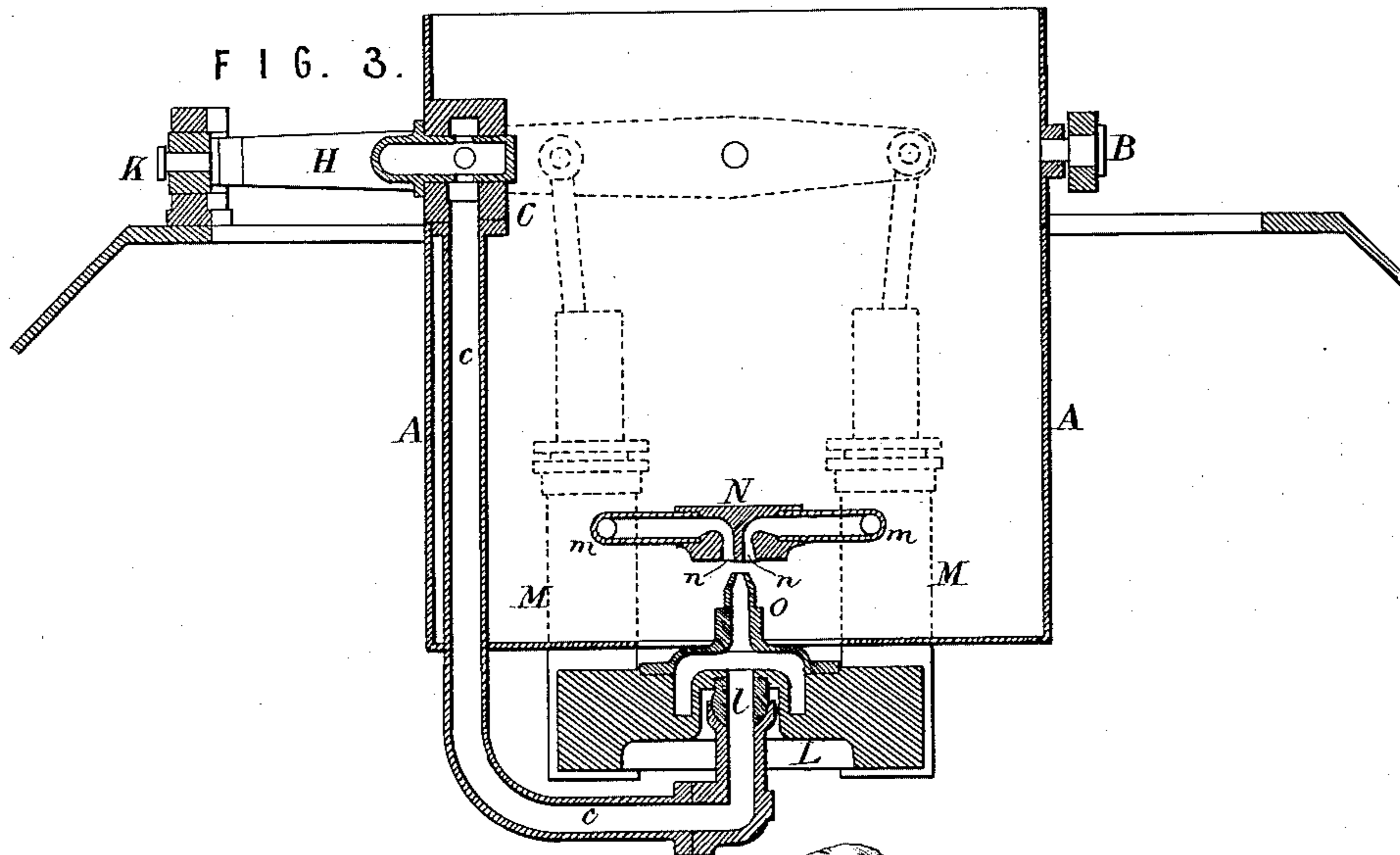
2 Sheets—Sheet 2.

B. TOWER.

APPARATUS FOR MAINTAINING THE CONSTANT PLANE IN A FLOATING VESSEL.

No. 366,438.

Patented July 12, 1887.



Witnesses:

J. A. Rutherford.
Robert Everett.

Inventor:

Beauchamp Tower.
By James L. Norris.
Atty.

UNITED STATES PATENT OFFICE.

BEAUCHAMP TOWER, OF WESTMINSTER, COUNTY OF MIDDLESEX, ENGLAND.

APPARATUS FOR MAINTAINING THE CONSTANT PLANE IN A FLOATING VESSEL.

SPECIFICATION forming part of Letters Patent No. 366,438, dated July 12, 1887.

Application filed May 4, 1887. Serial No. 237,115. (No model.) Patented in England November 4, 1886, No. 14,208, and in Belgium April 20, 1887, No. 77,145.

To all whom it may concern:

Be it known that I, BEAUCHAMP TOWER, a citizen of England, residing at 19 Great George Street, Westminster, in the county of Middlesex, England, have invented a new and useful Apparatus for Maintaining a Constant Plane in a Floating Vessel, (for which I have obtained Letters Patent in Great Britain by an application for patent dated November 4, 1886, No. 14,208, and by patent in Belgium dated April 20, 1887, No. 77,145,) of which the following is a specification:

My invention relates to apparatus for maintaining in a floating vessel, subject to oscillations, a plane always parallel to some given plane, and therefore available as an artificial horizon, or as a platform for guns, or for other purposes for which great steadiness is required.

