(No Model.) 5 Sheets—Sheet 1.

A. B. BROWN.

STEERING VESSELS.

No. 568,736. Patented Oct. 6, 1896.

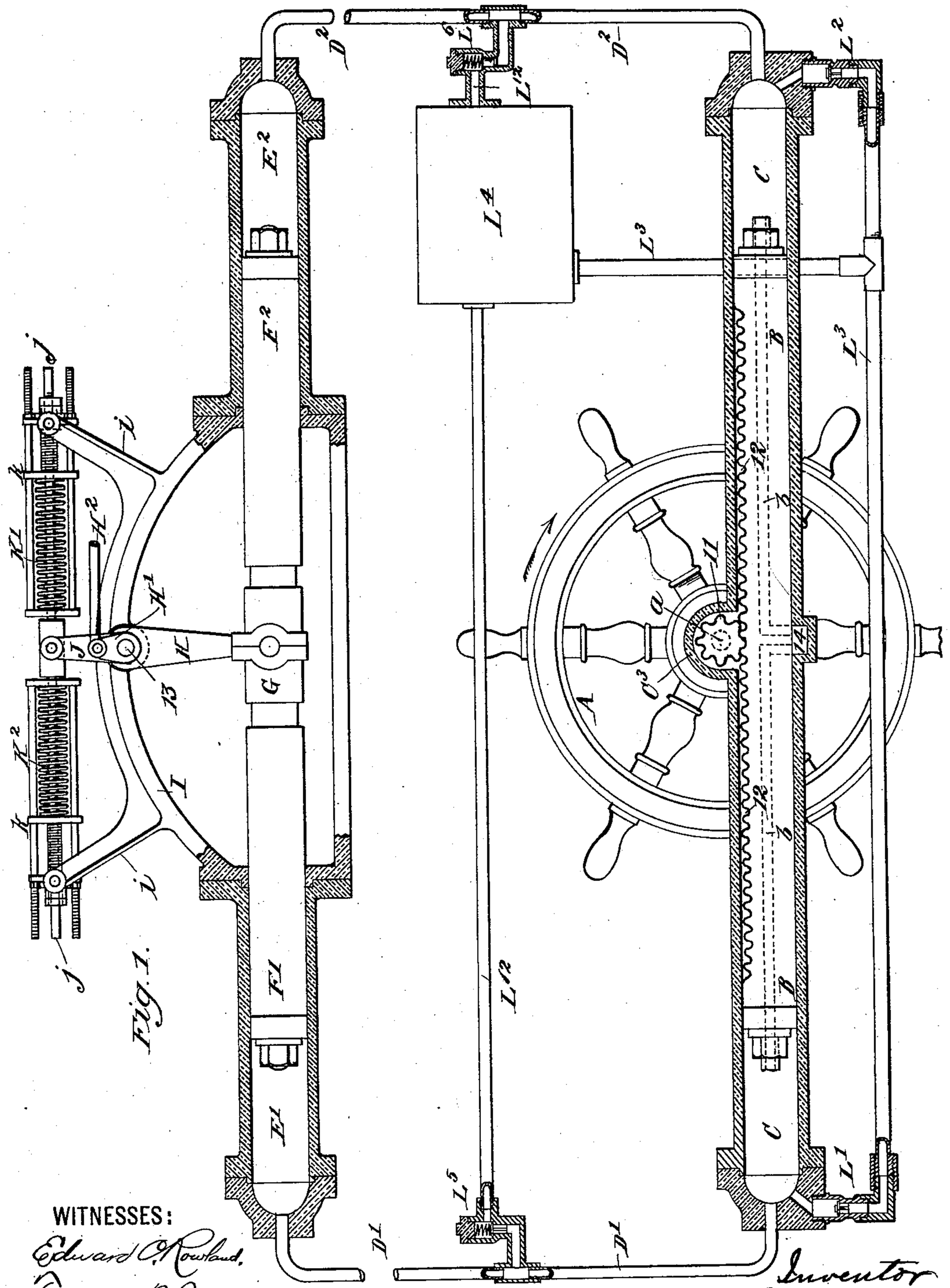


Fig. 1.

WITNESSES:

Edward C. Rowland.

Francis B. Reiley

Inventor

A. B. Brown

By D. B. Voorhees ATTORNEY

(No Model.) 5 Sheets—Sheet 2.

A. B. BROWN.

STEERING VESSELS.

No. 568,736. Patented Oct. 6, 1896.

