

(No Model.)

R. L. FROST.  
STEAM ACTUATED VALVE.

No. 431,045.

Patented July 1, 1890.

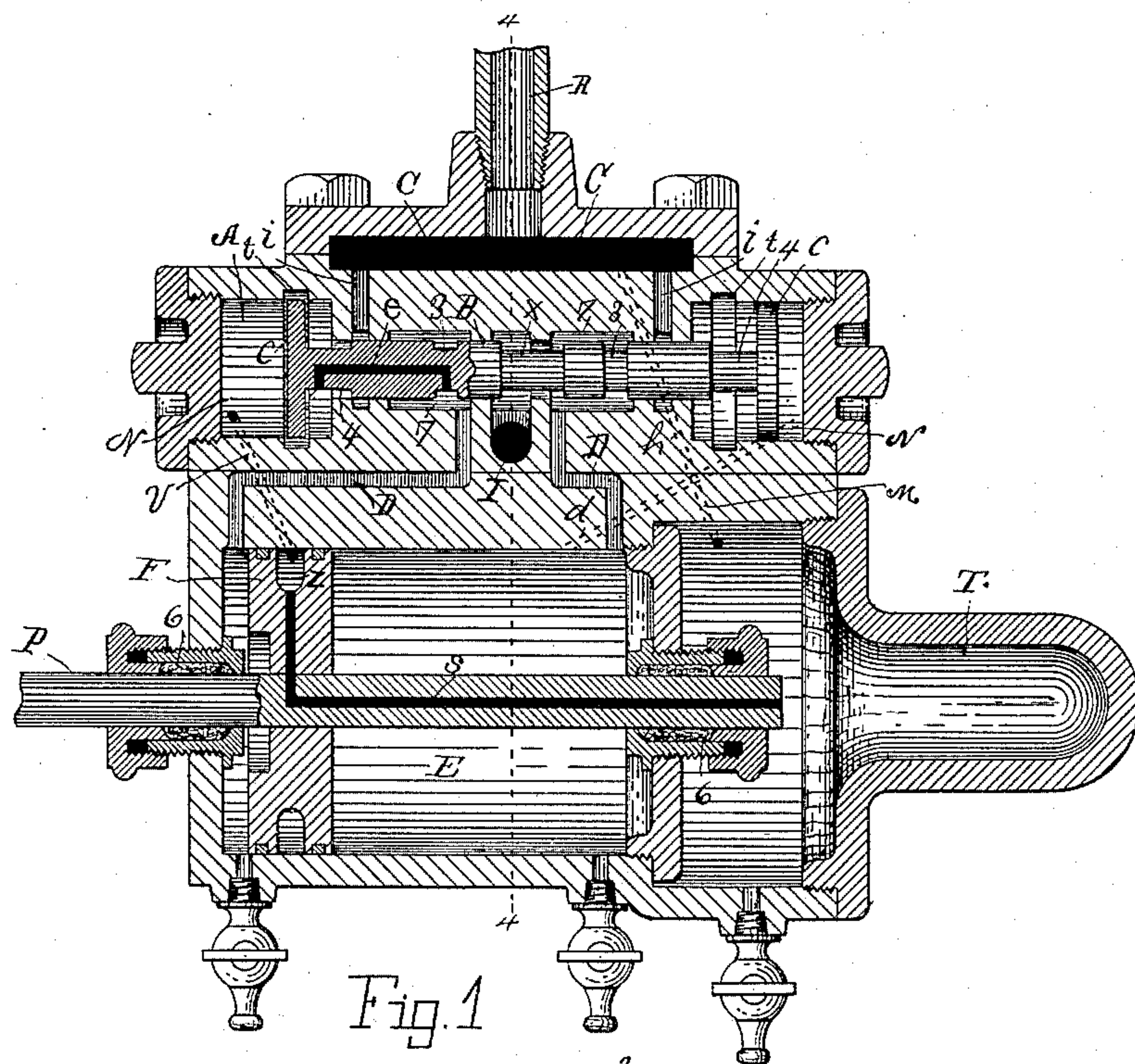


Fig. 1

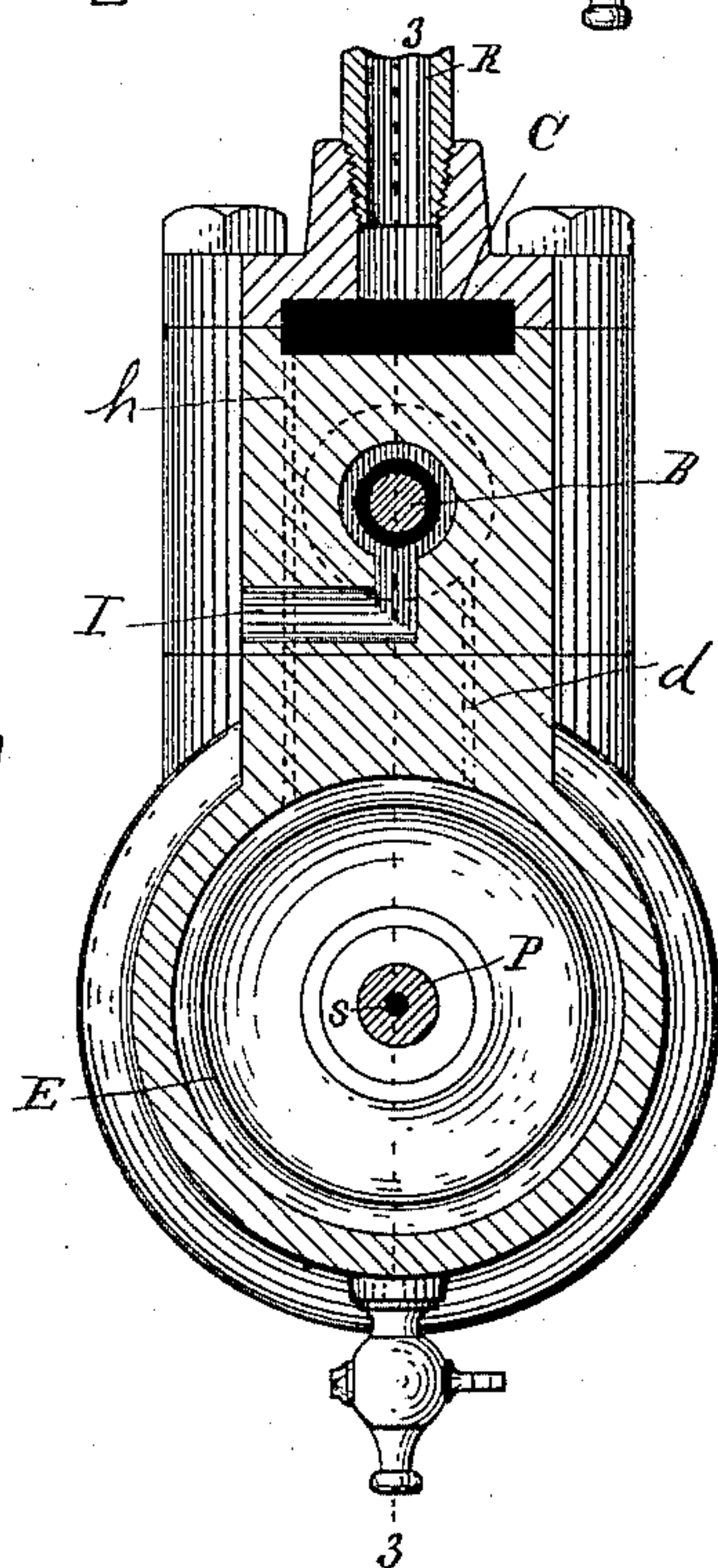


Fig. 2

Witnesses:

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By *Lucius C. West*  
Att'y.



# UNITED STATES PATENT OFFICE.

RICHARD L. FROST, OF BATTLE CREEK, MICHIGAN, ASSIGNOR TO THE UNION MANUFACTURING COMPANY, OF SAME PLACE.

## STEAM-ACTUATED VALVE.

SPECIFICATION forming part of Letters Patent No. 431,045, dated July 1, 1890.

Application filed April 18, 1890. Serial No. 348,497. (No model.)

*To all whom it may concern:*

Be it known that I, RICHARD L. FROST, a citizen of the United States, residing at Battle Creek, county of Calhoun, State of Michigan, have invented a new and useful Steam-Actuated Valve, of which the following is a specification.

This invention relates to that class of steam-engines in which the pressure of steam in the cylinder is so regulated as to obtain isochronal movement of the steam-piston under varying resistances; and it more especially relates to an invention disclosed in an application of mine filed August 28, 1889, Serial No. 332,222, in which application the object of the invention as set forth consists in a peculiar construction of the steam-engine valve and its relation to the ports in the steam-chest and cylinder, whereby when the resistance of the work being done increases the pressure of steam in the cylinder said pressure of steam would not so act upon the valve in the steam-chest as to entirely close the live-steam port at either end of the stroke of said valve when the engine was in operation.

