(No Model.) 3 Sheets—Sheet 1.

C. F. ELMES.

HYDRAULIC CYLINDER FOR CONTROLLING STEAM CYLINDERS.

No. 404,523. Patented June 4, 1889.

Fig. 2.

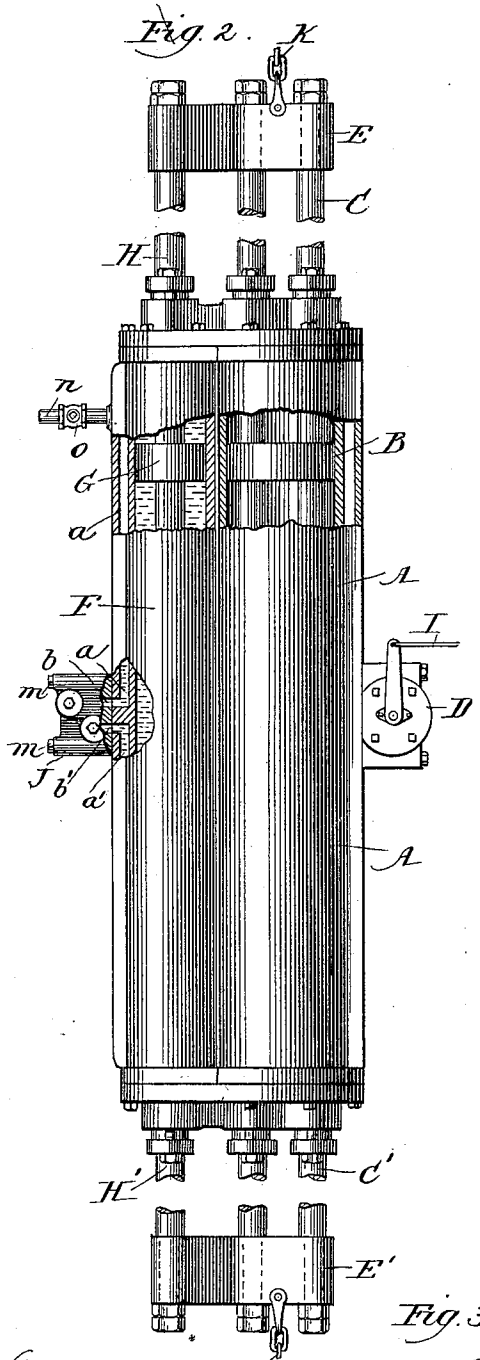


Fig. 1

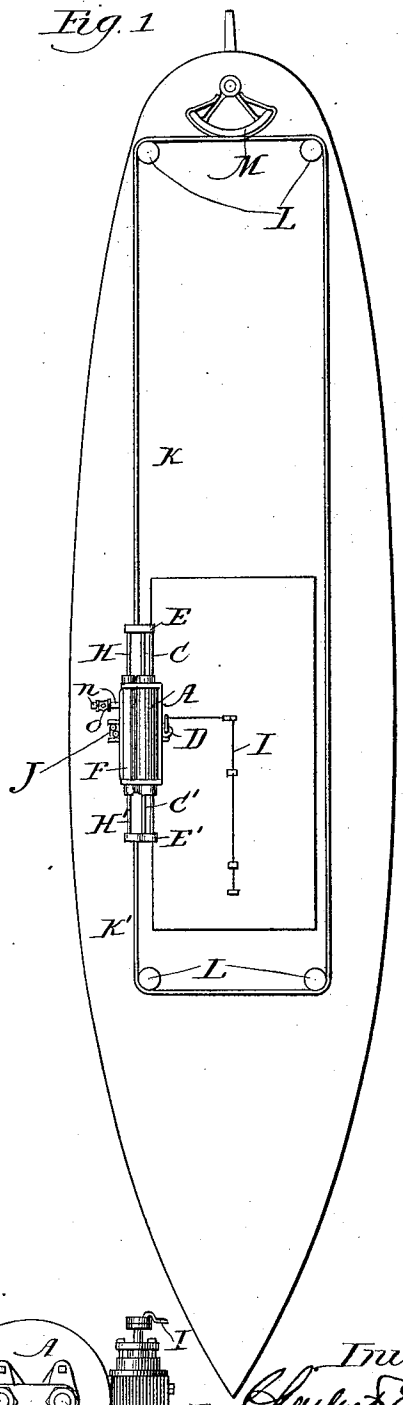
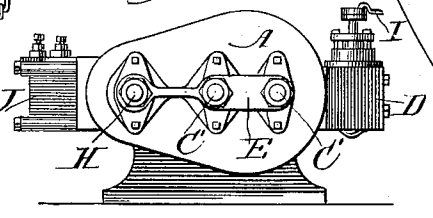


Fig. 3.



