R. AFFELTRANGER.

Distribution and Expansion Valve for Engines.

No. 223,871. Patented Jan. 27, 1880.

Fig. 1.

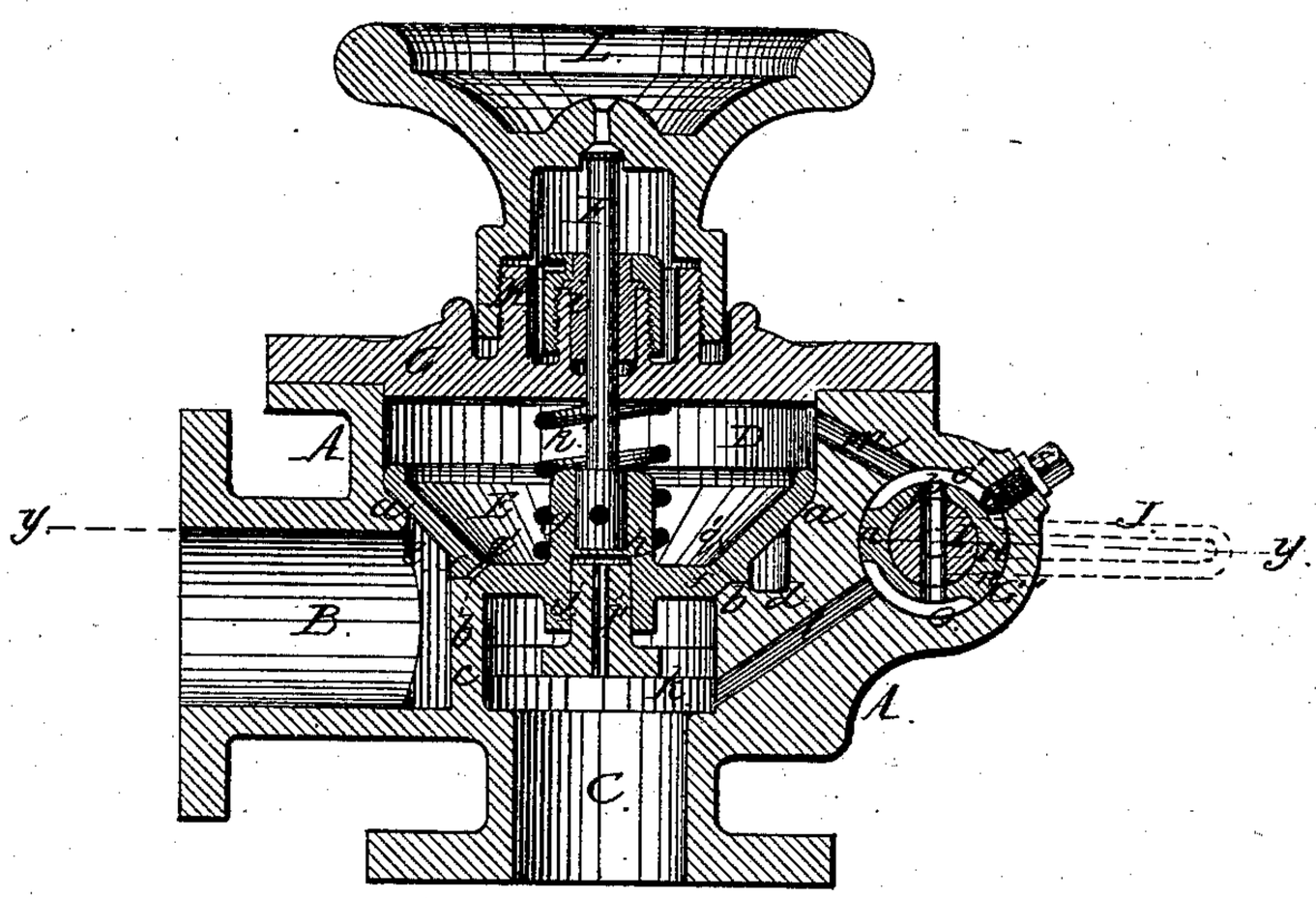
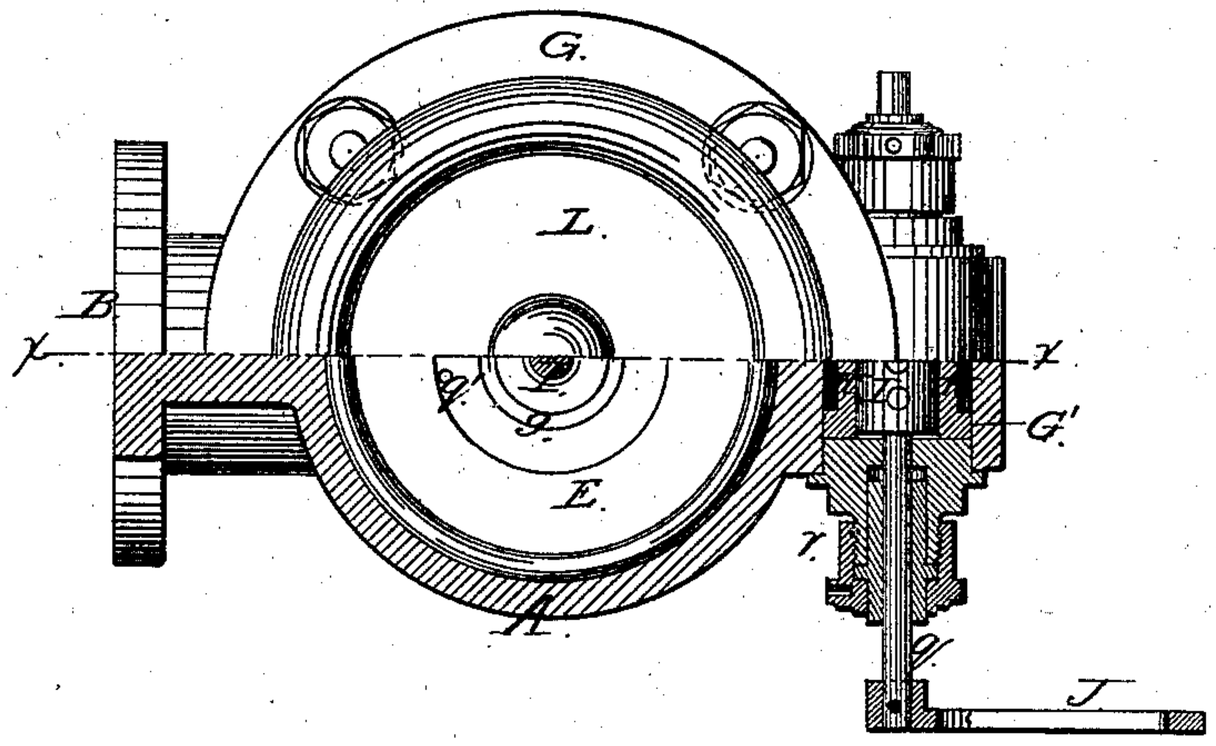


