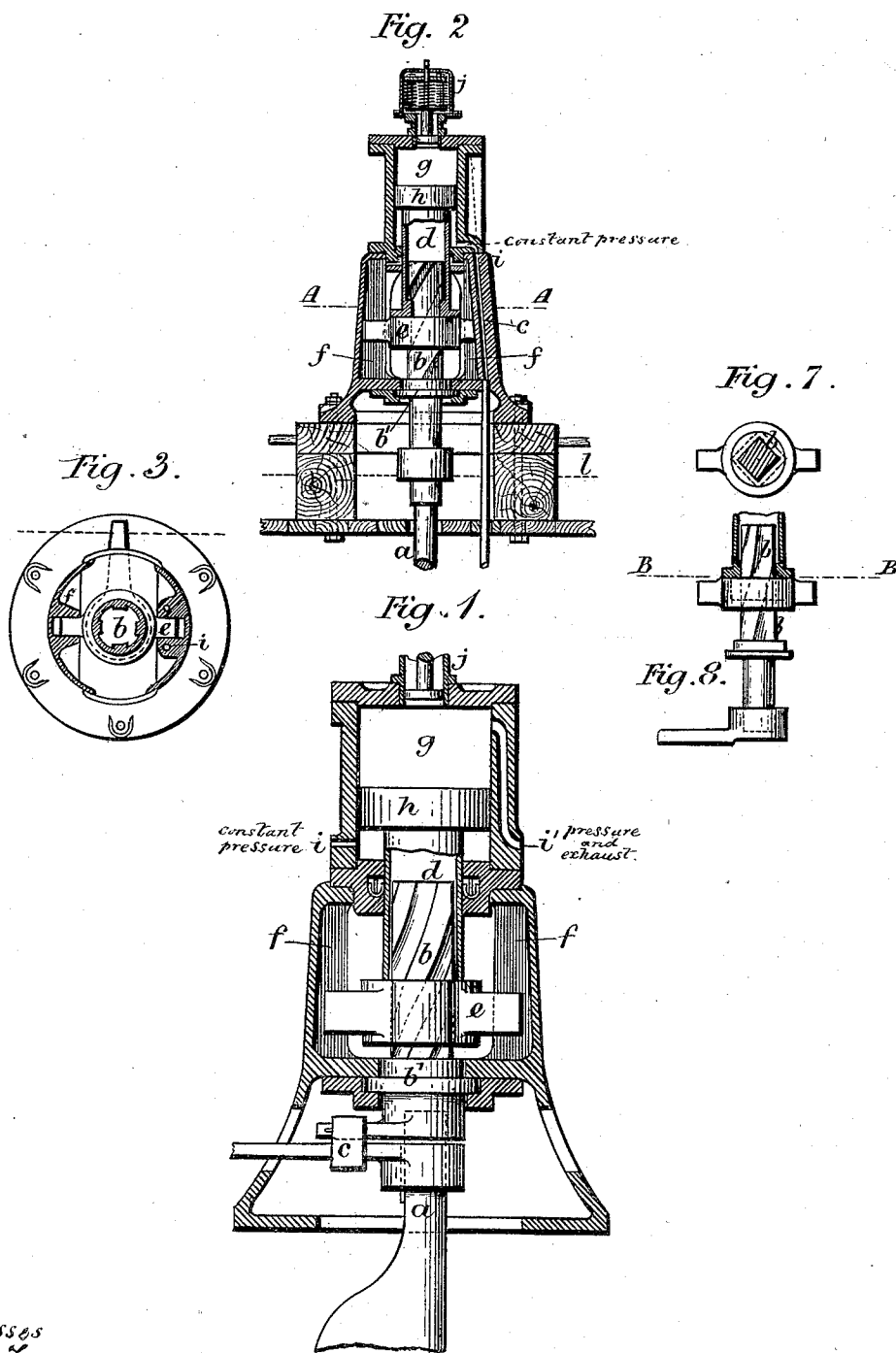


(No Model.)