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Fig. 6.

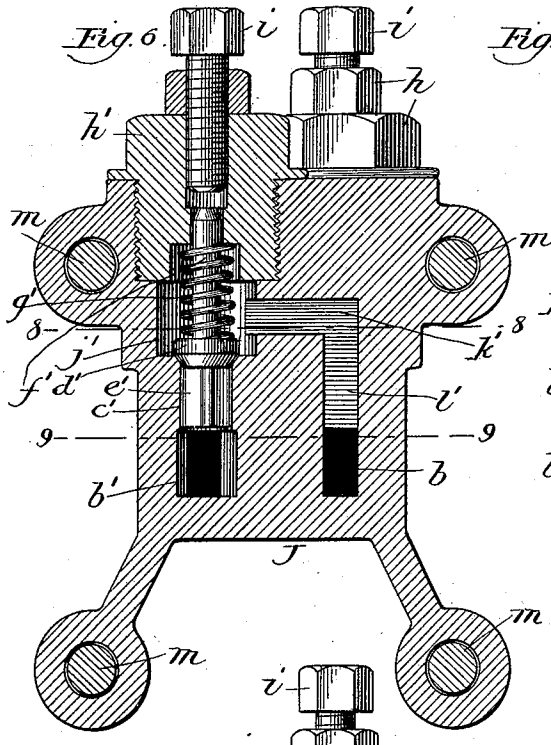


Fig. 5.

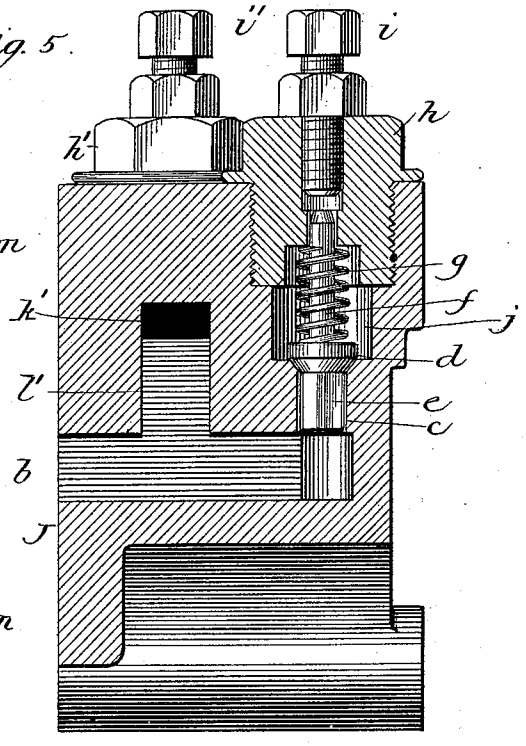


Fig. 7.

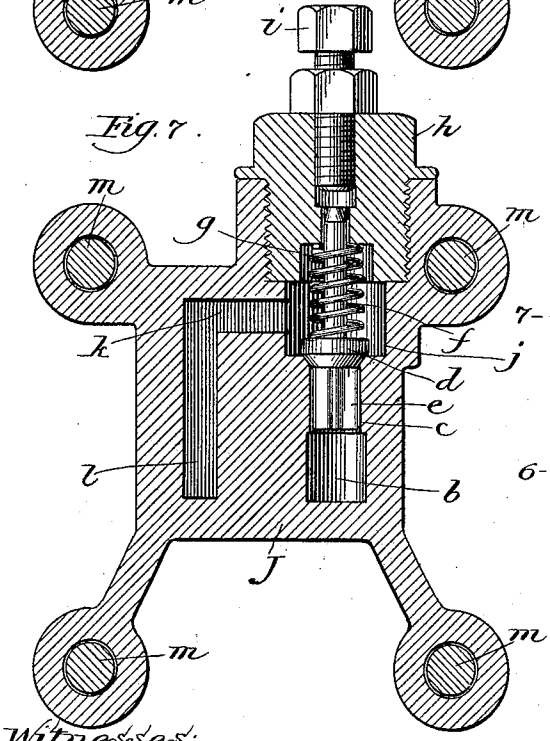
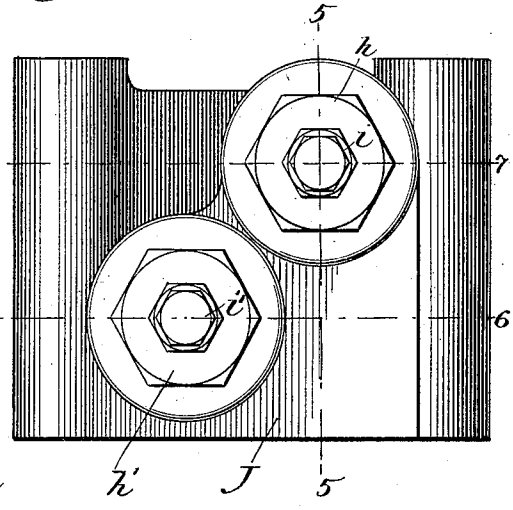


Fig. 4.



