No. 701,983. Patented June 10, 1902.

R. H. YALE.

STROKE REGULATOR.

(Application filed Aug. 23, 1901.)

(No Model.)

Fig. 1.

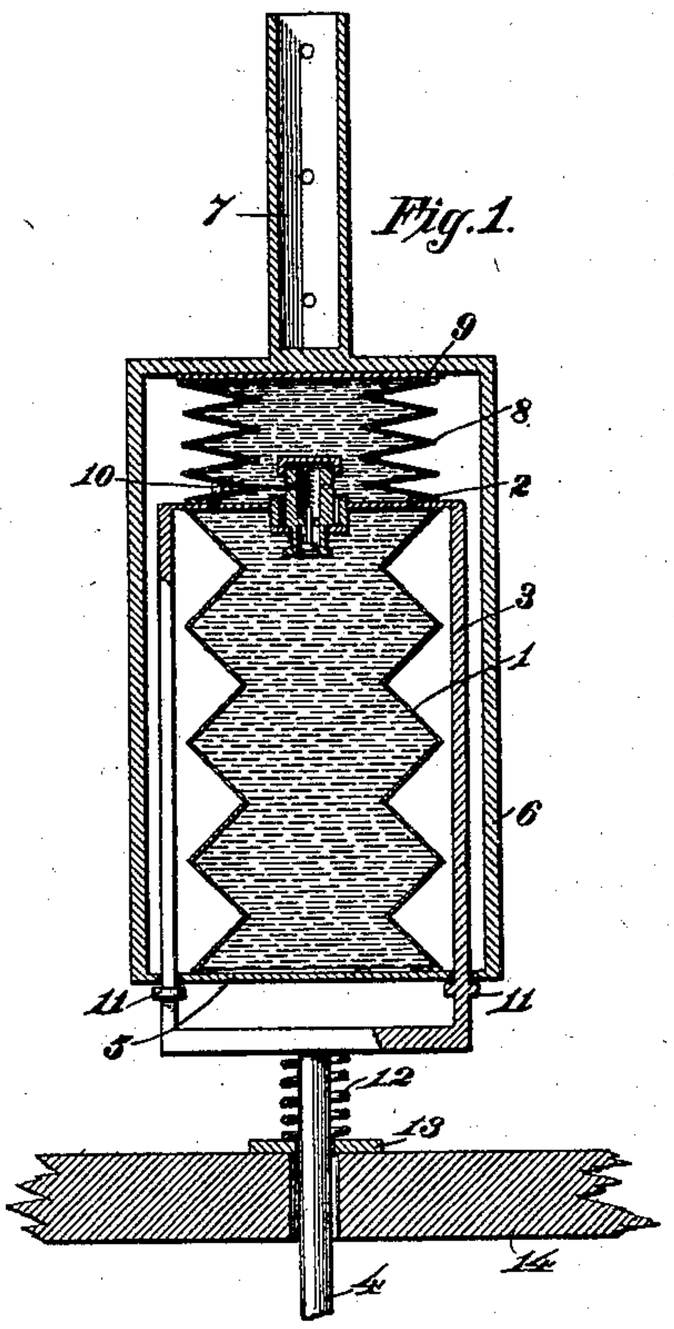


Fig. 2.

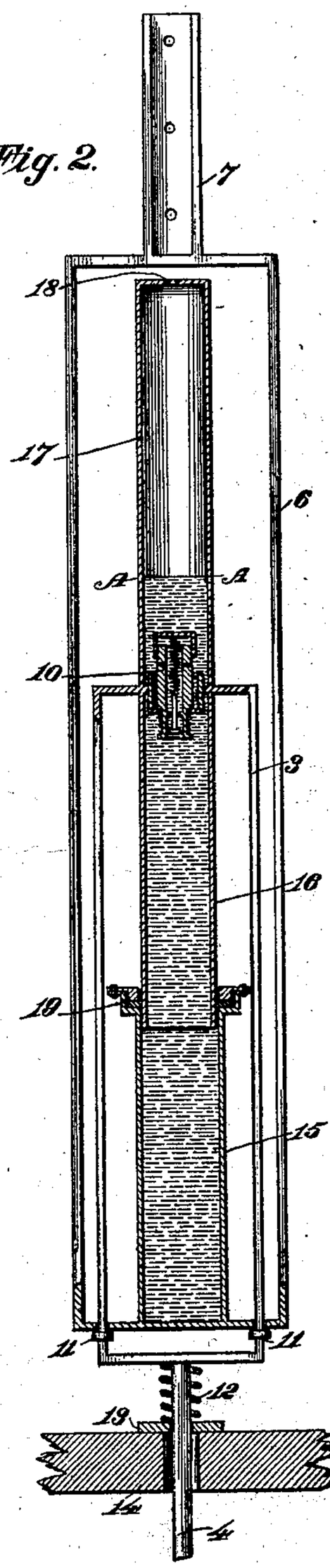


Fig. 3.