The invention further relates to an invention disclosed in an application of mine filed December 2, 1889, Serial No. 332,346, in which a secondary steam chest or receiver and a piston having certain changes in construction were employed.

The main object in the present invention consists in providing the valve-chest at each end with annular ports in its internal periphery, which, in conjunction with the valve and other features of the engine, arrest the valve at given points in its movement and supply live steam back of the piston-head in the cylinder to cushion and initially start the piston on its reverse movement to accomplish the advantages which will appear in the following description.

The construction herein disclosed is more especially intended for use in connection with steam-pumps, the same as my prior invention referred to, but of course may be used for other purposes.

In the drawings forming a part of this specification, Figure 1 is a sectional elevation on

line 3 3 in Fig. 2, looking from a point at the right of said figure; and Fig. 2 is a section on line 4 4 in Fig. 1, looking from a point at the left.

Referring to the lettered and numeral parts of the drawings, E is the cylinder, and F is the piston-head, having an annular depression Z in the periphery of said head, as shown in Fig. 1.

At A is shown the valve-chest, having therein what is usually termed a "float-valve" B, said valve having enlarged heads *c c* at each end, which play back and forth in the internal enlargements N in the ends of the valve-chest.

Referring to Fig 1, the valve B is shown having an annular depression 4 4 at each end and centrally at X, and at 3 3 between said center and end depressions. Each end of the valve B has a live-steam port *e* leading from the annular depressions 4 4 internally and longitudinally through said valve and out into the annular depressions 3 3. These several depressions 4 4, 3 3, and X may be termed "annular steam-ports." This valve B is like the one shown in my first prior application herein referred to. The ports *e* through the valve are as clearly shown at left hand in Fig. 1.

At R is the ordinary steam-supply pipe, and from said pipe the live-steam ports *C i C i* lead into the interior of the valve-chest and into the steam-passage *h M*, which leads into the receiver T, Fig. 1.

At D D are ports leading from the valve-chest into each end of the cylinder E, and I is the exhaust-port. Ports *d v* lead from either end of the steam-chest into the cylinder E.

The piston-rod P has bearings in the stuffing-boxes 6 6 in the ends of the cylinder E.

The secondary steam chest or receiver is shown at T and joins the opposite end of the cylinder E to that shown in my second prior application above referred to. During the stroke of the piston the free end of the piston-rod P, which terminates in the receiver T, plays back and forth in said receiver, and of course the other end of the rod P would be connected with the pump or other machinery



to be driven. The piston-rod P has a steam-port *s* passing longitudinally through it from the steam-receiver T and into the piston-head F, and leading from thence out into the annular depression Z in the periphery of said head.

In the operation of the engine, referring to Fig. 1, live steam has filled the steam-passages D D and *h*, and steam from the right-hand passage D has passed through the right-hand annular port 4 of the valve B, and from thence through the steam-passage *e*, through said valve, and thence through the right-hand induction-port D and into the right-hand end of the cylinder E. A portion of the live steam has passed through the branch steam-passage *d* into the right-hand end of the steam-chest A. Since the outer surface of the ends *c* of the valve exceed the inner surface of said heads, the steam which enters the end of the valve-chest through passage *d* counterbalances the pressure of the live steam against the inner surface of said head, and thus prevents abnormal displacement of said valve.

The steam which entered the cylinder through the right-hand passage D forced the piston over to left-hand end of the cylinder, during which action the exhaust-steam passed through the left-hand steam-port D, through the central annular port *x*, and on through the exhaust-port I. The live steam which passes through the steam-passage *h* into the steam-receiver T fills said receiver, and for which reason, when the piston has reached the end of the cylinder just described, live steam passes through port *s* into the annular depression *z* in the periphery of the piston-head, and from thence through the steam-passage *v* into the left-hand end of the valve-chest A for the purpose of throwing the valve B to the right, which of course would reverse the position of said valve and cause the live steam to pass through the left-hand steam-passage D and left-hand annular port 4 and passage *e*, through the left-hand end of the valve B, annular port 3, and on through the left-hand steam-port D into the left-hand end of the cylinder E, and thus throw the piston to the right-hand end of said cylinder. In the present construction, as illustrated in Fig. 1, the valve has not yet moved sufficiently far to the right to open the left-hand annular port 4 of the valve; but when it has moved sufficiently far then the piston will be thrown to the right, as above stated, and as will be explained below. The valve B is in its arrested position, Fig. 1, and its left-hand head *c* registers with the annular port *t* in the enlarged end N of the valve-chest, because the live steam which passed from the steam-receiver T through port *s* of the piston-rod P, and through port *v* into the end of the valve-chest and pushed the valve to its present position, now passes by the piston-head (for the reason, of course, that the annular port *t* is larger than said head) and on through port *e* of the valve out into the chambered portion 7 of the valve-chest through port D, and into