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Fig. 8.

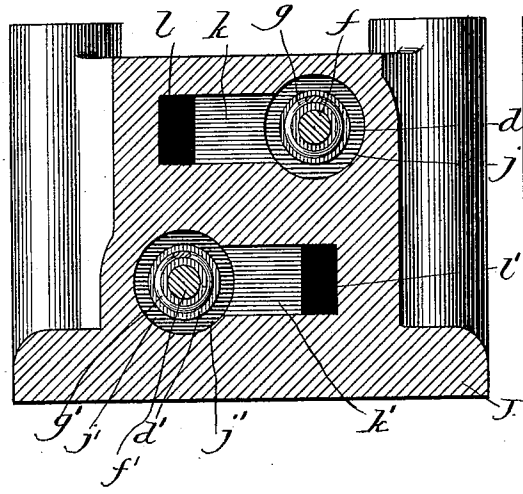
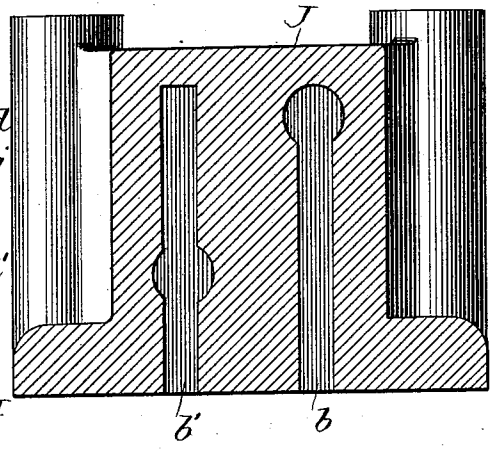


Fig. 9.



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UNITED STATES PATENT OFFICE.

CHARLES F. ELMES, OF CHICAGO, ILLINOIS.

HYDRAULIC CYLINDER FOR CONTROLLING STEAM-CYLINDERS.

SPECIFICATION forming part of Letters Patent No. 404,523, dated June 4, 1889.

Application filed January 24, 1889. Serial No. 297,470. (No model.)

To all whom it may concern:

Be it known that I, CHARLES F. ELMES, residing at Chicago, in the county of Cook and State of Illinois, and a citizen of the United States, have invented certain new and useful Improvements in Hydraulic Cylinders for Controlling Steam-Cylinders, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a reduced plan view showing my invention applied to the steering apparatus on a boat. Fig. 2 is a plan view, some parts being broken away, of the steam and hydraulic cylinders and their operating connections. Fig. 3 is an end elevation of the parts shown in Fig. 2. Fig. 4 is a plan view of the valve-chest of the hydraulic cylinder. Fig. 5 is a section taken at line 5 5 of Fig. 4. Fig. 6 is a section taken at line 6 6 of Fig. 4. Fig. 7 is a section taken at line 7 7 of Fig. 4. Fig. 8 is a section taken at line 8 8 of Fig. 6. Fig. 9 is a section taken at line 9 9 of Fig. 6. Figs. 4, 5, 6, 7, 8, and 9 are enlarged.

This invention relates to hydraulic cylinders used in connection with steam-cylinders for holding the piston of a steam-cylinder at any point in its stroke to which it may be moved by the admission of steam.

The objects of the invention are to provide such a hydraulic cylinder with an automatic valve, communication between its opposite ends, and to provide automatic means for supplying it with liquid, as it is liable to lose a part of its liquid by leakage, which I accomplish as illustrated in the drawings, and hereinafter described.

That which I claim as new will be pointed out in the claims.