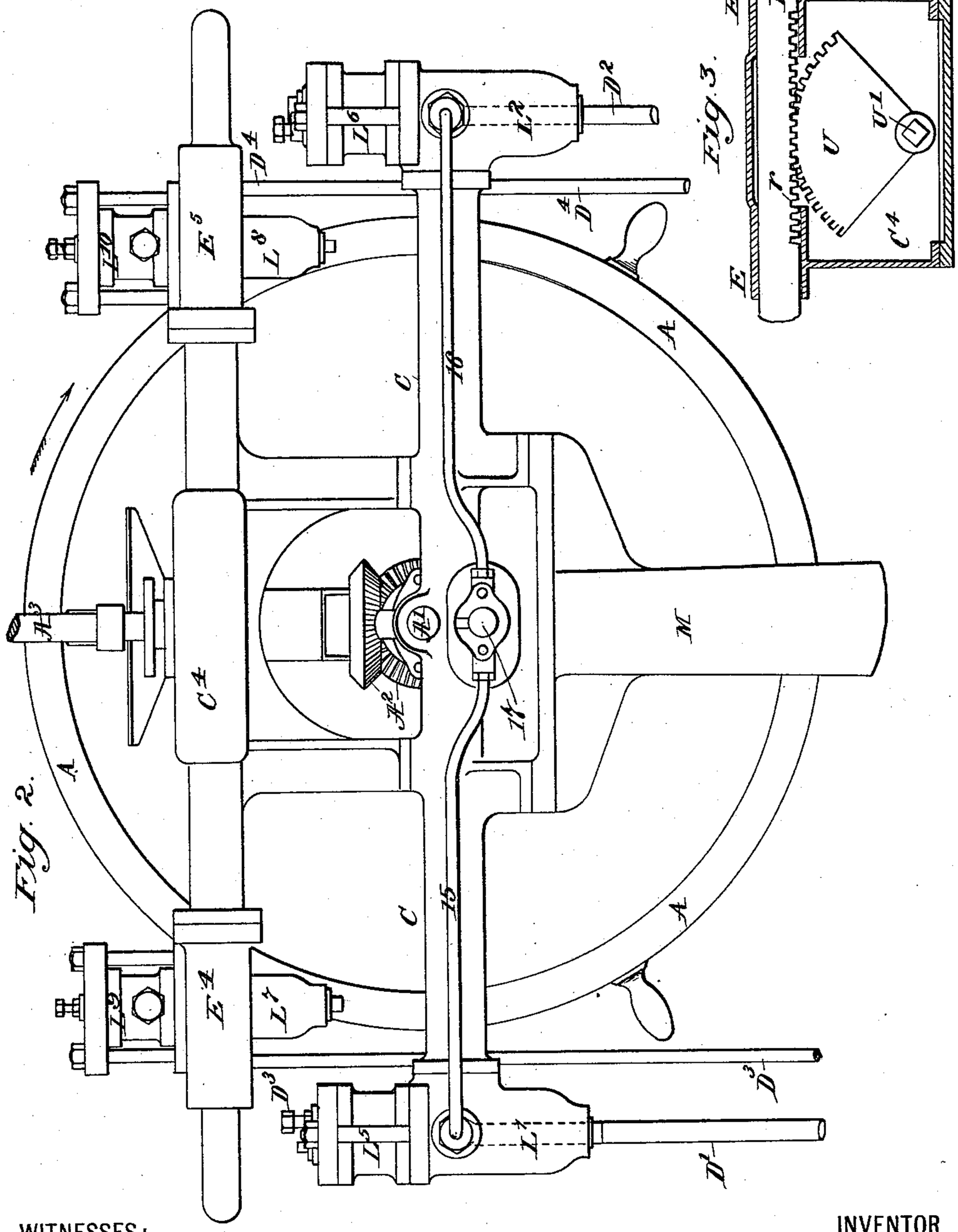


Fig. 2.

Fig. 3.

WITNESSES:
Edward C. Rowland.
Francis T. Reilly.

INVENTOR
A. B. Brown
BY P. B. Borchers
ATTORNEY

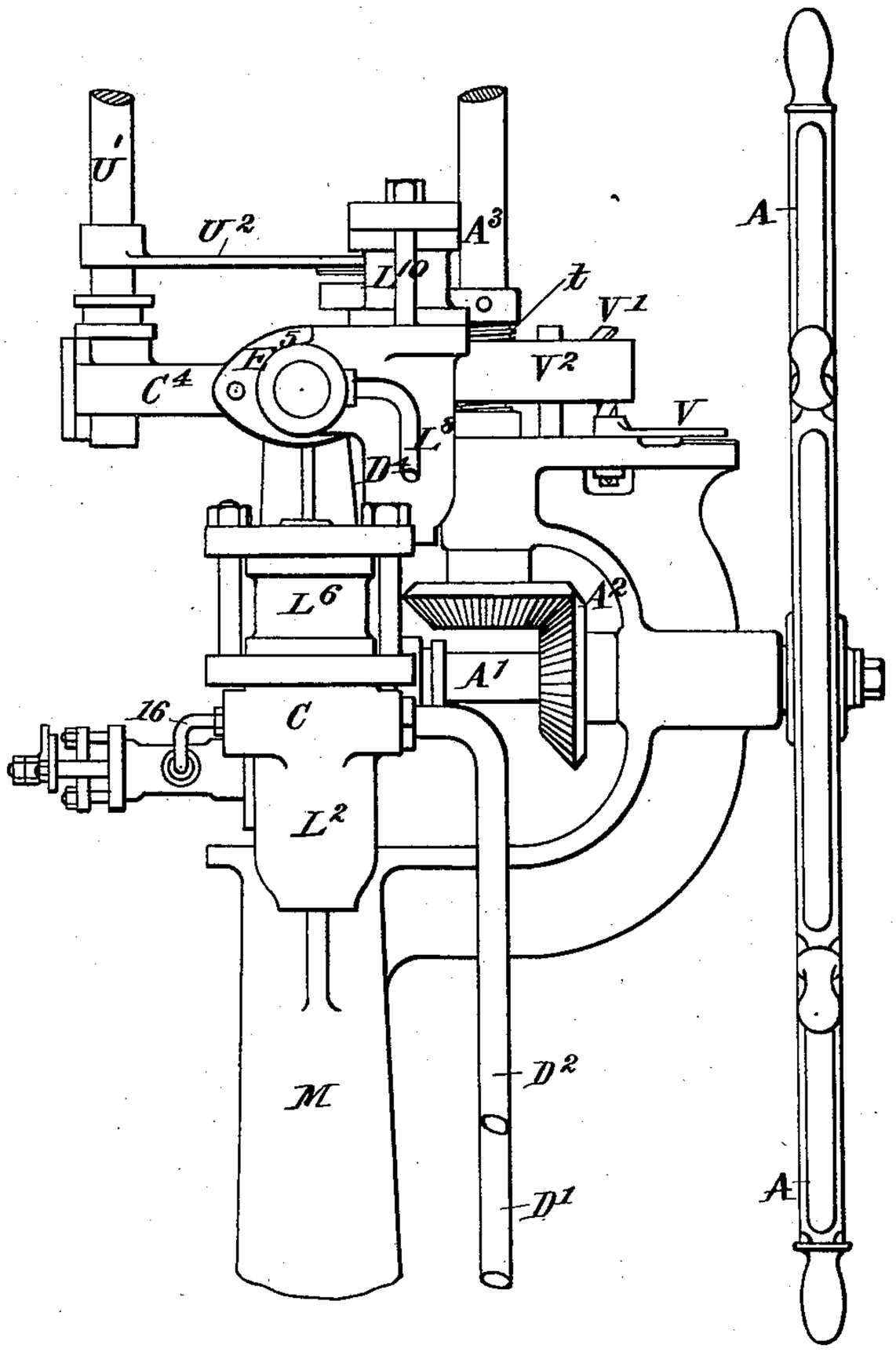
(No Model.) 5 Sheets—Sheet 3.