I mount a framing in gimbals giving freedom of movement in two directions at right angles to each other. On this framing are fixed four vertical cylinders, fitted with pistons which are linked to arms of the gimbals. Each of these cylinders has a passage for fluid leading to its upper part from a central place where these four passages present their mouths downward very near to each other. At the bottom of the framing is mounted on a spherical bearing a reaction-wheel capable of revolving on a vertical axis which coincides with that of the framing, and the central cavity of this wheel is supplied through a trunnion of the gimbals with water or other fluid under pressure. From the central cavity of the wheel there is a vertical passage to a nozzle, which presents itself just under the mouths of the four passages above mentioned.

While the fluid flows from the reaction-wheel it causes it to revolve with considerable velocity, and consequently by its gyroscopic action to maintain constancy of attitude of its axis. Should the framing tend to deviate from its true axial attitude relatively to the reaction-wheel, the jet from the central nozzle enters with force into one or other of the four passages, and thus produces an increase of pressure in the cylinder to which this passage leads, causing a movement of the plunger of this cylinder, and consequently of the framing, which rectifies the deviation.

Figure 1 of the accompanying drawings is a plan, and Figs. 2 and 3 are vertical sections, respectively on the lines X X and Z Z of Fig. 1, of apparatus according to my invention. Fig. 4 shows diagrammatically how the apparatus may be applied in a floating vessel to maintain a platform level or at a constant inclination, so as to facilitate the service of a gun.

A is the framing, conveniently made in the form of a cylindrical vessel, mounted by trunnions B C on bent arms D E, which are themselves mounted by trunnions F G on some stationary framing. Thus the vessel A is mounted in gimbals free to oscillate in two planes at right angles to each other. A third bent arm, H, is jointed to one side of the vessel in the line of the axis of F G, and to a block, K, which is free to slide horizontally in guides on either side of the middle position, which is in the line of the axis of B and C. This arm, having freedom for its block K to slide, does not interfere with free oscillation of A on its gimbals. The reaction-wheel L is mounted in the lower part of the framing A on a spherical bearing, *l*, allowing freedom for the axis of the wheel L to be somewhat out of line with the axis of A in any direction.

Water under pressure is supplied by the trunnion G, through the tubular arm E and the trunnion C, to a pipe, *c*, by which it flows through the spherical bearing *l*, partly to the channels of the reaction-wheel L and partly to the nozzle O in the line of the axis of the wheel L. To the vessel A are fixed the four hydraulic cylinders M, each fitted with a plunger. Two of these plungers are linked to the gimbal-arm D symmetrically on each side of the trunnion B. The other two are similarly linked to the arm H. From the upper parts of the cylinders M pipes *m* communicate through a head, N, each with an orifice, *n*, on the under side of the head N immediately above the nozzle O. While the reaction-wheel L is caused to revolve rapidly by the action of the water issuing from its lateral nozzles, its axis tends to remain permanent in position even when force is applied to alter it. As long as the axis of the vessel A remains coincident with the axis of L, the jet from O acts equally on the water in the four orifices *n*, pro-

5 ducing equal pressure in the four cylinders
 M. Should the axis of A move a little out of
 alignment with the axis of L, then one or other
 of the orifices n will receive more of the jet
 10 from O than the others, and the pressure in
 that one of the cylinders M with which that
 orifice communicates will be increased, caus-
 ing its plunger to tend to move outward, and
 thus imposing a strain on the arm to which
 15 that plunger is linked. This excess of force
 on one of the gimbal-arms reacts on the vessel
 A, causing it to recover its normal position,
 bringing its axis into coincidence with the
 axis of the wheel L. Consequently, as long as
 20 the wheel L revolves, the axis of A is main-
 tained in a permanent position. In applying
 this apparatus, as shown by Fig. 4, a framing,
 P, of funnel shape, is mounted on board a ves-
 sel, Q, on a circular race, so that it can be
 25 made to revolve by a pinion, q , gearing with
 teeth on the circumference of the race. The
 vessel A is mounted by its gimbals within the
 framing P, and has its axis maintained per-
 manently vertical, or more or less inclined to
 the horizon, notwithstanding very violent os-
 cillations of the vessel Q.

In some convenient part of the vessel a
 pumping-engine, R, serves to supply the wheel
 L and jet O, the discharged water returning
 30 from P by the suction-pipe S, and being forced
 back by the pipe T to supply the wheel and
 jet.

Although I have shown a reaction-wheel, L,
 as one of the simplest forms of machine by
 35 which water under pressure can be applied to
 produce rotary motion, obviously turbines or
 hydraulic engines of various forms might be

substituted for it; also, although I have shown
 in Fig. 4 an application of apparatus accord- 40
 ing to my invention for facilitating the service
 of a gun, it might obviously be applied in any
 case where permanence of a plane or its axis
 is desired, notwithstanding oscillations of the
 vessel or other structure in which it is mounted.

Having thus described the nature of my in- 45
 vention and the best means I know of carry-
 ing it out in practice, I claim—

An apparatus for maintaining a constant
 plane in a floating vessel, consisting of a sup-
 porting-frame, a vessel, A, mounted in gimbal- 50
 arms and provided in its lower portion with a
 spherical bearing, l , a rotary wheel, L, arranged
 on said bearing, and having an upward-project-
 ing axial nozzle, means for supplying the wheel
 with fluid to rapidly revolve it, a series of cyl- 55
 inders, M, containing plungers connected with
 the gimbal-arms, and a head, N, located above
 the axial nozzle, and having a set of orifices, n ,
 communicating with the cylinders, substan-
 tially as and for the purpose described. 60

In testimony whereof I have signed my name
 to this specification, in the presence of two sub-
 scribing witnesses, this 30th day of March, A.
 D. 1887.

BEAUCHAMP TOWER.

Witnesses:

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