4 Sheets—Sheet 1.

A. LAFARGUE.
Steam Steering Apparatus.
No. 243,450. Patented June 28, 1881.



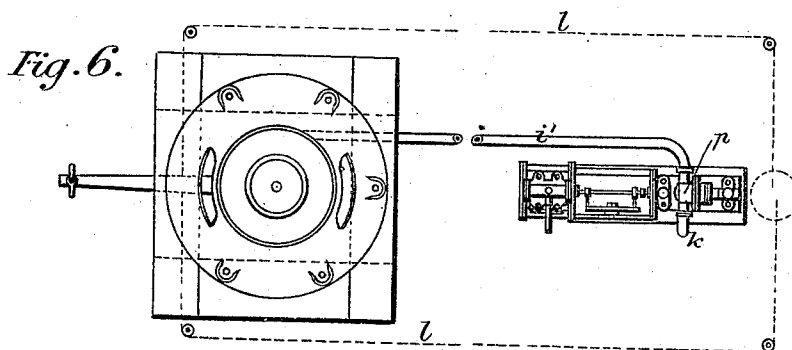
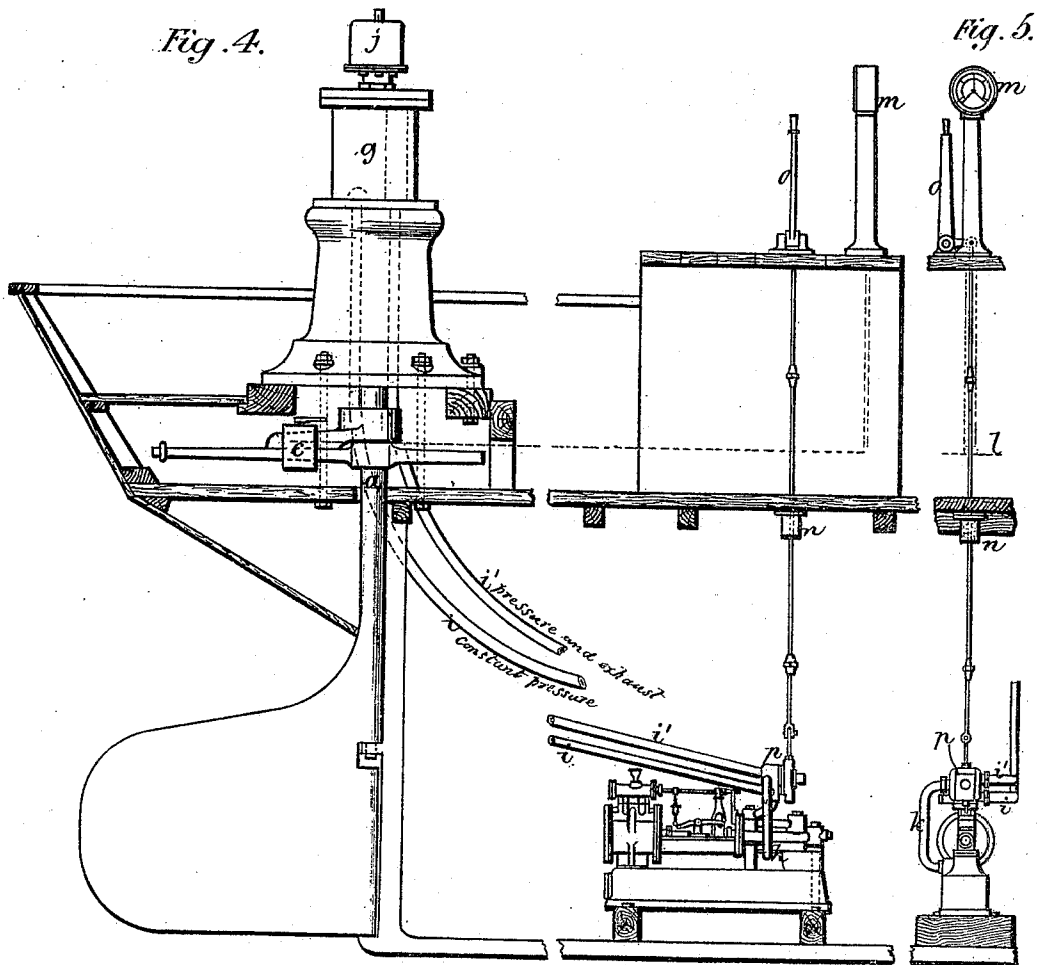
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(No Model.)