A. B. BROWN.

STEERING VESSELS.

No. 568,736. Patented Oct. 6, 1896.

Fig. 4



WITNESSES:

Edward C. Rowland.

Francis P. Reiley.

INVENTOR

A. B. Brown

BY E. M. Wheeler

ATTORNEY

(No Model.) 5 Sheets—Sheet 4.

A. B. BROWN.

STEERING VESSELS.

No. 568,736. Patented Oct. 6, 1896.

Fig. 5.

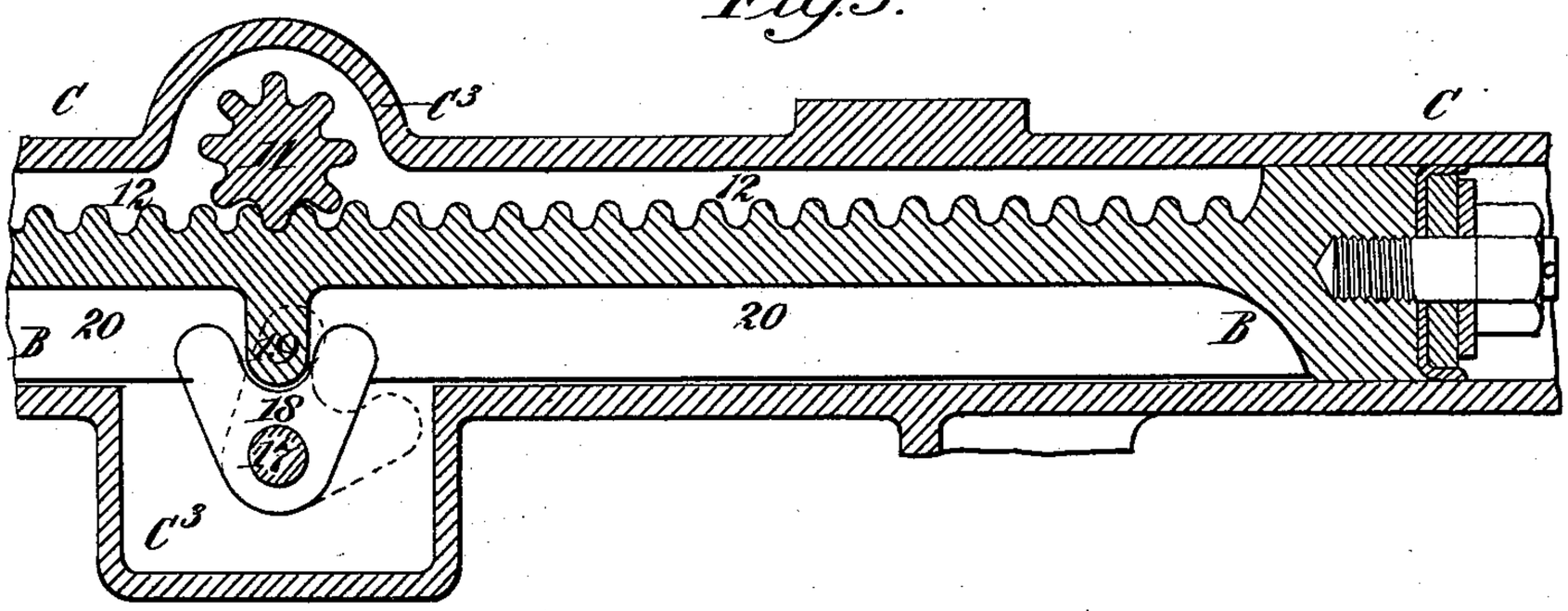


Fig. 6.