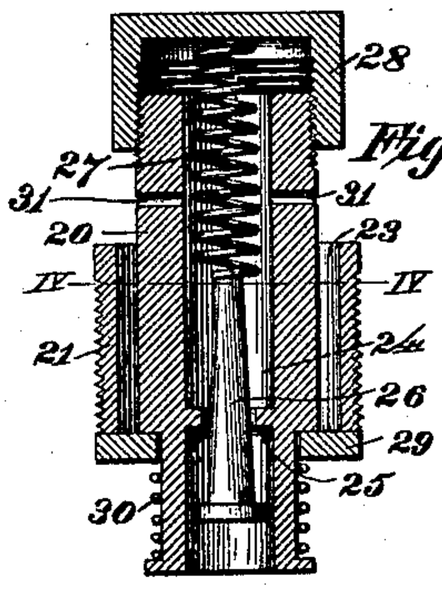
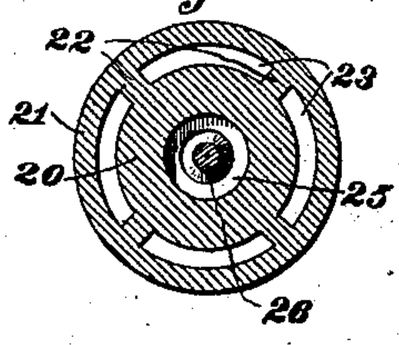


Fig. 4.



Witnesses
H. S. Austin.
E. S. York.

Inventor
Rodney H. Yale,
by
F. A. Fraser.
Attorney.

UNITED STATES PATENT OFFICE.

RODNEY H. YALE, OF BEATRICE, NEBRASKA.

STROKE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 701,983, dated June 10, 1902.

Application filed August 23, 1901. Serial No. 73,072. (No model.)

To all whom it may concern:

Be it known that I, RODNEY H. YALE, a citizen of the United States, residing at Beatrice, in the county of Gage and State of Nebraska, have invented new and useful Improvements in Stroke-Regulators, of which the following is a specification.

My invention relates to improvements in apparatus for varying and regulating the length of stroke of a reciprocating rod, arm, or implement, and thereby regulating the amount of work done per stroke.

Said improvements relate more specifically to that class of stroke-regulators in which a casing containing within it a body of liquid is interposed between two sections of a severed piston-rod or other reciprocating rod, said casing being so constructed and arranged that said body of liquid shall receive the impact of the force applied by the power-section of the rod and also the stress resulting from the work being done by the working section of the rod, so that, in other words, such body of liquid or a portion of it shall form a cushion or abutment between the power and the work, provision also being made for increasing or diminishing the quantity of such liquid under pressure and the longitudinal space occupied thereby in the casing according to the speed of the motor, so that the sections of the rod shall be kept at a greater or less distance apart, thus decreasing or increasing automatically the length of the rod considered as a whole and the amount of work performed.

My present improvements relate especially to collapsible casings for holding the liquid and improved means for passing the liquid or a portion thereof from the section or part of the casing where it is under pressure to a section or compartment in which it is free from pressure and returning it again.

In the accompanying drawings, Figure 1 is an elevation, partly in vertical section, of a form of my device designed mainly for connecting to a windmill and pump, the drawing showing the connections for the actuating-rod leading up to the windmill and also for the pump-rod. Fig. 2 is a similar view of a modified form of my device, showing a different means of collapsing the casing. Fig. 3 is a vertical section of the regulating valve device used on each form of the stroke-regulator when deemed desirable. Fig. 4 is a horizontal cross-section through said valve device on the line IV IV of Fig. 3.