4 Sheets—Sheet 2.

A. LAFARGUE.
Steam Steering Apparatus.
No. 243,450.
Patented June 28, 1881.



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(No Model.)

4 Sheets—Sheet 3.

A. LAFARGUE.
Steam Steering Apparatus.
No. 243,450.
Patented June 28, 1881.

Fig. 1.

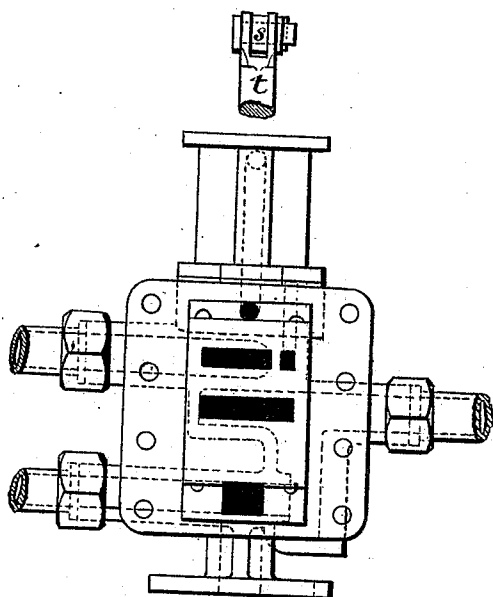


Fig. 2.

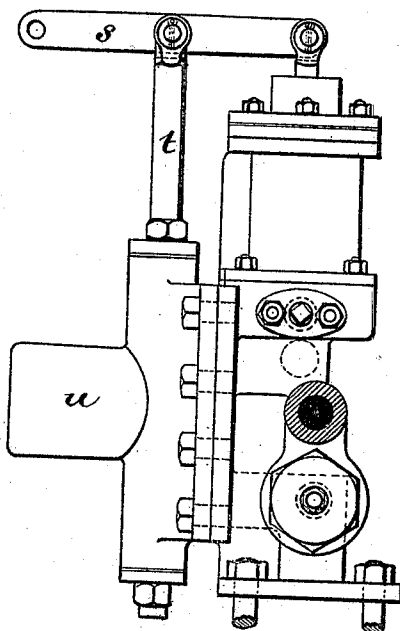


Fig. 4.

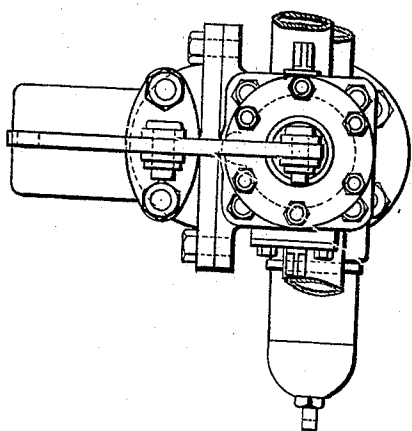
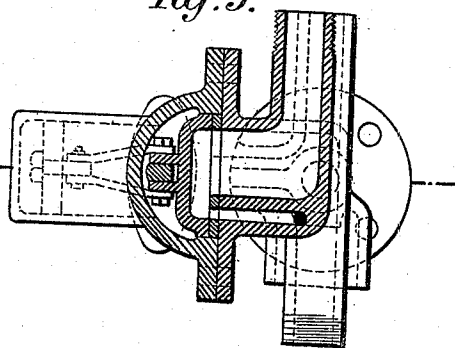


Fig. 3.