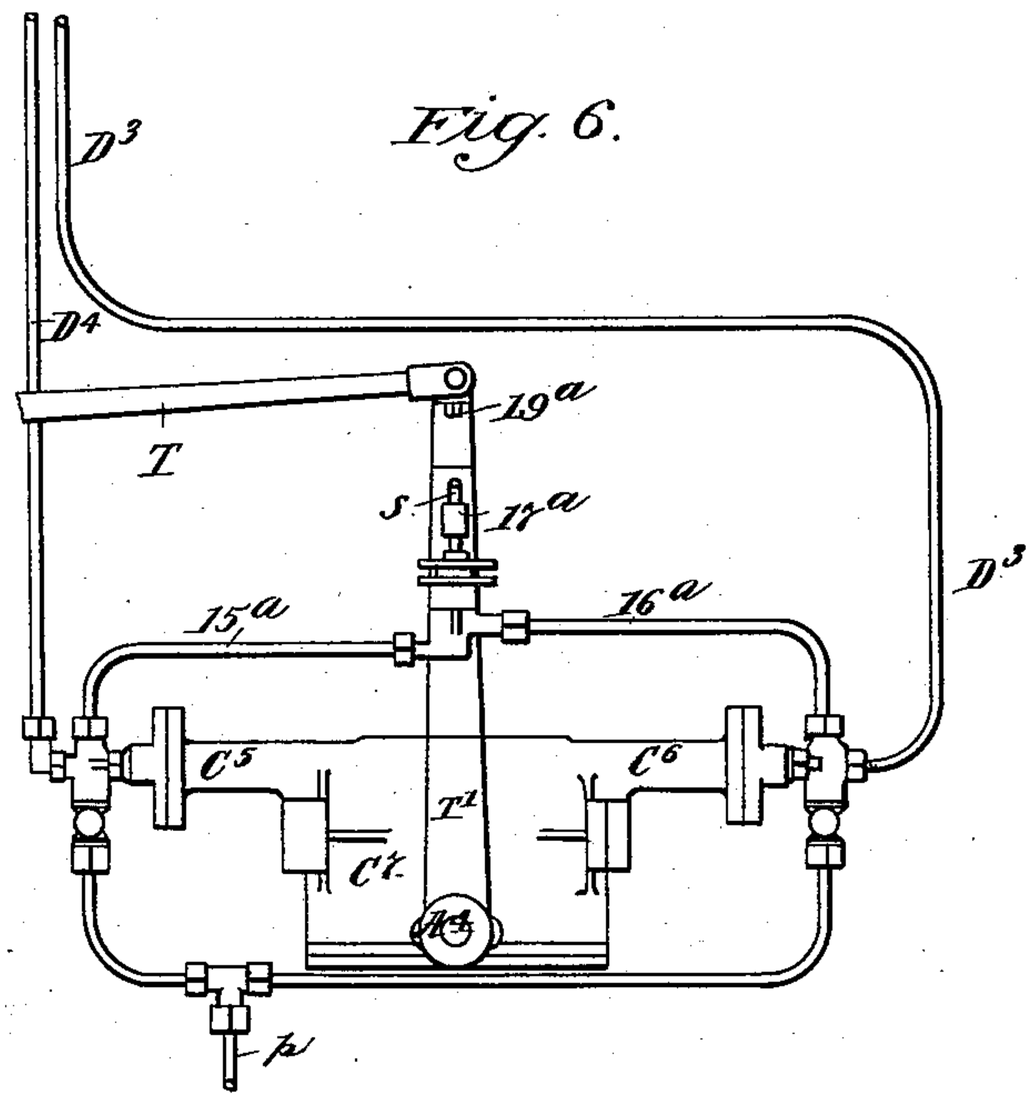
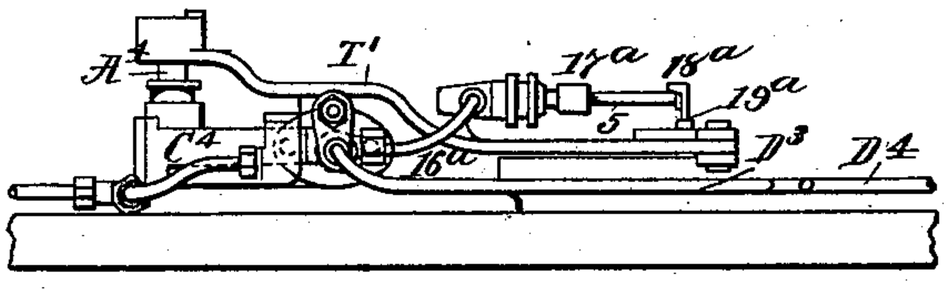


Fig. 7.



WITNESSES:

Edward C. Rowland

Francis P. Reiley.

INVENTOR

A. B. Brown

BY R. R. Rowlee

ATTORNEY.

