(No Model.) 2 Sheets—Sheet 1.

M. PFATISCHER.

STEERING GEAR FOR SHIPS.

No. 559,903. Patented May 12, 1896.

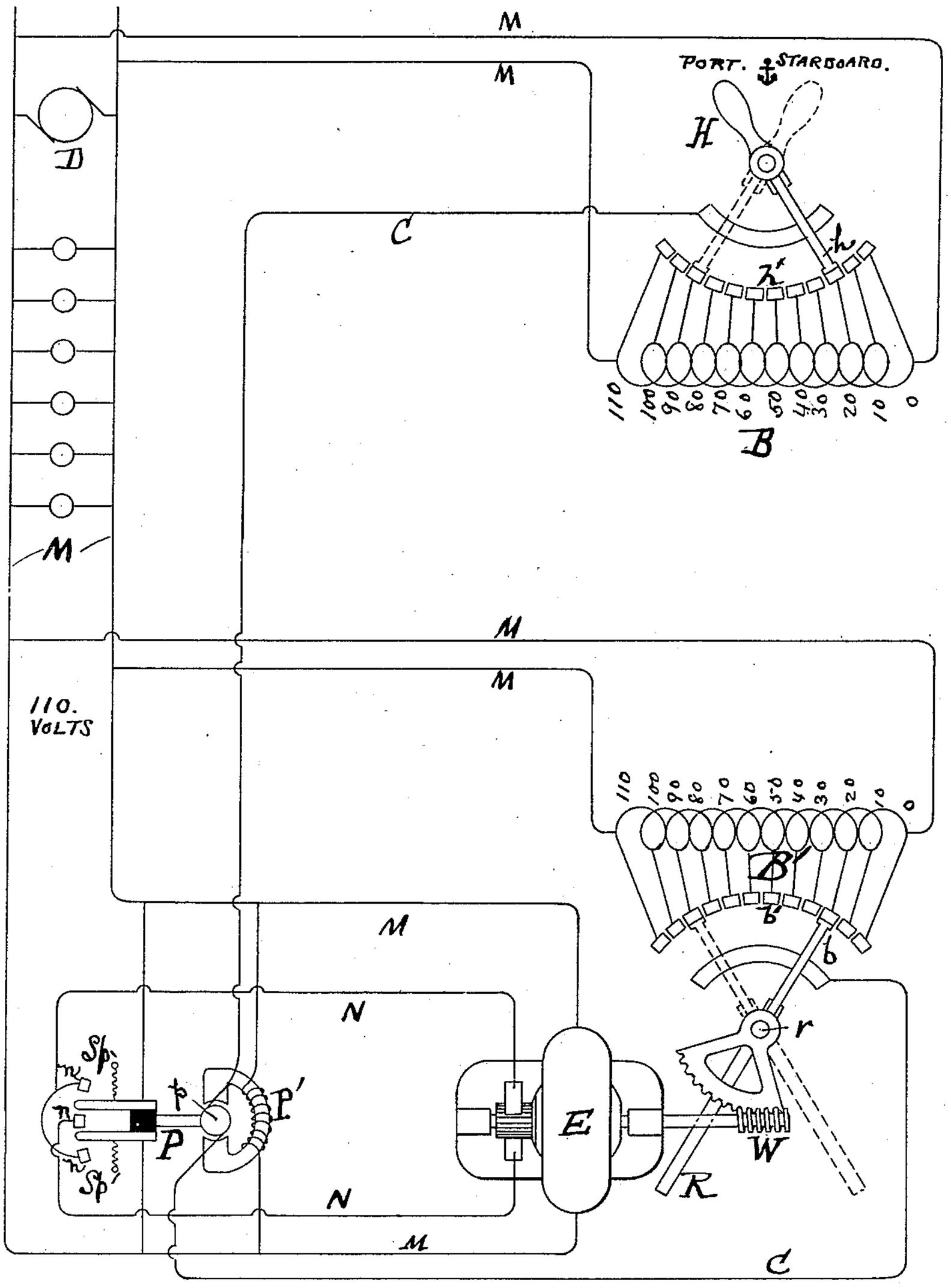

Figure 1.