the left-hand end of the cylinder, which supply of steam will initially start the piston to the right; but during this action the valve B continues to move to the right, but with less velocity, until the left-hand annular port 4 and the left-hand end of the valve-port *e* register with the live-steam port *i*. Live steam will now pass around the annular port 4 and on through port *e* into the left-hand end of the cylinder and continue the movement of the piston to the right. This main feature of the present invention cushions the valve and piston with live steam, obviates pounding of the same, and secures a steady and uniform movement of said parts. When the piston-head is in the right-hand end of the cylinder, the annular depression Z of said head will register with the right-hand steam-passage *d*, which communicates with the cylinder and the right-hand end of the valve-chest, and of course a reverse action of the valve will now take place, and also of the piston at the proper time in like manner, as described for the opposite movements of said parts.

The chambered portions 7 7 in the valve-chest were shown in my second application, hereinbefore referred to, in order to allow the steam which escaped by the valve-heads to pass on through the exhaust, and thus not interfere with the proper throw of the valve.

Returning to the steam-receiver T, with this receiver thus constructed with the elongated hollow projection, and thus associated with the cylinder and valve-chest at the end here shown, greater compactness and simplicity are secured, and the single port *s* through the piston-rod is much more desirable than my former plan, in which the end of the piston-rod extended through the receiver and into the pump.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination of the valve having the annular end depressions, the annular central depression, the annular depressions each side of the central depression, and the steam-ports leading from the end depressions longitudinally through the valve and into the annular depressions next to the central depression, a suitable piston and cylinder, the valve-chest having the chambered portions communicating with the central depression, with the annular depressions each side thereof, and with the exhaust-port, said valve-chest being also provided with the annular ports in the end enlargements, which ports permit the live steam to pass the valve-head and arrest or retard the movement of said valve, and said cylinder and valve-chest having suitable ports coacting with said valve and piston, substantially as set forth.

2. The combination of the valve-chest, the end chambers, a steam-actuated valve in said valve-chest, said chest and valve having suitable coacting ports, and said chest being provided with the annular ports in the end en-



largements, which ports permit the live steam to pass the valve-heads and arrest or retard the movement of the valve, a cylinder, live-steam passages leading from each end of the steam-chest into said cylinder, induction and exhaust ports, the steam-receiver, a live-steam port leading into said receiver, a piston-rod passing into said receiver and having a piston-head with the annular depression in the periphery thereof, said piston-rod and head having the port leading therethrough from the steam-receiver into the annular depression of said head, and said steam-port having an opening into the receiver, substantially as set forth.

3. In an engine employing a steam-actuated valve in the valve-chest, the combination of a steam-receiver, a piston-rod extending into said receiver, the piston-head of said rod having the periphery-depression, a live-steam passage leading through said rod from the receiver and out through the head into said depression, which depression registers with the live-steam ports leading to the ends of the valve, and a valve-chest provided with the annular ports in the end enlargements, which ports permit the live steam to pass the valve-

heads and arrest or retard the movement of the valve, substantially as set forth.

4. In an engine, the combination of a steam-actuated valve, a valve-chest having the annular ports in the end enlargements, which ports permit the live steam to pass the valve-head and arrest or retard the movement of the valve, a cylinder and piston, the chest, cylinder, piston, and valve being provided with suitable coacting ports, substantially as set forth.

5. In a steam-engine, a steam-actuated valve, and a valve-chest having the annular ports in the end enlargements, said valve and chest having suitable ports communicating with the cylinder and piston, whereby the live steam which trips the valve is permitted to pass the valve-heads at the desired point and arrest or retard the movement of said valve, substantially as set forth.

In testimony of the foregoing I have hereto subscribed my name in presence of two witnesses.

RICHARD L. FROST.

Witnesses:

L. N. BURKE,  
H. J. FREEMAN.