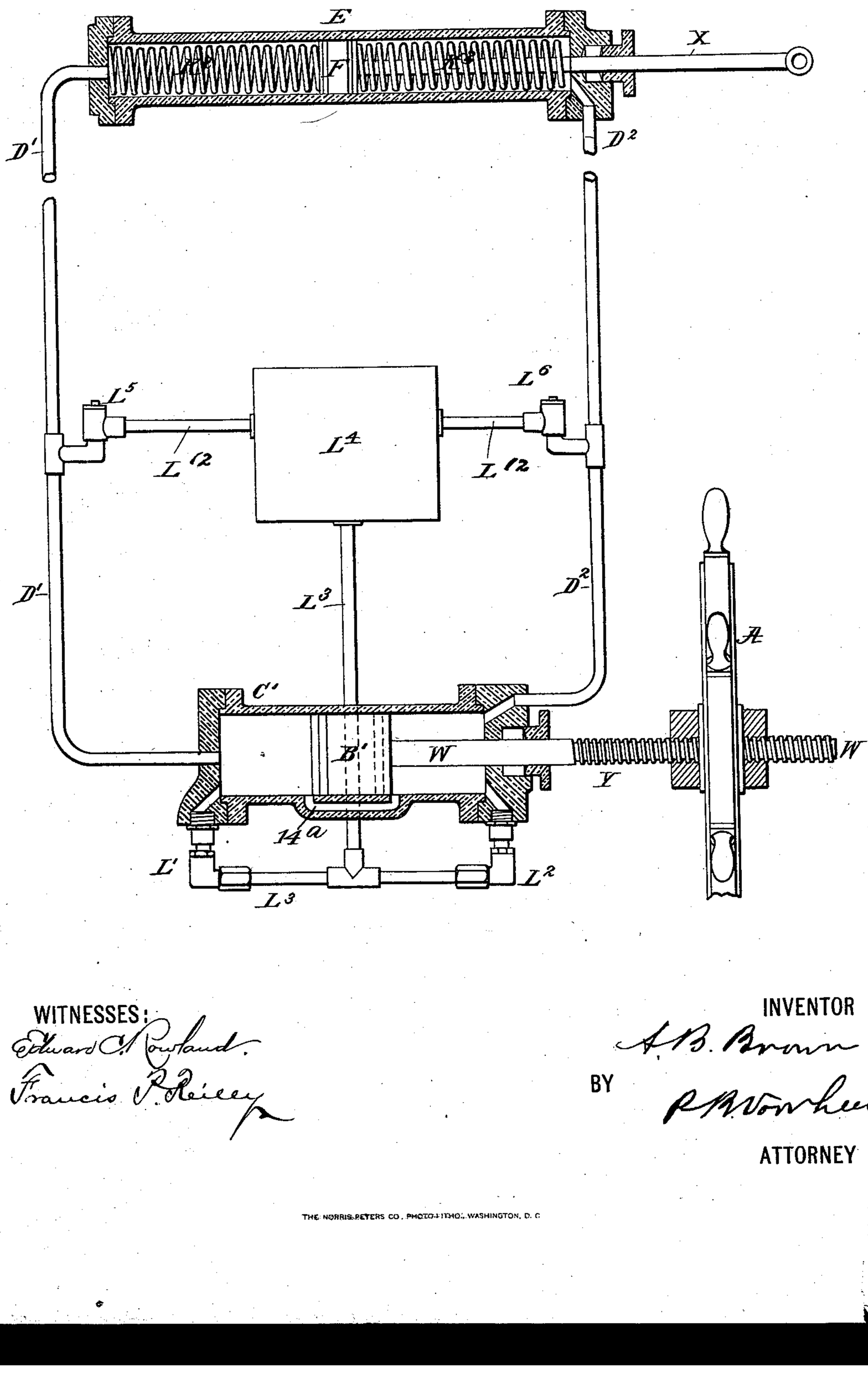
(No Model.) 5 Sheets—Sheet 5.

A. B. BROWN.

STEERING VESSELS.

No. 568,736. Patented Oct. 6, 1896.

Fig. 8.



WITNESSES:
Edward C. Rowland.
Francis P. Reiley

INVENTOR
A. B. Brown
BY
R. H. Voorhees
ATTORNEY

UNITED STATES PATENT OFFICE.

ANDREW B. BROWN, OF EDINBURGH, SCOTLAND.

STEERING VESSELS.

SPECIFICATION forming part of Letters Patent No. 568,736, dated October 6, 1896.

Application filed November 8, 1895. Serial No. 568,259. (No model.) Patented in England October 9, 1888, No. 14,456.

To all whom it may concern:

Be it known that I, ANDREW BETTS BROWN, a subject of the Queen of Great Britain, residing at Edinburgh, in the county of Mid-Lothian, Scotland, have invented a new and useful Telemotor Apparatus for Operating Steering Machinery and for other Purposes, (for which I have obtained Letters Patent in Great Britain, No. 14,456, bearing date October 9, 1888,) which invention is fully set forth and illustrated in the following specification and accompanying drawings.

The object of this invention is to transmit movements from a distance, by means of hydraulic power, to steering, telegraphing, indicating, and other analogous apparatus.

As the steering-engines of a vessel are frequently located in close proximity to the rudder, while the steering-wheel is located on a bridge nearer to the bow of the vessel, some connection must be provided between said steering-wheel and the valves of said engine, and a complicated arrangement of shafting and gearing has heretofore been used for this purpose. By my invention herein described the inconveniences and difficulties attendant upon the use of such mechanism is avoided, and a simple hydraulic connection is established between the steering-wheel and the valve of the steering-engine, which is readily and certainly operated.

The invention will first be described in detail and then set forth in the claims.

In the accompanying drawings, Figure 1 is a general view in elevation of a transmitting and receiving apparatus constituting a hydraulic telemotor embodying my invention, several of the parts being shown in section. Fig. 2 shows in elevation a modified form of transmitting apparatus having combined therewith an apparatus for indicating the position of the rudder. Fig. 3 shows in horizontal section a detail of construction shown in Fig. 2 and hereinafter described. Fig. 4 is a side elevation of Fig. 2, looking to the left. Fig. 5 shows in vertical section, enlarged, a portion of the transmitting apparatus illustrated in Fig. 2. Fig. 6 is a view in plan of the transmitting portion of an apparatus employed to indicate the position of the rudder. Fig. 7 is an end elevation of Fig. 6. Fig. 8 is an elevation, partly in section, of a modified form of hydraulic telemotor embodying my invention.

In said figures the several parts are respectively indicated by reference letters and numbers, as follows:

Referring first to Fig. 1, the letter A indicates a steering-wheel located on the bridge of the vessel or at any other convenient point and mounted upon a shaft *a*. Said shaft extends through a stuffing-box into a casing or enlarged portion C^3, formed on a transmitting-cylinder C and is provided with a pinion 11, which meshes with a rack 12, formed upon or attached to the surface of a piston or plunger B, located within said transmitting-cylinder, the ends of said piston being suitably packed.

Connected to the ends of the transmitting-cylinder C are two pipes D' D^2, which lead to the place where the steering-engine is located and there connect with the receiving apparatus. Said receiving apparatus consists of a cylinder or cylinders E' E^2, provided with pistons or plungers F' F^2, connected by a bar G. The pipe D' from the transmitter leads into the cylinder E', and the pipe D^2 leads into the cylinder E^2.

