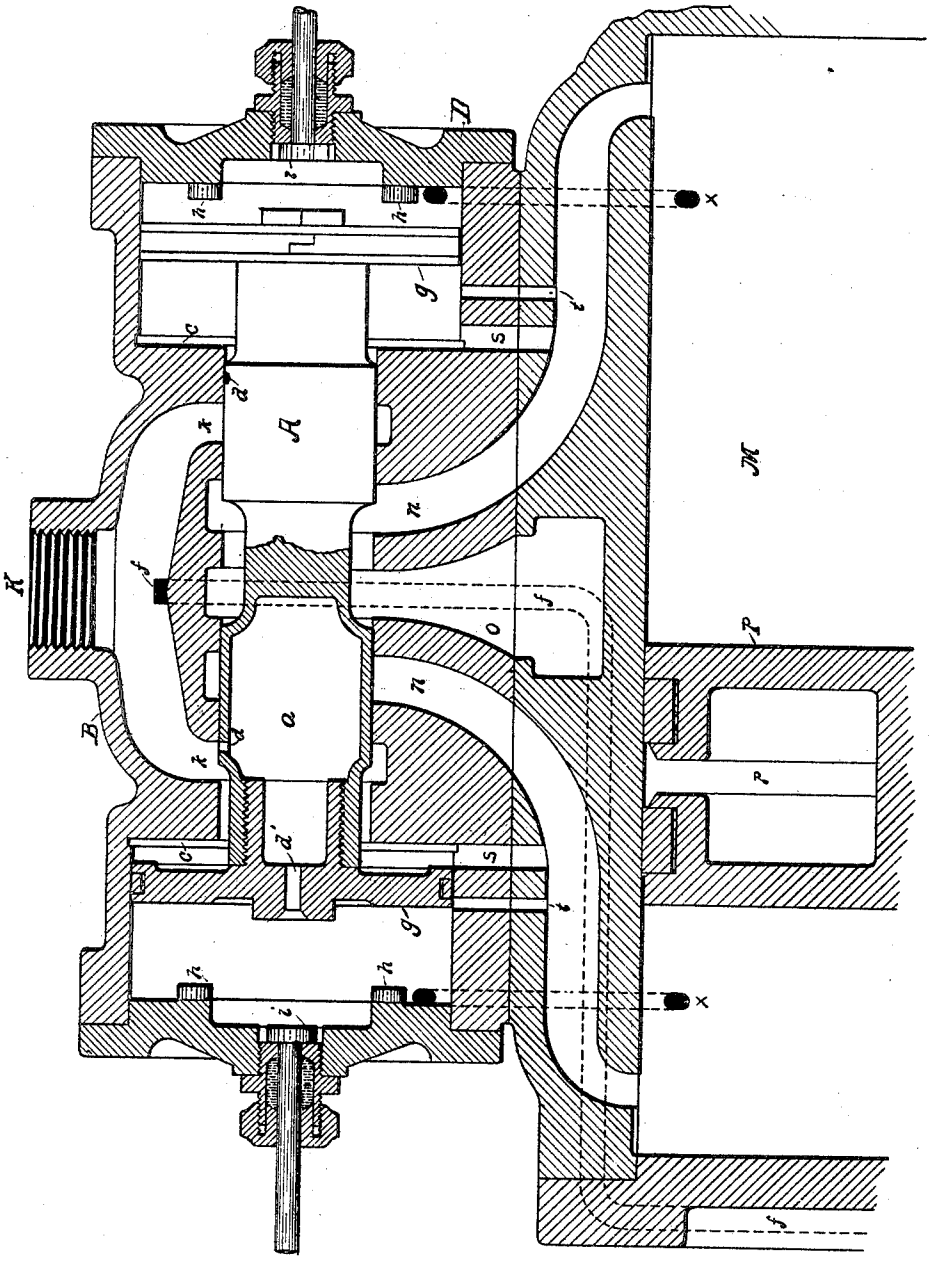
No. 649,739. Patented May 15, 1900.

F. M. METCALF.

STEAM ACTUATED VALVE.

(Application filed Jan. 29, 1900.)

(No Model.)



Witnesses.

F. R. Dowsett.

R. R. Hicks

Inventor.

Foster M. Metcalf

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FOSTER M. METCALF, OF BATTLE CREEK, MICHIGAN, ASSIGNOR TO THE AMERICAN STEAM PUMP COMPANY, OF SAME PLACE.

STEAM-ACTUATED VALVE.

SPECIFICATION forming part of Letters Patent No. 649,739, dated May 15, 1900.

Application filed January 29, 1900. Serial No. 3,251. (No model.)