WITNESSES:
E. H. Reinecke
F. H. Daniels

INVENTOR
Mathias Pfatischer
BY Harold Sinney
ATTORNEY

(No Model.) 2 Sheets—Sheet 2.

M. PFATISCHER.

STEERING GEAR FOR SHIPS.

No. 559,903. Patented May 12, 1896.

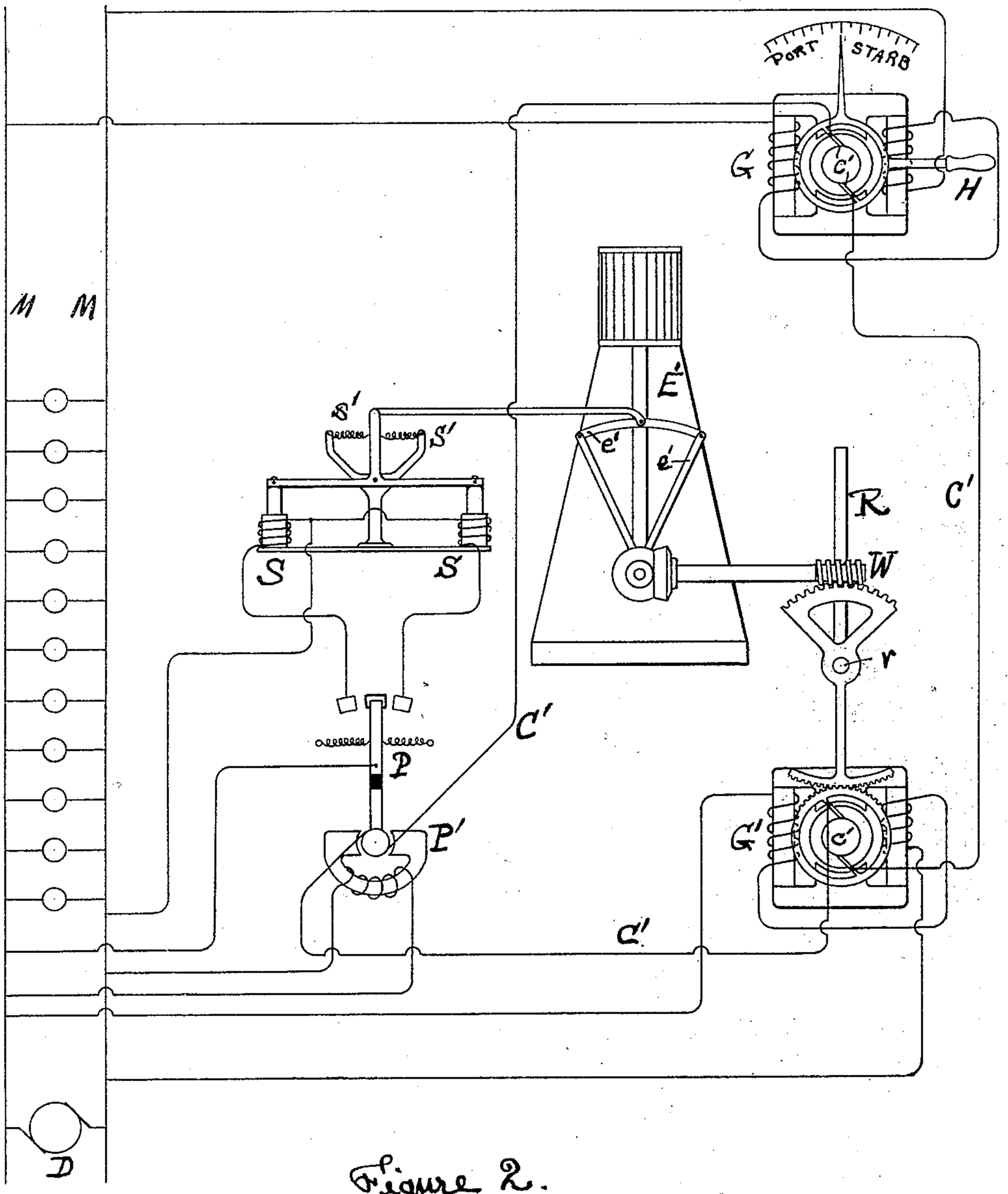

Figure 2.

WITNESSES:
E. M. Meinecke
F. H. Davis

INVENTOR
Mathias Pfatischer
BY Harold Binney.
ATTORNEY.

UNITED STATES PATENT OFFICE.

MATHIAS PFATISCHER, OF PHILADELPHIA, PENNSYLVANIA.

STEERING-GEAR FOR SHIPS.

SPECIFICATION forming part of Letters Patent No. 559,903, dated May 12, 1896.

Application filed August 24, 1895. Serial No. 560,448. (No model.)

To all whom it may concern:

Be it known that I, MATHIAS PFATISCHER, of Philadelphia, Pennsylvania, have invented certain new and useful Improvements in Steering-Gear for Ships, of which the following is a description, referring to the accompanying drawings, which form a part of this specification.

The object of my invention is to produce simple, reliable, and effective steering apparatus which may be controlled with extreme ease and delicacy by hand to steer the ship by steam, electricity, water, or other convenient motive power. The power—whether steam, water, or electricity—is controlled by an electrical controlling system which is of so simple a nature that a single circuit from the handle by which the ship is steered to the engine or other steering mechanism which applies the power to turn the rudder replaces the multiplicity of circuits heretofore employed.

The nature of my invention and the essential features of my method of and apparatus for steering ships will be clearly apparent from the accompanying drawings and the following description.