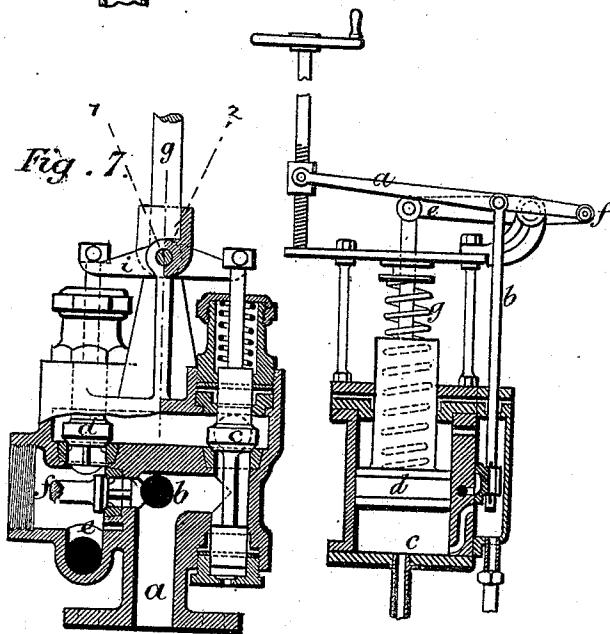
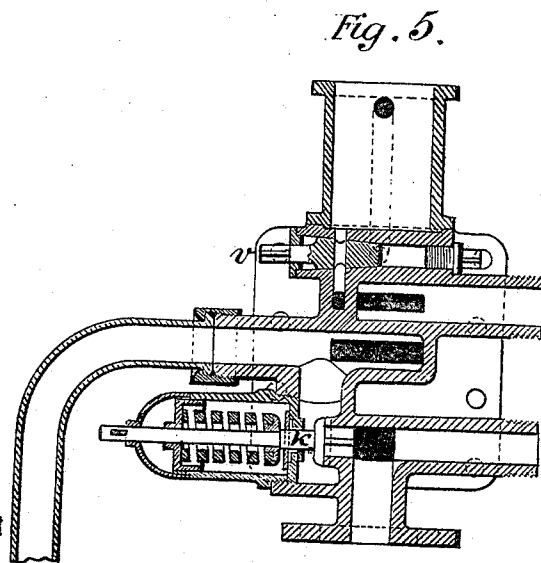
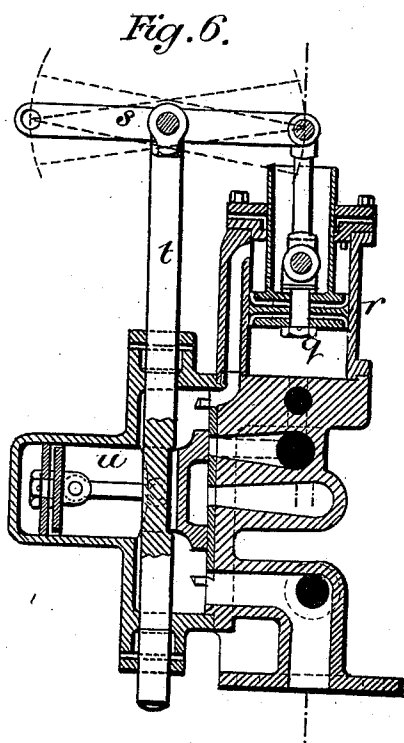
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(No Model.)

4 Sheets—Sheet 4.

A. LAFARGUE.
Steam Steering Apparatus.
No. 243,450.
Patented June 28, 1881.



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UNITED STATES PATENT OFFICE.

ALPHONSE LAFARGUE, OF KENSINGTON, COUNTY OF MIDDLESEX, ENGLAND.

STEAM STEERING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 243,450, dated June 28, 1881.

Application filed January 8, 1881. (No model.) Patented in England, No. 2,045 of 1877, and No. 2,122 of 1880.

To all whom it may concern:

Be it known that I, ALPHONSE LAFARGUE, a subject of the Queen of Great Britain, residing at Kensington, in the county of Middlesex, England, engineer, have invented certain new and useful Improvements in Steam Steering Apparatus, of which the following is a specification, certain of said improvements being embraced in British Letters Patent No. 2,045 of 1877 and No. 2,122 of 1880.

This invention relates to improvements in hydraulic and steam apparatus for steering ships or other floating vessels; and my improvements are applicable to that class of steering apparatus in which a quick-threaded screw or spiral bolt is mounted on the rudder-head to actuate the rudder.

