M. Cridge,

Governor.

No. 26,654. Patented Jan. 3, 1860.

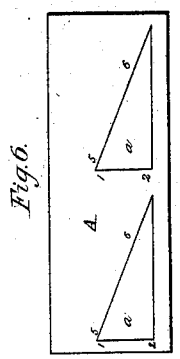


Fig. 6.

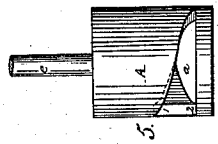


Fig. 5.

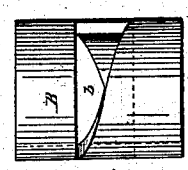


Fig. 4.

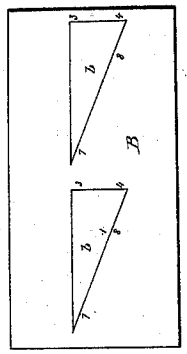


Fig. 7.

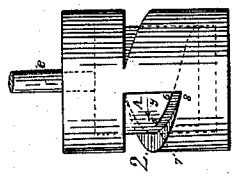


Fig. 2.

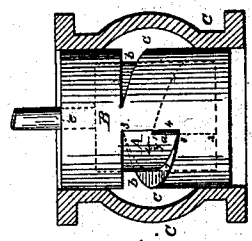


Fig. 3.

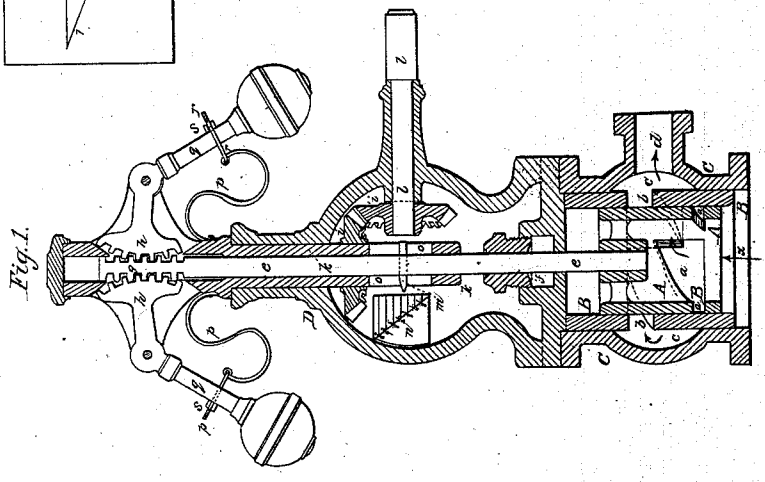


Fig. 1.

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

MATTHEW CRIDGE, OF PITTSBURG, PENNSYLVANIA.

STEAM-VALVE.

Specification of Letters Patent No. 26,654, dated January 3, 1860.

To all whom it may concern:

Be it known that I, MATTHEW CRIDGE, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Variable Cut-off Governor-Valves for Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same.

The nature of my invention consists in a novel arrangement of a revolving cylindical or cup valve, which is capable of cutting off the steam at any point in the stroke of an engine, being connected with the governor of the engine so, that the point of cut-off is controlled by the action of the said governor, whereby the charge of steam admitted into the cylinder, is regulated or varied so, as to meet any changes in the resistance or load of the engine, or any variations in the steam pressure;—thus regulating the speed of the engine.

To enable others skilled in the art to make and use my invention I will proceed to describe its construction and operation, taking reference to the accompanying drawings making a part of this specification, and in which—

Figure 1, is a vertical section of the valve and governor;—Figs. 2, 3, 4 and 5 are details and Figs. 6 and 7 diagrams to which special reference will be had in the following description.

In all the figures the same characters of reference are marked on alike parts.

A is the valve; B is the valve seat, forming a shell which incloses the valve; C is the outer casing, into which the valve seat is fitted; D is the governor set on the casing.

The valve A, of which a separate view is shown in Fig. 5, has two triangular steam ports *x x* in it, as fully seen in Fig. 6, which is a diagram of the outer cylindrical surface of the valve, laid into a plane. The valve seat B, of which a separate view is shown in Fig. 4, has also two steam ports *b*, *b*, in it, which are of a similar triangular shape, but reversed to those of the valve, as is fully seen in Fig. 7, which is a diagram of the cylindrical (inner) surface of the seat, laid into a plane. The valve seat with the valve inclosed, is also shown in Figs. 2 and 3, in which the valve seat is represented in side view, taken at right angles to that shown in Fig. 4; and the valve shown in two different positions in relation to the seat viz.: Fig. 2 showing its position when the ports *a* and *b* are nearly closing or cutting-off the steam; and Fig. 3, when the ports are opening, or commencing to admit the steam. This latter position of the valve also corresponds to that shown in the section Fig. 1. The arrow *y* indicates the direction in which the valve turns. The outer casing C is made to leave an annular space *c*, between it and the seat, which communicates with the passage *d*.