In the drawings, Figure 1 is a diagrammatic illustration of my system as applied where an electric motor is used to generate the power for turning the rudder. Fig. 2 is a diagrammatic illustration illustrating the system as applied where steam is employed to do the work of turning the rudder.

Throughout the drawings like letters of reference indicate like apparatus or parts.

I will first describe the invention as illustrated in Fig. 1, electricity being used as both motive power for the rudder and as controlling power in the controlling system.

At D is shown a dynamo, which is preferably the main source of supply for the lighting and other mains M of the ship. For convenience of illustration I have taken one hundred and ten volts as the difference of potential between the mains. The rudder R is turned by means of the worm and wheel W, the worm-wheel being mounted upon the rudder-post *r* and the worm being directly driven by means of the electric motor E. The field-magnets of this motor E are constantly excited by direct connection to the mains M. The armature, on the other hand, receives its current from the conductors N, which are connected, by means of a controlling-switch P, with the mains M in a manner to turn the armature of the motor E in either direction as required. This switch P is controlled by the lever, wheel, or handle which steers the ship in the following manner: At H is indicated the handle by which the ship is steered. This may be located in the pilot-house, on the bridge, or elsewhere. It is desirable that there should be one or more such handles at convenient locations. The handle H carries the movable switch-contact *h*, which sweeps over and makes contact with the series of fixed contacts or stops *h'*. These contacts or stops *h'* are severally connected with the subdivisions of a resistance-coil B, which is connected to and included between the mains M.