The transmitting-cylinder C, the pipes D' D^2, and the receiving-cylinders E' E^2 are kept full of liquid by means of a pipe L^3, leading from a reservoir or tank L^4 and provided with inlet check-valves L' L^2. The pipes D' D^2 are provided with safety-valves L^5 L^6, suitably loaded by springs, so that, should the internal pressure become excessive from any cause, said valves will open and relieve the pressure by establishing communication with the reservoir L^4 through the pipes L^{12}.

Connected to the bar G, which unites the two pistons F' F^2 of the receiver, is one end of a rocker arm or lever H, the other end of which is secured to a rock-shaft 13, carried in a frame I, mounted upon and secured to the receiving-cylinders E' E^2. Secured to said rock-shaft also is one end of a small rocker arm or lever H', to the other end of which is connected a rod H^2, leading to the valve-gear of the steering-engine. (Not shown.) A rocker arm or lever J has one of its ends secured to the shaft 13, its other end being connected to spring-rods *j*. Spiral springs K' K^2 surround said rods between cross-heads *k*,

supported from arms *i* of the frame I. Said springs act upon the arm or lever J so as to move it to its central position when it is free to move. Whenever the steering-wheel A is turned so as to move the transmitting-piston B into its middle position, a communication is opened, as below described, between the two ends of the transmitting-cylinder C, and then, if the correcting arm or lever J, connected to the pistons F' F^2 of the receiver, has not also been brought to its central position, the springs K' K^2, acting upon said lever, will force it and the receiving-pistons F' F^2 into their central positions. The liquid in the pipes D' D^2 and in the cylinders C E' E^2 will thus be free to adjust itself by moving from one cylinder to another, as may be required. The parts will in this way be brought into exact correspondence every time the steering-wheel A is turned to its middle position. Various devices may be used for effecting communication between the ends of the transmitting-cylinder C. In Fig. 1 the piston B is shown provided with passage-ways *b*, extending from its ends to separate ports in one side of the piston at its middle, said ports opening into a cavity 14, formed in the sides of the cylinder C. When the piston is in its middle position, communication will thus be established between the ends of the cylinder. In Figs. 2 and 5 communication is effected by means of pipes 15 16, connected to a stop-cock, the plug 17 of which has fixed upon it a forked piece 18, operated by a tooth or projection 19, formed upon or attached to the piston B at the middle of a groove 20, formed along the piston. The stop-cock plug 17 is opened when the forked piece 18 is moved to its middle position by the piston-tooth 19, but is instantly closed by the action of said tooth when the piston is moved from its middle position in either direction by the steering-wheel A.

In Figs. 2, 3, and 4 a transmitting apparatus is shown having combined therewith an apparatus for indicating the position of the rudder, all the parts being carried by a pedestal or standard M. The filling-valve L' L^2 and the relief-valves L^5 L^6 are shown in these figures attached to the ends of the transmitting-cylinder C, but the supply-pipe L^3 and reservoir L^4 are not shown. The pipes D' D^2 lead to the receiving-cylinders E' E^2 in the manner shown in Fig. 1. The steering-wheel shaft A′ is connected by means of bevel-wheels A^2 with a vertical shaft A^3, which may be actuated, when desired, by a steering-wheel placed at a higher level. The shaft A^3 is provided with screw-threads *t*, adapted to raise and lower a block V^2, which is provided with an internal helix acting upon a helical spindle V′, to which is fixed an index-arm V. By means of this construction the index-arm V will indicate the position in which the rudder should be placed by the movement of the steering-wheel A when the apparatus operates correctly.

For showing the actual position of the rudder the apparatus now to be described is provided. Mounted upon suitable brackets or frames carried by the standard M, Fig. 2, is a long cylinder or pair of cylinders E^4 E^5, provided with filling check-valves L^7 L^8 and relief check-valves L^9 L^{10}. Within the cylinders E^4 E^5, which may be called the "indicator-receiving" cylinders, is a long piston E^6, provided at its central portion with a rack *r*, which meshes with a toothed sector U, secured to a shaft U′, within a casing C^4, formed upon or secured to the cylinders E^4 E^5, Figs. 2 and 3. The shaft U′ passes upward out of the casing C^4 and has secured to it an index-arm U^2 to indicate the position of the rudder. Leading from the cylinders E^4 E^5 are two pipes D^3 D^4, which lead to the place where the steering apparatus is located and there connect with the indicator-transmitting cylinders C^5 C^6, (shown in Figs. 6 and 7,) which are similar to the indicator-receiving cylinders E^4 E^5, (shown in Fig. 2,) and are provided with a piston having a rack meshing with a toothed sector (similar to the sector U, Fig. 3) secured to a shaft A^4 within a casing C^7. Connected to the upper end of the shaft A^4 is one end of a lever T′, the other end of said lever being connected to a lever T, operated in any suitable manner by the movements of the rudder.

The cylinders C^5 C^6 may be supplied with fluid through an inlet-pipe *p*, leading from any suitable source of supply, and filling and relief-valves similar to those shown in Fig. 2 may be provided. For establishing communication between the cylinders C^5 C^6 pipes 15^a 16^a are provided, having a stop-cock 17^a, the plug of which is operated by a spindle *s*, provided on its ends with a forked piece 18, acted upon by a tooth 19 on the lever T′. By this construction the ends of the indicator-transmitting cylinders C^5 C^6 will be put into communication with each other whenever the lever T′ and the rudder are in their central positions, and the piston E^6 in the indicator-receiving cylinders E^4 E^5 will also thus be allowed to assume its central position, the centering of this latter piston being accomplished by helical springs (not shown) applied in the cylinders themselves in a manner to act on the piston when moved from the middle position.