In the drawings, A indicates a steam-cylinder; B, a piston of the steam-cylinder A; C C′, the piston-rods of the steam-cylinder A, which project through the opposite ends of the cylinder A; D, a valve-chest containing any suitable valve for admitting and exhausting steam; E E′, cross-bars to which the piston-rods C C′, respectively, are attached; F, a hydraulic cylinder of equal length with the steam-cylinder A; G, the piston of the hydraulic cylinder A; H H′, the piston-rods attached to opposite sides of the piston G, projecting through opposite ends of the cylinder F and attached to the cross-bars E E′, respectively; I, connecting devices for operating the steam-valve; J, the hydraulic valve-chest through which the liquid flows in passing from one end of the hydraulic cylinder F to the other; K K′, chains or cables for connecting the cross-bars E E′, respectively, with the tiller of a boat; L, anti-friction rollers or wheels; M, the tiller of a boat; *a a′*, the ports of a hydraulic cylinder F, which lead to the valve-chest J; *b b′*, ports in the hydraulic chest J, which communicate with the ports *a a′*, respectively; *c c′*, vertical passages leading upward from the passages *b b′*, respectively, as shown in Figs. 6 and 7; *d d′*, valves for closing the passages *c c′*, respectively; *e e′*, guiding-wings formed on the under side of the valves *d d′*, respectively; *f f′*, the stems of the valves *d d′* respectively; *g g′*, springs surrounding the stem *f f′* for closing the valves *d d′*; *h h′*, screw-plugs in the valve-chest J over the valve-stems *f f′*, respectively; *i i′*, set-screws in the plugs *h h′*, respectively, which regulate the distance which the valves *d d′* may rise from their seats; *j j′*, valve-spaces around the valves *d d′*, respectively; *k k′*, horizontal passages leading from the spaces *j j′*, respectively; *l l′*, vertical passages leading from the passages *k k′*, respectively, to the ports of passages *b′ b*, respectively; *m*, bolts by which the chest J is secured to the cylinder F; *n*, a pipe leading from the feed-pipe of the boiler (not shown) and communicating with one end of the hydraulic cylinder F, and *o* a check-valve in the pipe *n*, which prevents the escape of any liquid from the hydraulic cylinder F through the pipe *n*.

The steam-cylinder A, its piston B, and piston-rods C C′, valve-chest D, cross-bars E E′, cables K K′, wheels L, and tiller M may be constructed in any of the common and well-known forms and in any suitable arrangement. The construction and arrangement here shown is one of the best known to me.

The connecting device I may be any suitable device which will enable the operator to control the valve so as to admit the steam to either end of the cylinder A or to close it, as may be desired or necessary. The structure and arrangement of the device for admitting steam here shown illustrates how the valve

may be controlled by the pilot from the pilot-house of a steam-vessel to which the apparatus, as shown in Fig. 1, is applied; but I do not limit the use of my improvements to the application to steering apparatus, as they can be applied to many other uses. It will be obvious that the construction and arrangement of the main parts will be dependent upon their location and the work to be done.

When steam is admitted into the cylinder A to move the piston B from the rear end, as shown in Figs. 1 and 2, to the opposite end, it is necessary that a portion of the liquid in the front end of the hydraulic cylinder F be passed to its opposite end through the chest J. In passing from the front end of the hydraulic cylinder F to the opposite end, the liquid passes through the ports or passage a' in the cylinder to and through the ports b' in the chest J, then upward through the passage c', forcing the valve d' up against the pressure of the spring g' into and through the chamber j', to and through the passage k' downward to and through the passage l', to and through the port or passage b, and then to and through the passage a into the cylinder F at the opposite end from which it has been forced. When the piston is moved in the opposite direction, the liquid passes through the passage a, port b, passage c, valve d, chamber j, passage k, passage l, passage b', and port or passage a'.

The valves d d' remain closed by the spring-pressure, thus preventing both pistons G and B from moving in either direction until the pressure on one side of the piston G, caused by the steam in the cylinder A or the chains K or K′, is sufficient to lift the valve d or d' against the pressure of its spring, when the valve will rise and allow the liquid to pass, thus making the hydraulic valve-chest J automatic in its action, which occurs only when the steam or chain pressure exceeds the spring-pressure on the valve d or d', so that the tension of the springs g g' controls the amount of pressure necessary to open the valves d d' and permit the piston G to move in either direction. By admitting steam to either end of the cylinder A the operator can move the piston G and the piston-rod C C′ and the connecting operating devices in either direction, as may be required, because as soon as the pressure on one side of the steam-cylinder piston is increased sufficient to cause the pressure against the liquid in the opposite end of the hydraulic cylinder F to force the valve d or d' upward from its seat, communication will be opened automatically between the opposite ends of the hydraulic cylinder F, so that the liquid can pass from one end to the other. By thus admitting steam to the cylinder A at one end or the other the operator can move the piston D to any desired position. When the steam-valve is closed, or the pressure on either side of the piston B is not sufficient to cause a pressure on the opposite side of the hydraulic piston G sufficient to open the valve in the chest J, which opens toward the opposite end of the cylinder, the piston B will be locked or held stationary, so that by the closing of the steam-valve the operator can hold the piston in any desired position.