Referring to Fig. 1, 1 indicates a closed casing made of some collapsible material in bellows form and attached at the top to a horizontal plate 2, carried by a frame 3 on the upper end of a rod 4, leading down to the pump. The bottom of said casing 1 is attached to a plate 5 on the lower end of a frame 6, secured to the connection 7 of the actuating-rod leading up to the windmill. 8 also indicates a casing or compartment which may be regarded as an extension or section of casing 1, made of similar material in bellows form and secured between the plate 2, forming the top of compartment 1, and a plate 9, attached to the upper bar of the frame 6. Compartment 1 is separated from compartment 8 by the plate 2; but intercommunication between the same is provided for by a central opening in plate 2, in which opening is placed the valve device 10. (Shown on a larger scale in Figs. 3 and 4.) The vertical side bars of frame 3 pass through slots or openings in the lower horizontal bar of frame 6 for the purpose of keeping said frames and their connected rods 4 7 in alinement. Stops 11 limit the longitudinal movement of the two rod-terminals toward each other. 12 indicates a cushion-spring, 13 a plate supporting said spring and serving as a guide for the pump-rod, and 14 is a part of the windmill-tower supporting plate 13. Compartments 1 and 8 are at all times filled with liquid, preferably some variety of oil.

Fig. 2 shows a modified form of the device, which is of substantially the same construction as shown in Fig. 1, except that the main casing or pressure-chamber is composed of two tubular sections 15 16, which telescope into each other, section 16 passing inside of section 15 when the casing collapses, as hereinafter described. An extension or section 17 is also provided, rigidly connected with section 16 of the main casing and communicating with the same by a passage-way controlled by a valve 10. (Also shown in Figs. 1, 3, and 4.) Sections 15 16 of this form of the casing are at all times filled with liquid, also section 17 to a point above the valve 10 or

about the level of the line A A in Fig. 2. A vent-hole 18 is provided in the upper end of section 17 to permit the liquid to rise and fall freely therein. Suitable packing 19 is provided at the joint where the sections 15 16 telescope into each other.

In Figs. 3 and 4, illustrating the details of the regulating-valve 10, 20 designates the tubular body or barrel of the valve; 21, an exteriorly-threaded outer cylinder connected to the body 20 by ribs 22, with free openings 23 between said parts at other points for the passage of liquid. 24 is the central opening through the body 20, and 25 a circular valve-seat therein; 26, the regulating-valve, having a head adapted to engage said valve-seat and a tapering stem extending through said seat and bearing against a spring 27, which normally holds valve 26 open or away from valve-seat 25. 28 designates a threaded cap for adjusting the tension of spring 27; 29, a circular valve engaging a seat on the parts 20 21 to close or open the ports 23; 30, a spring tending to hold valve 29 closed, and 31 lateral passages through the barrel 20 for permitting the liquid to pass into and out of the central passage-way 24.

In operation, referring again to Fig. 1, it will be seen that if the windmill-rod starts on its upward stroke the power will be transmitted through frame 6 to the bottom of casing 1 and likewise through the liquid in its lower compartment to the plate 2, forming the top of said compartment, and through the side bars of frame 3 to the pump connection 4. If the upward stroke is made quickly, the pressure on the liquid in compartment 1 will cause valve 26 to close firmly against its seat 25, and as none of the liquid can pass the valve the pump-rod 4 will be carried upward the full length of the upward stroke of the windmill-crank. In fact, under such conditions the resulting stroke will be of the same length as it would be if the windmill connection 7 and pump-rod 4 were rigidly connected together. In the following or downward stroke under the same conditions the frame 6 will press against the stops 11 on frame 3 and carry the pump-rod 4 down to its lowest limit or starting-point. If, on the other hand, the upward movement of the windmill-rod is a slow one, the power will be applied to the liquid in compartment 1 in the same manner as in the previous instance; but valve 26 instead of being forced to its seat, as in the former case, will remain open or partially open, so that the liquid in compartment 1, or a good portion of it, if the speed is quite slow, will pass under valve 26 into compartment 8, expanding the part of the casing inclosing said compartment to the same extent that compartment 1 is collapsed, and in this case it will be seen that the movement of pump-rod 4 is as much less than the movement of the windmill connection 7 as the length of compartment 1 is diminished by collapsing. The length of stroke of the pump-rod 4 therefore depends upon the extent to which valve 26 closes during the upward stroke and the quantity of liquid permitted to pass the valve during the stroke, or, in other words, upon the speed of the windmill-rod. During the downward stroke following the slow upward stroke just described the frame 6 presses against plate 9, compressing compartment 8, and draws on the casing 1, extending the latter again to its condition at the beginning of the upward stroke, the liquid previously driven into compartment 8 passing back into compartment 1 through the now open valve and the pump-rod moving down to first position. Also during the downward stroke under consideration the large valve 29 opens freely, allowing the liquid above it to pass downward to its normal position through passages 23.