For convenience of illustration I have in the diagram divided the resistance-coil into eleven equal parts, so that there will be a difference of potential of ten volts between each pair of adjacent contacts or stops *h'*. Secured to the rudder-post *r*, or otherwise moving with the rudder, is a movable switch *b*, which makes contact with a similar series of fixed contacts or stops *b'*. Each of these contacts *b'* is, similarly to the contacts *h*, connected to the several subdivisions of a resistance-coil B', connected across the mains M. A conductor C connects the movable switch *b* with the movable switch *h* through the armature of the polarized relay P', which directly controls the position of the switch P. The switch P forms a reversing-switch for the conductor or circuit N, which includes the armature of the electric motor. When no current is passing through the armature *p* of the relay, the springs S*p* hold the switch P in its central position and no current is sent into the circuit N. When, however, the current passes through the armature of the polarized relay in one direction, the two movable contacts of the switch are moved into contact with the fixed contacts *n* of the circuit N in a manner to send current from the mains M through the armature of the motor in a certain direction. When, however, current is sent through the polarized relay in the oppo-

site direction, the switch P is shifted and reverses the flow of current in the circuit N, as will be clearly understood from the diagram.

It will now be clear that when the contacts *h* and *b* are in the position shown in the diagram no current will be sent into the conductor C and the polarized relay and switch will assume the position shown, and this will be equally true so long as the switch-contacts *h b* are upon respective stops *h'* and *b'* that have the same potential. If now the handle H be turned, the contact *h* travels over the stops *h'* and immediately causes a flow through the conductor C in one direction or the other. If the handle is turned to the position indicated in dotted lines, it is clear that there will be a difference of some seventy volts between the switch-contacts *h* and *b*, tending to send current through the conductor C and through the polarized relay. This current actuates the armature of the relay and causes the switch P to send current through the circuit N, starting the motor E in a direction to shift the contact *b*, together with the rudder, in a direction corresponding to the position of the handle H and switch *h*, and the motor E will continue to rotate until the rudder and switch *b* have assumed the position indicated in dotted lines, in which the switch *b* rests upon the contact of equal potential to the contact upon which the switch *h* rests. When this contact is reached, the current through the circuit N will cease and the springs S*p* will draw the switch P from the contact *n*, and thereby break the armature-circuit N of the motor E.

If the handle H be moved in the opposite direction from that described, current will be sent into the conductor C in a direction to operate the polarized relay and connect the armature of the motor in such a manner as to cause the rudder and movable switch-contact *h* to move to a position corresponding to the stop *b'*, that has a potential equal to that of the stop on which contact *h* rests. By this system a very slight movement of the handle H will actuate the relay and start the motor E with full power, causing the rudder to be turned accordingly until it again corresponds to the position of the handle H. It will also be seen that the handle H and its switch *h* are connected with the polarized relay and with the switch *b* by a single conductor C, so that in introducing my system into a ship it is only necessary, after making the connections with the lighting-circuit or other electrical circuit of the ship, to run a single conductor from the pilot-house to the steering apparatus in the stern of the ship.

In Fig. 2 is similarly illustrated in diagram my electrical system as applied to a steam-motor for moving the rudder. The polarized relay P' is in this instance included in a circuit C', which includes extra brushes *c'* of two electric motors or motor-generators, which replace and are substantially equivalent in function to the resistance-coils B B' described in connection with Fig. 1. The hand-lever H, instead of shifting a switch-contact *h*, shifts the extra brushes *c'*, which are connected to the circuit C'. The movement of the rudder R similarly, instead of shifting a switch *b*, as described in connection with Fig. 1, shifts the commutator-brushes of the second motor-generator G. The function of these two motor-generators G G' is to introduce a current in one direction or the other into the circuit C', according to the angular position of the brushes *c'*. When the rudder is amidships and the handle H is in a position corresponding thereto, all four brushes *c'* are upon the neutral points of the commutators of the motor-generators G G'. When, however, the handle H displaces the corresponding commutator-brushes *c'*, current is sent through the circuit C' and through the polarized relay P' until the brushes *c'* of motor G' are shifted to introduce an opposing and equal electromotive force. The switch P, which is actuated by the polarized relay, instead of introducing current in one direction or another into an electric motor actuates one of the magnets or solenoids S, which actuate the valve connections or the link-motions *e'* of a steam-engine E, and cause it to actuate the worm and worm-wheel W and turn the rudder R. This turning of the rudder continues until the brushes *c'* of the motor-generator G' have been brought to a position to introduce an equal and balancing electromotive force into the circuit C'. When this point has been reached, the cessation of the current in the circuit C' allows the relay-switch P to be drawn back to its central position, breaking the circuit of the solenoid S and allowing the springs S' to stop the engine.