To all whom it may concern:

Be it known that I, FOSTER M. METCALF, a citizen of the United States, residing at Battle Creek, in the county of Calhoun and State of Michigan, have invented certain new and useful Improvements in Steam-Actuated Valves, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to that class of steam or other fluid engines in which the valve is actuated by direct steam-pressure at the end of each stroke of the piston, and has for its objects the prompt and certain action of the engine under all conditions, and such suitable arrangement of parts as to provide ample bearing and wearing surfaces, thereby insuring much longer and more satisfactory service than has been heretofore obtained with engines of this type.

My improvement consists in a peculiar and novel construction of the valve and its connecting steam and exhaust passages in the chest, as will hereinafter appear.

The accompanying drawing shows my improved form of valve mechanism attached to a steam cylinder and piston constructed substantially in the manner shown in Letters Patent No. 442,905, granted to me under date of December 16, 1890, in which the live steam employed to trip or reverse the valve at the end of each stroke is conveyed to the steam chamber or receptacle formed in the piston-head by a passage formed in the steam-chest and piston-head and connecting with a trip-tube extending into the cylinder and into a chamber or recess in the piston-rod; but I do not wish, of course, to be limited to the use of my improved form of valve in connection with that particular form of apparatus alone, as it is obvious that my invention may be equally well used with or applied to apparatus in which the steam for tripping or reversing the valve is conveyed to the valve-chambers by other and different means.

In the use of steam valves and chests as heretofore made trouble has sometimes occurred from the trip-steam admitted to the outer end of the valve-chambers for the purpose of actuating the valve passing through the preadmission-port formed in the valve into the enlarged part of the valve-chamber (in which the valve-head plays) on the inner side of the valve-head, thus causing the valve to center and fail in operation. This I have found to occur principally where valves so constructed have been used in connection with deep-well engines, sinking-pumps, vacuum-pumps, and other similar pumping apparatus, and also when such valves have been actuated and used with water instead of steam, the water passing back through the preadmission-port to the inner side of the valve-head in the same manner and with the same results as when used with steam. This defect in the operation of such valves is due to the steam-chest walls between the steam-passage furnishing live steam from the boiler to the valve and the enlarged part of the valve-chamber in which the valve-head plays being so thin or narrow and the construction of the preadmission-port or open steam-passage through the valve such that the opening of the preadmission-port intended to register and connect with the source of steam-supply is free at certain positions of the valve to connect with the enlarged part of the valve-chamber, with the results above stated. In my invention this defect is overcome and the certain and positive action of the valve assured by so increasing the width of the walls of the steam-chest separating the enlarged part of the valve-chambers from the passage furnishing live steam to the valves and so constructing the preadmission-port or steam-passage formed in the valve itself that it is impossible for the opening of the preadmission-port intended to connect with the source of steam-supply to connect with and deliver steam to the enlarged part of the valve-chamber on the inner side of the valve-head.

The accompanying drawing shows a vertical section longitudinally through a steam chest and valve embodying my invention, (together with a portion of the cylinder and piston,) one-half only of the valve being shown in section.

In the drawing, A represents the valve, which is cylindrical in form, having the usual

enlarged heads *g g* at either end and the usual annular depressions at each end next the valve-heads and in the center for the admission of live steam and the escape of exhaust-steam. In each end of the valve is formed the steam-passage *a*, having an opening *d*, connecting with the source of steam-supply at certain positions of the valve, and another opening *d'* through the valve-head into the outer end of the valve-chamber, the whole forming a preadmission port or passage for the conveyance of live steam through the valve into the outer end of the valve-chamber. It is evident, of course, that the preadmission port or passage need not be of the size or dimensions shown in the drawing, but may be merely a steam-passage of uniform size throughout, I preferring the construction shown, however, as materially lessening the weight of the valve, and thus facilitating its operation. B represents the steam-chest, and K the main steam-opening to the chest, leading from the boiler or other source of steam-supply to and branching inside the steam-chest into the branch pipes or passages *k k*, leading into the valve-chamber. M represents the cylinder, and P the piston, the latter having formed within it the chamber or receptacle *p* for the conveyance of steam to the ends of the valve-chambers for the purpose of tripping or reversing the valve at the end of each stroke of the piston. *h h h h* are lugs attached to the steam-chest heads, so as to prevent the inner faces of the valve-heads from striking against the chest-walls. *i i* are starting-pins working in suitably-constructed stuffing-boxes. *s s* are steam-ports for admitting live steam to the cylinder; *t t*, relief-ports; *n n* and *o*, exhaust-ports; *x x*, trip-ports, and *f f* the passage leading from the source of live-steam supply through the steam-chest and cylinder-head to the trip-tube, the general construction, except as hereinafter pointed out, being substantially the same as heretofore in use.