When from any cause the tension on either of the chains K K′ is increased beyond their adjusted tension, as when the boat backs against the dock or its rudder strikes a stone or pile, the increased tension will produce an increased pressure on the hydraulic piston G, which will cause one of the valves in the chest J to automatically open and allow the chains K K′ to move before they or any of the other parts of the apparatus are broken by such increased or unusual strain.

The pressure which the liquid in the cylinder F will sustain before allowing the piston G to move can be regulated by the compression of the spring g g', as the greater the compression of the spring the greater the pressure required to open the valves against the springs. The pressure can be regulated by placing disks or washers on the springs in the cavity in the screw-plugs h h'.

The volume of the flow of the liquid through the valve-chest J and the consequent rapidity of movement of the piston G can be regulated by means of the set-screws i i', which limit the upward movements of the valves d d', as the valves can be regulated to allow only a very slow movement of the piston, as is necessary in some applications of my apparatus, or to allow of a more rapid movement of the piston G by an increased flow, as is desirable in other cases.

In use it has been found difficult to pack the stuffing-boxes of the hydraulic cylinder F, so that some of the liquid in the cylinder will not escape. When a small portion of the liquid has escaped, the piston G, when reversed in its movements, will move suddenly, causing a blow against the liquid in the opposite end, which has been found very objectionable. In order to avoid this objection, I connect a pipe n with one end of the cylinder F and with the feed-pipe from the pump to the boiler. As the pump is in operation almost continuously while the apparatus is in use, there will be a continuous pressure in the pipe n toward the hydraulic cylinder, keeping the cylinder filled, so that no attention from the operator is necessary. I provide a check-valve o in the pipe n, which prevents the escape of any of the liquid from the cylinder F through the pipe n when the liquid is under pressure. It is only necessary to attach the pipe n to one end of the cylinder F, as there is communication between the opposite ends when in operation.

The employment of double piston-rods for the steam-cylinder is not essential.

I am aware that a hydraulic valve-chest has heretofore been employed in which the valve was moved by the steam or air used for motive power to open the fluid-ports, while by my chest and valve arrangement the fluid

itself opens its ports and passages, which simplifies both the construction and operation of the device and avoids the possibility of steam condensation in such valve-chest, and the hydraulic piston is instantaneously locked and held in position without removing any extraneous pressure.

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a hydraulic cylinder and piston for controlling the movements of a steam-cylinder piston, of valves located between the hydraulic cylinder ends operated in their movements solely by fluid-pressure, substantially as shown and described.

2. The combination, with the steam-cylinder and its piston, of a hydraulic cylinder having ports *a a'*, leading from its ends, a valve-chest J', having the opposite ports *b b'*, communicating, respectively, with said hydraulic cylinder ports, the vertical passages *c c'* rising, respectively, from the said valve-chest ports, the vertically-movable valves *d d'*, controlling said passages, the springs *f f'*, for closing the valves, the horizontal passages *k k'*, leading from the valve-spaces *j j'*, and the vertical passages *l l'*, leading, respectively, from said horizontal passages to the valve-chest ports *b b'*, substantially as described.

3. The combination, with a hydraulic cylinder and piston for controlling a steam-cylinder piston, of the valve-chest J, having the vertically-movable spring-closed valves *d d'*, provided with stems *f f'*, and the adjusting-screws *i i'*, operated from the exterior of the valve-chest and tapped therethrough to vary the height to which the valves and their stems rise, and thereby control the volume of liquid flowing through the valve-chest, substantially as described.

4. The combination, with a hydraulic cylinder and piston for controlling a steam-cylinder piston, of the valves *d d'*, controlling the liquid passage-way between the ends of the hydraulic cylinder, and the adjusting-screws *i i'*, movable in the valve-chest to and from the stems of said valves to vary their extent of movement and thereby control the volume of liquid flowing through the valve-chest, substantially as specified.

5. The combination, with the hydraulic cylinder F, having the passages or ports *a a'*, of the hydraulic chest J, having the ports *b b'*, passages *c c'*, valves *d d'*, and passages *k k'* and *l l'*, substantially as specified.

6. The combination, with the hydraulic cylinder F, adapted to control a steam-cylinder piston, of the pump-connecting pipe *n* and check-valve *o*, substantially as and for the purpose specified.

CHARLES F. ELMES.

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