The operation of the form of the device shown in Fig. 2 is substantially the same as that shown in Fig. 1, except that the collapse of that portion of the casing in which the liquid is under pressure (sections 15 16) is effected by section 16 telescoping into section 15 instead of employing the bellows form of construction, as in Fig. 1. The result, however, is the same in both cases—that is, to permit the length of the pressure-chamber or compartment to be varied automatically, thus varying the distance apart of the crank connection 7 and the pump connection 4—in other words, varying the length of the stroke of the piston-rod considered as a whole according to the speed of the motor. The relief chamber or compartment 17 in Fig. 2 corresponds to compartment 8 in Fig. 1, the latter being capable of expansion and contraction, owing to the bellows form of construction, while the former is rigid, but has sufficient capacity to accommodate the liquid which passes through the valve.

The operation of the apparatus is materially affected by the adjustment of valve 10. If the stress of the spring 27 is strong, considerable pressure will be necessary to wholly close the valve, and the tendency will be to diminish the amount of work done, whereas if said spring is weak in its action the valve will close easily and the average of work performed will be increased.

The regulator herein described may be located at any preferred point in the connection between the motor and the machine or device to be operated, either at an intermediate point of the rod, as shown in the drawings, or at either extremity of it in immediate juxtaposition with the motor or with the device operated, the only essential condition being that the regulator shall be interposed in and form a part of the operative connection between the power and the work.

Having described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination with a reciprocating rod for communicating power from a prime mover to a machine to be operated, of a stroke-regulator adapted to be interposed between

two sections of said rod, the same comprising a casing and a body of liquid therein, said body of liquid forming a cushion or abutment between the rod-terminals, and said casing being capable of collapse and expansion, to reduce or increase longitudinally the space occupied by said liquid and the distance between said rod-terminals, substantially as set forth.

2. The combination with a reciprocating rod for communicating power, of a stroke-regulator for regulating the amount of work performed per stroke of said rod, the same comprising a casing interposed between two sections of said rod, said casing containing two chambers, a pressure-chamber and a relief-chamber, connected with each other by a passage-way, said pressure-chamber being held between the oppositely-extending rod-terminals, and being capable of collapse and expansion, to vary the longitudinal distance between said terminals, a body of liquid within said chambers, and means for controlling the capacity of said passage-way, substantially as set forth.

3. In a stroke-regulator, the combination of the rod divided into two sections, the frames forming the terminals of said rod-sections, the casing carried by said frames, a pressure-chamber within said casing, a body of liquid within said chamber, forming an abutment between the power and the work, a relief-chamber, a valve-controlled passage-way between said chambers, and means for collapsing and expanding the pressure-chamber, to vary the length thereof and the longitudinal distance between said rod-sections, substantially as set forth.

4. In a stroke-regulator, the combination of the two sections of the rod, the casing having a pressure-chamber and a relief-chamber therein, said pressure-chamber being held between the oppositely-extending rod-terminals, and being capable of collapse and expansion, to vary the longitudinal distance between said terminals, a body of liquid within said chambers, a passage-way connecting said chambers, and a valve controlling said passage-way adapted to close and prevent the liquid from passing out of the pressure-chamber when the pressure is strong, and to remain open and permit the liquid to pass into the relief-chamber when the pressure is weak, substantially as set forth.

5. In a stroke-regulator of the character described, the combination of the casing having two chambers with a body of liquid therein, one of said chambers being collapsible and held between the rod-terminals, so as to form a variable abutment between the power and the work, a passage-way between said chambers, a valve controlling said passage-way, and means for retarding the movement of said valve when pressure is applied thereto by said liquid, substantially as set forth.

6. In a stroke-regulator, the combination of the two sections of the rod, the casing, the collapsible pressure-chamber therein, the relief-chamber, the body of liquid within said chambers, the valve-controlled passage-way between said chambers, the terminal frame connected to the power-section of the rod and supporting the casing, and the terminal frame connected to the working section of the rod and carrying the partition and valve interposed between said chambers, substantially as set forth.

7. The combination with a source of power and a reciprocating rod actuated thereby of a stroke-regulator attached to and forming, with said rod, a connection between such power and the device to be operated, said regulator comprising a casing and a body of liquid therein, oppositely-extending terminals connected with the power and the work respectively, said body of liquid forming a cushion or abutment between said terminals, and said casing being capable of collapse and expansion, to reduce or increase longitudinally the space occupied by said liquid and the distance between said terminals, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

RODNEY H. YALE.

Witnesses:

WILLIAM Z. WARNER,

ALBERT W. KING.