The operation of the complete telemotor apparatus constructed as shown in Figs. 1 to 7 is as follows: If the hand-wheel A of the transmitting apparatus be revolved in the direction of the arrow, Figs. 1 and 2, by the helmsman on the bridge, said movement will, through the instrumentality of the pinion 11 and the rack 12 on the piston B, move said piston to the left within the transmitting-cylinder C. As said piston moves it will expel through the pipe D′ the fluid contained in the cylinder C at the left-hand end of said piston, and said fluid will then rush through said pipe to the receiving ap-

paratus, located near the steering-engine, and will enter the cylinder E′ of said receiver at the left of the piston F′. Said piston will thus be forced to the right, carrying with it the cross-bar G and piston F², and imparting motion by means of the rocker arm or lever H to the rock-shaft 13. This movement of the shaft 13 will move the rocker arm or lever J and compress the spring K², and will also move the rocker arm or lever H′, thus imparting to the valve-rod H², connected to said lever, the necessary motion to cause the engine to move the rudder the desired distance. If the hand-wheel A be moved in the direction opposite to the arrow, it is obvious that the operations of the several parts will be the reverse of those just described. The position which the movement of the hand-wheel A should cause the rudder to assume, if the apparatus be in proper working condition, will be indicated to the helmsman by the indicator-arm V, Fig. 4, which, when the steering-wheel A is revolved, will be moved through the instrumentality of the bevel-wheels A², shaft A³, block V², and helical spindle V′. The position actually assumed by the rudder will be indicated to the helmsman by the indicator-arm U², Fig. 4, which will be moved in the ~~following~~ manner: As the rudder moves by the action of the steering-engine it will move the lever T, Figs. 6 and 7, which, by means of the lever T′, connected thereto, will vibrate the shaft A⁴, and thus, by means of the toothed sector within the casing C⁷, move the piston in the indicating-transmitting cylinder C⁵ C⁶ to one side or the other. This movement of said piston will expel a current of fluid through one of the pipes D³ D⁴ to the indicator-receiving cylinders E⁴ E⁵, located at the steering-station, Figs. 2 and 4, and the piston E⁶ of said cylinders will thus be moved. As said piston moves it will, by means of the rack *r* thereon, move the sector U and vibrate the shaft U′, to which said sector is secured. As the shaft U′ rotates it will move the indicator-arm U², secured thereto, thus indicating to the helmsman the position in which the rudder has been placed by the action of the steering-engines.

In the modified form of telemotor apparatus shown in Fig. 8 a comparatively short transmitting-cylinder C′ is employed, having a piston B′. The piston-rod W of said piston extends through a stuffing-box and is provided on its outer portion with screw-threads acted upon by internal screw-threads on the hub of the steering-wheel A, which is mounted on said rod W, said hub forming a nut on said rod. The receiving-cylinder E is also shortened and is provided with a piston F. The rod X of said piston passes out of said cylinder through a stuffing-box and may be connected to the controlling-valve of the steering-engine or other apparatus. Springs K² K³ are located in the cylinder E to act in opposite directions on the piston F and center the same. To allow of such centering, the transmitting-cylinder C′ is provided with a passage 14ª, which establishes communication between the ends of said cylinder when the piston B′ is in its middle position. The arrangement of supply pipes and valves and connecting-pipes is the same as that shown in Fig. 1.

The operation of the apparatus constructed as shown in Fig. 8 is as follows: If the hand-wheel A be rotated, such rotation will, by means of the screw-threads *y* on the piston-rod W, cause the piston B′ in the transmitting-cylinder C′ to move in one direction or the other, according to the direction in which the wheel A is rotated. As said piston moves it will expel fluid through one of the pipes D′ D² to the receiving-cylinder E and cause the piston F of said cylinder to move to one side or the other, thus imparting the desired motion to the valve-rod of the steering-engine, to which rod may be connected the piston-rod X. The indicating apparatus shown in the preceding figures, or any other indicating apparatus, may be used in connection with the transmitter and receiver shown in Fig. 8.

In either form of hydraulic telemotor shown in the drawings, whenever the piston of the transmitting-cylinder is moved to its middle position by the hand-wheel A, communication will be established between ends of said cylinder in the manner above described, and the piston of the receiving-cylinder will be brought into a corresponding position by the action of the spring devices, hereinbefore described, connected to said piston. So, also, when the piston in the indicator-transmitting cylinders C⁵ C⁶ is in its middle position, communication will be established between the ends of said cylinders in the manner above described, and the piston E⁶ of the indicator-receiving cylinders E⁴ E⁵ will also be brought to its middle position by the springs (not shown) connected thereto. It is obvious that some equivalent device may be substituted for the spring devices described for centering the pistons of the receiving apparatus.

I do not confine myself to the use of the telemotor apparatus herein described in conjunction with a steering-engine, as it is obvious that said apparatus may be employed to operate from a distance other mechanism or machinery, in particular where motion of an intermittent character is desired. If a steering-engine be employed, such engine may be of any suitable construction.

Having thus fully described my invention, I claim—

1. In a hydraulic telemotor apparatus the combination of a receiving-cylinder provided with a piston; a lever connected to said piston; and means connected to said lever for automatically centering said piston.

2. In a hydraulic telemotor apparatus, the combination with a receiving-cylinder provided with a piston, of a spring or springs

connected to said piston for automatically centering the same.

3. In a hydraulic telemotor apparatus the combination of a transmitting-cylinder provided with a piston; means for establishing communication between the ends of said cylinder; a receiving-cylinder provided with a piston; pipes connecting said cylinders; and means connected to the piston of said receiving-cylinder for centering the same.