According to my present improvements I dispense with the use of an accumulator. For this purpose, in lieu of an accumulator, and in order to maintain the constant pressure previously derived from an accumulator, I pass the fluid direct from the pump through the governing-valve into the chambers above and below the piston, which moves up and down in the steering-gear or hydraulic cylinder, the piston being attached to the nut working or actuating the screw on the rudder-head. The upper chamber, above the piston, is of larger area than the chamber below the piston, by reason of the space occupied by the piston-rod. The vertical thrust, which heretofore was allowed to act on the rudder-head, is, according to another part of my improvements, prevented from so acting on the rudder-head by my improved apparatus being so constructed that it is self-contained in its own bed-plate and standard, being supported by means of a collar (fixed on the screw or spiral bolt) revolving between two disks or surfaces bolted or otherwise fastened together or forming parts of the bed-plate and standard.

Another part of my improvements consists in forming the screw or spiral bolt on the rudder-head from a bar of metal having two or more flat surfaces, the bar being twisted to the required angle or pitch suitable for giving motion to the rudder.

According to another part of my improvements, I construct an automatic slide-valve for cutting off the supply of water to the chamber above the piston. To accomplish this I em-

ploy a cross-bar or lever having the center connected by a rod to a slide or other valve, one end of the lever being connected to the piston-rod of a small hydraulic cylinder, the other end being connected with the steering-wheel, handle, lever, or other mechanical arrangement for imparting motion to the valve. Any motion given to the slide-valve by the actuating wheel or lever will admit or discharge the water or other fluid to or from both the upper chamber of the large steering-gear or hydraulic cylinder and the lower chamber of the small hydraulic cylinder above the valve at one and the same time, and on the actuating wheel or lever being again held steady at any point a contrary motion of the slide-valve is immediately brought into play, causing the center rod to alter its position and close the valve, thus leaving the position of the actuating wheel or lever to indicate the relative movement that has been given to the rudder. The pressure on the slide-valve is compensated for by connecting it with a piston working in a small hydraulic cylinder forming part of the valve-box.

In order that my invention may be clearly understood and readily carried into practice, I will proceed to describe the drawings hereto annexed.

In the drawings, Sheet 1, Figures 1 and 2 show vertical sections, differing only in the arrangement of pipes and in the scale; and Fig. 3, a plan, in section, of hydraulic steering apparatus arranged and constructed in accordance with my improvements. Fig. 4, Sheet 2, shows a side elevation, Fig. 5 an end view, and Fig. 6 a plan, of the general arrangement of my improved hydraulic steering apparatus as applied to a ship or vessel. The location of the hydraulic apparatus and the valve controlling the action of the steering-gear may be fixed at any convenient part of the ship or vessel that may be found desirable, whereas the steering-gear can be fixed either directly above the rudder-head on the deck, as shown in the drawings, Fig. 4, Sheet 2, or in some cases below the deck, the rudder-head being continued through the steering-cylinder to an ordinary tiller, if so required; or the steering-gear may be made to act on the rudder-head or tiller by means of a rack and pinion or some other auxiliary mechanical arrangement. Also, Figs 7 and 8, Sheet 1, show the substitution of a

ed bar, *b*, of square section for the steering screw. The bar of metal to form the v or spiral bolt *b* may have two or more surfaces and be twisted, formed, or cut to required angle or pitch suitable for giving on to the rudder. In this case loose adble brasses are placed inside the nut to the wear off the screw or spiral bolt.