c c represent the walls of the steam-chest, which separate the enlarged outer ends of the valve-chambers from the live-steam passages *k k* and which should be constructed of such thickness as to prevent the opening *d* of the preadmission-port from ever coming into connection with the outer and enlarged end of the valve-chamber, and thus permitting steam to pass from the outer face of the valve-head to the inner, no matter in what position the valve may be. The opening *d* of the preadmission-port should also be constructed, as shown, inside of the annular depression next to the valve-head, so that it may be closed except when registering with the live-steam passage *k*, and should also be arranged so as to be incapable of ever opening into the enlarged end of the valve-chamber, no matter what the position of the valve may be, in order that the trip-steam when admitted to the outboard end of the valve for reversal shall be completely retained, and not thereby escape to weaken or prevent a prompt movement of the valve. These openings *d d* should preferably be so arranged that one or the other of them will be fully or partially in connection with the live-steam passages *k k* when the valve is at or near its central position of lateral travel, this latter arrangement serving better the double purpose of preventing the engine-valve from finding a dead-center or point from which it will not move when steam is applied and of preventing the rebounding and consequent closing of the valve during the period when the piston-head and ring cover the actuating trip-port, and consequently cut off the supply of steam from the cylinder to the outer end of the valve-chamber. With this construction and arrangement of the walls of the steam-chest *c c* and the openings *d d* of the preadmission-ports it will be absolutely impossible for the steam in the outer ends of the valve-chambers to pass through the preadmission-ports into the valve-chambers on the inner face of the valve-heads and so cause or tend to cause failure or uncertainty of operation.

So far as I aware all valves of this character hitherto constructed and used have been subject to failure or uncertainty of operation under certain circumstances and conditions for the reasons I have stated, and I believe the construction of the valve and steam-chest shown in the drawing and above described to be the first practical suggestion for remedying such defects.

The operation of the valve, which is substantially the same as that of other steam-actuated valves of this character, is briefly as follows: The valve being, as shown in the drawing, nearly to the full limit of travel toward the right, admitting steam to the cylinder through the annular depression at the left, the piston is driven by the incoming steam toward the right, the exhaust-steam escaping through the right-hand exhaust-port and the annular depression in the center of the valve. The pressure and impulse of incoming steam impinging against the inner surface of the valve-head tend to move the valve toward the left and reduce the opening for the admission of steam to the cylinder. Opposed to this the direct pressure of cylinder-steam, assisted by the current from the preadmission-port reacting against the outer face of the valve-head *g*, which is larger in area than the inner face of the head, tends to force the valve to the right, and thus increase the opening for the admission of steam through the annular depression next the valve-head. The valve-head, thus standing in a floating balance between the several forces tending to move it in opposite directions, assumes a position relative to the load upon the piston, thus affording a governing element in addition to simple actuation. Upon the arrival of the piston at the end of the stroke, the opening of the trip-port *x* coming into connection with the live-steam chamber in the piston-

head, live steam is admitted into the right-hand end of the valve-chamber, thus driving the valve to the left and reversing its action.

I have not attempted a more complete description of the operation of the valve mechanism, it being substantially the same as that described in the prior patents and being well known to persons familiar with this class of valves, a more complete description, moreover, not being necessary for a complete comprehension of my improvement and invention.

While I have described the operation of the valve as employed with steam, it is evident that it may be equally well employed where the propelling force is water or any other fluid instead of steam, and I do not wish to be understood as confining myself to the use of my invention in connection with steam-engines alone.

Having thus briefly described my improvement, what I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of a steam-chest having lateral delivery-passages *k*, *k*, and a steam-valve having preadmission-ports with centers approximately coinciding with the outside limits of these passages when the valve is on "center" of travel, together with the chest-walls of sufficient width to properly inclose each alternately at outside limit of valve travel substantially as shown and described.

2. In a steam-actuated valve, the combination of the steam-chest B, steam-valve A, chest-heads D, provided with valve-stops *h*, *h*, *h*, *h*, substantially as shown and described.

3. In a steam-actuated valve, a steam-chest having suitable induction and eduction ports, in combination with a valve arranged to operate therein provided with preadmission ports and passages—the whole so constructed that the travel of the preadmission-ports is inclosed between the outside limits of the chest-walls *c*, *c*, substantially as and for the purposes set forth, shown and described.

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

FOSTER M. METCALF.

Witnesses:
A. C. PERKINS,
F. R. DOWSETT.