4. In a hydraulic telemotor apparatus, the combination of a transmitting-cylinder provided with a piston; a receiving-cylinder provided with a piston; pipes connecting said cylinders; and springs connected to the piston of said receiving-cylinder for automatically centering the same.

5. In a hydraulic telemotor apparatus, the combination of a receiving-cylinder provided with a piston or plunger; an arm or lever secured to a rock-shaft and connected to said piston; a correcting-lever also secured to said shaft; and springs connected to said correcting-lever.

6. In a hydraulic telemotor apparatus, the combination of a transmitting-cylinder provided with a piston; a receiving-cylinder provided with a piston; pipes connecting said cylinders; an arm or lever secured to a rock-shaft and connected to the piston of said receiving-cylinder; a correcting-lever also secured to said shaft; and springs connected to said correcting-lever.

7. In a hydraulic telemotor apparatus, the combination of a transmitting-cylinder provided with a piston; means substantially as described for establishing communication between the ends of said cylinder; a receiving-cylinder provided with a piston; and pipes connecting said transmitting and receiving cylinders.

8. In a hydraulic telemotor apparatus, the combination of a transmitting-cylinder; a pipe connecting the ends of said cylinder; a cock or valve located in said pipe and provided with a forked arm or lever; and a piston within said cylinder provided with a tooth or projection fitting into said forked lever.

9. In a hydraulic telemotor apparatus, the combination of the following-named parts: a transmitting-cylinder provided with a piston; a receiving-cylinder provided with a piston; a reservoir or tank; a pipe for supplying fluid to said transmitting-cylinder from said tank; pipes connecting said transmitting and receiving cylinders; and a pipe, or pipes, leading from said connecting-pipes to said tank and provided with spring-loaded safety-valves.

10. In a hydraulic telemotor apparatus, the combination of a transmitting-cylinder provided with a piston or plunger having a rack formed upon or attached to its surface within said cylinder; a pinion within said cylinder meshing with said rack and mounted upon a shaft; a hand-wheel secured to said shaft; a receiving-cylinder provided with a piston; and pipes connecting said receiving and transmitting cylinders.

11. In a hydraulic telemotor apparatus, the combination of a transmitting-cylinder provided with a piston or plunger having a rack formed upon or attached to its surface within said cylinder; a pinion within said cylinder meshing with said rack and mounted upon a shaft; a hand-wheel secured to said shaft; a receiving-cylinder provided with a piston; pipes connecting said transmitting and receiving cylinders; an arm or lever secured to a rock-shaft and connected to the piston of said receiving-cylinder; a correcting-lever also secured to said shaft; and springs connected to said correcting-lever.

12. In a hydraulic telemotor apparatus, the combination of a transmitting-cylinder provided with a piston; mechanism for reciprocating said piston; a receiving-cylinder provided with a piston; a rod connected to said last-mentioned piston for operating the valve of a steering-engine; and a separate indicator-cylinder provided with a piston, adapted to be operated by the movement of the rudder.

13. In a hydraulic telemotor apparatus, the combination of transmitting and receiving cylinders; an indicator-transmitting cylinder; an indicator-receiving cylinder; a piston within said indicator-receiving cylinder provided with a rack; a toothed sector secured to a shaft and meshing with said rack; and an index-arm also secured to said shaft, for indicating the angle of the rudder.

14. In a hydraulic telemotor apparatus, the combination of a transmitting-cylinder; a receiving-cylinder; pipes connecting said cylinders; an indicator-transmitting cylinder provided with a piston operated by the movement of the rudder; an indicator-receiving cylinder provided with a piston; pipes connecting said cylinders; and an index-arm operated by the movement of the piston in said indicator-receiving cylinder.

15. In a hydraulic telemotor apparatus, the combination of a transmitting-cylinder; a receiving-cylinder; pipes connecting said cylinders; an indicator-transmitting cylinder provided with a piston operated by the movement of the rudder; an indicator-receiving cylinder provided with a piston; pipes connecting said cylinders; an index-arm operated by the movement of the piston in said indicator-receiving cylinder; and mechanism substantially as described for bringing the pistons of said cylinders into corresponding positions.

16. In a hydraulic telemotor apparatus, the combination of a transmitting-cylinder; a piston provided with a rack upon its surface within said cylinder; a shaft carrying a pinion in mesh with said rack within the cylinder; a hand-wheel for operating said shaft; a second shaft connected to said hand-wheel shaft by gearing; and an indicating apparatus operated by said second shaft.

17. In a hydraulic telemotor apparatus, the

combination of a transmitting-cylinder; a piston within said cylinder provided with a rack; a shaft carrying a pinion in mesh with said rack; a hand-wheel for operating said shaft; a bevel-gear secured to said shaft and meshing with a bevel-gear on a second shaft; a block connected to said second shaft by screw-threads and provided with an internal helix; a helical spindle actuated by said internal helix; and an index-arm connected to said spindle.

18. In a hydraulic telemotor apparatus, the combination of a transmitting-cylinder; a piston within said cylinder provided with a rack; a shaft carrying a pinion in mesh with said rack; a hand-wheel for operating said shaft; an indicating apparatus connected to said shaft; a receiving-cylinder provided with a piston for actuating the steering-engine; an indicator-transmitting cylinder provided with a piston operated by the movement of the rudder; an indicator-receiving cylinder; a piston within said indicator-receiving cylinder, provided with a rack; a toothed sector secured to a shaft and meshing with said rack; and an indicating apparatus connected to said shaft.

A. B. BROWN.

Witnesses:
ROBERT J. MACBRIDE, Jr.,
FREDERICK PIATT.