I have indicated the engine and several other parts diagrammatically because the details are quite immaterial so far as the essentials of my invention are concerned. So, also, while I have diagrammatically indicated motor-generators G G', it must be understood that dynamos with constantly-excited field-magnets and constantly-rotated armatures would be in every respect equivalents, and also that an ordinary motor can be utilized by adding extra brushes *c c'*, arranged to be moved around the commutator without disturbing the motor-brushes.

It will be seen that while I have set forth my invention as an improvement in steering-gear, where it is desired to adjust the rudder of a ship, the invention as applied to directing guns or other adjustable apparatus from a distance is in all respects identical, and I desire, of course, to protect my improvement in all its possible uses. It is also clear that while the details of Figs. 1 and 2 are somewhat different, the circuit or branch circuit C of Fig. 1 being a bridge or single conductor extending between the two subdivided resistances B and B', whereas the conductor C' of Fig. 2 is a complete circuit having no direct electrical connection to the lighting-circuits

of the ship and merely including the electrically-actuated controller P′ and the two armatures *c′*, nevertheless in both cases the devices are essentially similar in certain respects. For instance, one terminal of the controller P′ is connected to the movable brush of one of the armatures *c′*, while the other terminal is connected to one of the brushes of the other armature *c′*.

It is not essential that the controlling-circuit should be completed through the conductor, as shown in Fig. 2, for the other brushes of the two armatures could obviously be connected to earth, and they need not even be adjustable upon the commutators. So also many other mechanical and electrical changes of detail may be made without departing from the essentials of the invention, and I have purposely omitted the enumeration of several of these because to set them forth at length would obscure rather than make clear the more essential features; but

Having described the invention as embodied in two distinct forms, I claim, and desire to secure by these Letters Patent of the United States, together with all such modifications as may be made by mere skill in the art, and with only the limitations as expressed or by law implied in view of the related arts, as follows:

1. In combination with an adjustable apparatus, motive power for adjusting said apparatus, an electrically-actuated controlling device for the said motive power, a controlling circuit or branch (C or C′), two or more suitably-derived series of points maintained at different or graduated potentials, means, as a movable contact, connecting the said circuit to one said series of points and adjustable at will to thereby apply more or less electromotive force or potential to the said circuit, and means actuated by the said motive power for connecting the said circuit to the other of said series of points so as to apply more or less opposing electromotive force or potential thereto, substantially as set forth.

2. In combination with an adjustable apparatus, motive power for adjusting said apparatus, an electrically-actuated controlling device for the said motive power, two or more suitably-connected series of points maintained at different or graduated potentials, one or more movable brushes or contacts permanently connected to one terminal of the said controlling device, and adjustable at will to introduce more or less electromotive force or current from one of the said series of points, into the said controlling device, and one or more movable brushes or contacts permanently connected to the other terminal of the said controlling device and actuated by the said motive power to introduce more or less opposing electromotive force or current from the other of said series of points, substantially as set forth.

3. In combination with a ship's rudder and motive power for turning it, an electrically-actuated controlling device therefor, a motor or generator armature, commutator, and adjustable brushes therefor, included in circuit with the said controlling device, a second such armature, commutator, and adjustable brushes, also included in said circuit, and mechanical connections for automatically adjusting the last said brushes simultaneously with the said rudder, substantially as set forth.

In testimony whereof I have hereunto set my hand, at Philadelphia, Pennsylvania, this 16th day of August, A. D. 1895.

MATHIAS PFATISCHER.

In presence of—

EDWIN F. GLENN,

HAROLD BINNEY.