The stem *e* of the valve passes through the stuffing box *f* in the top of the casing, and is connected with the governor in such a manner as to be raised or lowered by the action of the same.

The governor D represented in Fig. 1, is of the well known construction of ball levers with toothed segments (*h*, *h*) gearing into the teeth *g* at the valve stem *e*.

m is a pin through the valve stem, passing through the openings *o o* in the governor stem *k*. The valve stem and valve are hereby made to revolve with the governor.

The openings *o o* are made slotted in perpendicular direction for the purpose of allowing the pin *m* a sufficient up and down play in it, so as not to impede the raising or lowering of the valve stem (with the valve) by the action of the governor.

n is a scale, fastened to the governor frame which is located and divided so, that the pin *m* shows the height to which the valve is raised by the governor, and thus indicates the degree of cut-off, corresponding to that height. Thus if the pin is opposite the figure $\frac{5}{8}$ of the scale, the engine is working with the steam cut-off at five-eighths of its stroke.

The governor receives its motion by the bevel wheels *i*, *i* and the shaft *l*, which communicates with the engine shaft by wheel gear or any other known mechanical means, suitable for the purpose.

The operation of the described valve arrangement is very simple. The steam enters into the valve at the arrow *x* (Fig. 1), and passes when the ports *a a* and *b b* are open, through the same into the circular space *c*; and from there, through the pipe or passage *d*, to the steam chest or distributing valve of the cylinder.

By reference to Fig. 3 (and also to the diagrams 6 and 7) it will be seen, that the openings of the ports or the admission of the steam takes place, when the perpendicu-

lar sides 1—2 of the valve ports *a a*, pass over the corresponding sides 3—4 of the seat ports, and that the point of opening is always the same or invariable, whether the valve be raised more or less by the governor. The closing of the ports or the cutting off however takes place when the inclined sides 5—6 of the valve ports *a* pass over the inclined sides 7—8 of the seat ports *b*, (see Fig. 2), and it is evident that this will be the later the higher the valve is raised, and the sooner the lower its position is. The degree of cut-off will therefore be perfectly controlled by the action of the governor.

It is obvious, that the revolving motion of the valve (when provided with two ports, as herein represented) has to be such, as to make one complete revolution for each double stroke of the piston of the engine or for each revolution of its crank shaft;—and the governor—from which the motion of the valve is derived—has consequently to be driven with precisely the same speed. The valve has further to be set, in relation to the piston of the engine in such a way, that the admission of the steam, (*i. e.* the opening of the ports *a* and *b*) takes place exactly at the beginning of the stroke of the same.

As the steam acts in the described valve as well from above as from below, it is balanced, with the exception of a slight pressure upward, acting under the valve stem. This pressure has the tendency of keeping the balls of the governor down or counteracting the centrifugal power of the same.

If the described cut-off and governor arrangement is applied to a fast running engine, the governor will run with an extraordinary speed, and it becomes necessary to counteract the centrifugal power of the same to some degree. This is partly done by the above mentioned steam pressure. But in addition thereto, I use springs *p*, *p*, fastened to the stem *k* of the governor, and connected with the ball arms *q*, *q*, by the screws *r*, *r*, and adjusting nuts *s*, *s*. By these means I am enabled to regulate or change the speed of the engine at pleasure. Thus, in order to increase the speed of the engine (its load remaining the same) I adjust the springs—by means of the screws and nuts—so that they are more strained, whereby they will counteract the centrifugal force of the balls with an increased power. In consequence thereof, the balls will adopt a lower position, whereby the valve is raised, and admits steam into the cylinder of the engine for an increased portion of the stroke. The charge of steam per stroke being thus increased, and the load remaining the same, the engine will necessarily run with an increased speed.

The number of ports in the valve (and valve seat) is not necessarily confined to two; but may be changed to three, four or more;—if this is done, the speed of the valve must be changed accordingly. Thus in using four steam ports in the valve, the same has to be made to revolve only once for two revolutions of the crank shaft of the engine;—in using 3 ports, the speed of the valve has to be only two-thirds of the crank-shaft.

The cut-off governor valve herein represented has the advantage that it is capable of changing the degree of cut-off from the smallest fraction of the stroke to full stroke; that it is extremely simple, effective, and easily kept in order.

I do not claim broadly the arrangement of a cup valve, so as to revolve and at the same time to ascend and descend by the action of the governor, as similar arrangements have been made before; but

What I do claim and desire to secure by Letters Patent is—

Providing in such an arrangement (*i. e.* of a revolving and ascending and descending cup valve) the valve A and its seat B with port openings, having inclined edges (5—6 and 7—8) so that the steam is cut off by them variably and controlled by the governor, substantially in the manner and for the purpose herein set forth.

MATTHEW CRIDGE.

Witnesses:
G. H. FICHREN,
AUG. HARTJE.