The manner in which the hydraulic power is led to the rudder-head is as follows: Over rudder-head *a* there is a screw or spiral *b*, (with its collar *b'* revolving between disks,) secured to the tiller at the lower end means of a slip-ring, *c*, which enables the steering-gear to be instantly coupled or shed, if desired. At the end of the hol-piston-rod *d* a cross-head, *e*, is fixed, which is up and down in the guides *f*, and also as a nut, the threads of which correspond those of the screw *b*. The vertical action e cross-head by the pressure of water act-against the piston in the cylinder *g* im-; a reciprocating motion to the rudder, carrying the tiller to any point required. e actuating-piston *h*, with its hollow pis-od *d*, is acted upon by the water as follows: pipe *i*, leading to the under side of the pis-*h*, and marked "constant pressure," is al- open, as its name indicates, to the water r pressure, and in uninterrupted commu- ion with the source of supply, while the r side of the piston is, by means of a con- g slide-valve, *p*, put in communication igh the upper pipe, *q*, with either the wa- nder pressure or the exhaust. It will be that the area of the upper side of the pis- is considerably greater than that of the r side. If, therefore, the water under- sure be admitted to the upper side of the n, the effect will be a downward move- of the piston *h* and piston-rod *d*, the ex- t water from the under side of the piston g forced at the same time into the upper ber, *g*, while if the pressure is removed the upper side by opening a communa- with the exhaust, the constant pressure the pump, still acting on the under side e piston, will cause an upward movement e piston *h* and rod *d*, and, as above ex- ed, motion will be imparted to the rud- o any extent desired.

hen necessary, in order to avoid any slight- ion motion produced by the hydraulic- pump, a small air-vessel is attached to onvenient part of the line of hydraulic , and by relieving the pressure, as re- d, prevents any jerking pulsation from g produced.

ief-valves *j* and *k* are applied, as shown, se of a heavy sea striking the rudder. A cord, or a chain, *l*, is carried in opposite- tions from the tiller to communicate with dicator, *m*, which shows on a dial the act- osition of the rudder or helm.

double-acting spring-box is shown at *n*, i brings the steering-lever *o* always back

to the center when released from the hand, thereby enabling the rudder to be fixed at any point of its movement when the automatic cut-off-valve apparatus is dispensed with.

The slide-valve *p*, which governs the action of the steering-gear, is worked from the bridge or elsewhere by means of a lever, *o*, (wheel, handle, or otherwise,) connected therewith, and may be made to act automatically, as shown in detail on drawings, Sheets 3 and 4, in which Figure 1 represents a front elevation with its slide and its cover removed; Fig. 2, a side elevation with the exhaust-pipe in section; Fig. 3, a plan section through the upper port, which port is divided to communicate with the upper chamber of the steering-gear cylinder and the lower chamber of the small hydraulic cylinder attached to the valve; Fig. 4, a general plan; Fig. 5, a vertical section through the small hydraulic cylinder and the pipes communicating with the valve; Fig. 6, a vertical section, showing the connection of the small hydraulic cylinder and its piston with the slide-valve.

The manner in which this slide-valve works automatically is as follows: In Fig. 6 the slide-valve is shown with the slide closing the upper port, which leads to the upper chamber, *g*, of the steering-gear cylinder; Figs. 1 and 2 of the drawings, Sheet 1, and lower chamber of the small hydraulic cylinder *q*, and to which the communicating pipes are filled with water. Thus, as the constant pressure is acting on the under side of the piston *h* in the steering-gear cylinder and the upper side of the piston *r* in the automatic hydraulic cylinder *q*, an equilibrium is established, whereby the valve and the steering-gear, with the rudder, are all stationary for the time being. On raising the cross-bar or lever *s*, with the central rod, *t*, attached to the valve, and holding the same steady, the upper port is put into communication with the exhaust, and the constant pressure forces the piston *r* downward, taking with it the rod *t* and valve, thus closing the upper port again. On lowering the lever *s* and holding the same steady, pressure is admitted to the under side of the small piston *r*, which, being of a larger area than the upper side, becomes pressed upward, taking with it the rod *t* and valve, and thus closing the upper port once more. The portion of the valve-box marked *u* contains the small piston for reducing the pressure on the slide-valve face.

The plug *v* is for regulating the rate of flow to or from the lower chamber of the small hydraulic cylinder.

The relief-valve, as shown at *k*, allows a communication between the constant pressure and the exhaust.

The above-described automatic action or arrangement of the valve can also be applied to a plunger-valve should such modifications be preferred.

Fig. 7, Sheet 4, shows the vertical section of another form of automatically-acting valve, which I use as an equivalent for that above

described, and which I term an "automatic equilibrium plunger-valve," which might, if preferred, be adopted to control the steering-gear, instead of the slide-valve above described.

5 It may be described as follows:

a is the pressure-pipe from the hydraulic force-pump; *b*, the constant-pressure pipe leading to the under side of the piston *h*, Figs. 1 and 2, Sheet 1.

10 *c* is the equilibrium plunger-valve, which, when raised, allows the pressure to communicate through the pipe to upper side of the piston *h*, (indicated by a dotted circle.)

d is an ordinary drop-valve, which, on being raised, allows the pipe leading to the upper side of the piston *h* to communicate with the exhaust-pipe *e*, connected with the tank.

f is a relief-valve corresponding to *h*, as shown on the slide-valve, Fig. 5. The action of this valve is as follows: The vertical lever *g* is used to control the steering-gear, and when held over to the right or left (marked 1 and 2) raises the opposite valve *d* or *c*, respectively, by means of the balance-lever *i*, which fastens underneath only the projections shown attached to the valve-spindles. On leaving hold of the vertical lever *g*, the valves will always return to their seatings automatically, by virtue of the springs shown contained in boxes surrounding the valve-spindles.

Fig. 8 is a vertical section of a modified arrangement of the automatic slide-valve (Figs. 1 to 6) previously described.

By giving a turn of the steering-wheel to raise the lever *a*, the slide-valve spindle *b* will also be raised, thereby admitting the water under pressure to enter the cylinder at *c* and force the piston *d* upward, causing the lever *e* to be depressed at *f*, together with the slide-valve spindle *b*, and thus close the slide-valve from the pressure entering the cylinder at *c*. The whole action of the hydraulic cylinder will then cease until further motion is imparted to the steering-wheel. If, on the other hand, a reverse action is required, the slide-valve will then have to be reversed by lowering the lever *a*, thereby opening the exhaust with the cylinder at *c*. The constant pressure, acting on the top side of the piston *d*, will impart a downward motion.

The spring *g* is made to answer as a cushion for the piston *d* in case of undue pressure in the cylinder *c*, which would then be open to the exhaust by the depression of the slide-valve rod *b*.

Having thus described the nature of my improvements and the manner of performing or

carrying the same into practice, I would remark that I do not claim, generally, the application of hydraulic apparatus to actuate the rudder-post and rudder for steering ships and other floating vessels; nor do I claim any of the mechanical parts separately, which are well known, and which comprise the steering and other apparatus hereinbefore described, and shown in the drawings annexed.

I am also aware that it is old to construct a steam-engine with a trunk-piston, and to admit live steam upon the trunk side of said piston, which is of smaller area, and exhaust said steam to the cylinder upon the side of said piston which is of larger area, and I therefore do not claim such an engine as of my invention.

What I claim as of my invention, and desire to secure by Letters Patent, is—

1. In a hydraulic steering apparatus, the combination of an actuating-cylinder and a piston the two sides of which have different areas, a pipe for supplying liquid under pressure to the side of said piston of smaller area, in constant and uninterrupted communication with a source of supply, and a pipe leading to said cylinder upon the opposite side of said piston and containing a valve, whereby the supply of liquid to said cylinder and the exhaust of liquid therefrom may be controlled, substantially as herein specified.

2. In a hydraulic steering apparatus, the combination, with an upright cylinder and piston, and a standard and bed-plate supporting the same, of a rudder-head, a spiral bolt having a fixed collar, whereby it is held against end movement, and a sliding spiral nut actuated by said piston and fitting said bolt, substantially as herein specified.

3. In a hydraulic steering apparatus, the combination of a hydraulic cylinder and piston, and a spiral nut actuated thereby, a rudder-head, and a spiral bolt fitting said nut, both said nut and bolt having two or more flat surfaces, substantially as herein specified.

4. The combination, with the cylinder *g* and piston *h*, having its two sides of different area, of the slide-valve *p*, the small hydraulic cylinder *q* and piston *r*, and the lever *s*, connected with said valve *p* and piston *r*, substantially as herein specified.

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