Fig. 2.



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RODOLPH AFFELTRANGER, OF TURBENTHAL, ASSIGNOR TO CHAS. AUGT. DE GONZENBACH, OF ZURICH, AND GUSTAVE NAVILLE, OF GENEVA, SWITZERLAND.

DISTRIBUTION AND EXPANSION VALVE FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 223,871, dated January 27, 1880.

Application filed November 22, 1879. Patented in France, April 30, 1879.

To all whom it may concern:

Be it known that I, RODOLPH AFFELTRANGER, of Turbenthal, Switzerland, have invented an Improved Distribution and Expansion Valve for Steam and other Engines, of which the following is a specification.

My invention relates to improvements in expansion or cut-off valves for steam-engines; and the object of said improvements is to provide a valve which will serve the double purpose of a throttle-valve and a cut-off valve, and which will be regulated in its action by the governor when the engine is working.

My invention consists, first, in double-seating the valve in a chamber interposed between the steam-pipe and the steam-chest, so that when the valve is down on its seats the steam is cut off and communication is interrupted between the steam-pipe connection and the steam-chest connection, but communication can be had through suitable passages between the steam-chest connection and the upper side of the valve.

It consists, secondly, in placing a valve in the passage leading from the upper side of the valve to the steam-chest, and in connecting said valve with the governor of the engine, so that the quantity of steam allowed to pass through the said passage is regulated by the governor.

In the accompanying drawings, Figure 1 is a vertical section of my improved valve and chamber and connections for the steam-pipe and steam-chest, taken on line *x x* of Fig. 2. Fig. 2 is a sectional top view of the valve-chamber, &c., the section being taken horizontally on line *y y* of Fig. 1.

Referring to the drawings, A represents a valve box or case provided on one side with a neck, B, for connecting the said box with the steam-supply pipe, and at the bottom provided with a neck, C, for connecting the box with the steam-chest of the cylinder. Inside of the valve-box A is a circular chamber, D. From the walls of said chamber projects a flange, forming a beveled seat, *a*, inwardly, just above the level of the top of neck B. The said flange forms one valve-seat.

Below valve-seat *a* is another valve-seat, *b*, of smaller diameter, which seat *b* is partly formed on the top of a vertical partition, *c*, projecting upward from the lower side of the neck B, while the remainder of the said seat *b* is formed on a projection, *d*, of the walls of the chamber D.

Between the seat *b* and the seat *a* is a space or opening, *e*, in line with pipe B, through which the steam passes from the neck B when the valve is raised, under said valve, and thence into neck C.

E is the valve, in the form of an inverted frustum of a cone, which is placed within the chamber D so that its upper conical part is in position to rest on the seat *a* when the valve is down, as in Fig. 1. The lower portion, *f*, of the valve is shaped to fit closely on the seat *b* when the valve is down, as shown in the same figure.

In the center of the valve E is a vertical tubular sleeve, *g*, the bore of which is divided into two parts by a horizontal partition, *h*. In the upper part is fixed the end of a stem, F, which projects up through a suitable opening in the cover G of the valve-box A and through a stuffing-box, *i*. The lower part of sleeve *g* fits over a post, *j*, which is held in the chamber *k*, above the neck C, by arms projecting from the said post and joining the walls of said chamber *k*. Through the post is an aperture, *j'*, for the steam to pass through to press against the partition *h*.

The post *j* and the stem F serve as guides for the valve E, which compel the said valve to move evenly up and down, and to settle squarely on its seats *a b* when forced down.

k' is a spring wrapped around the stem F, which, pressing against the under side of cover G and against the valve, assists in keeping the valve on its seats.

In place of the spring *k*, however, as a means of assisting in keeping the valve E on its seat, the valve itself may be made of sufficient weight to retain itself on the seat when the engine is not running; and when it is running this additional weight of the valve assists the steam in closing the valve quickly. The valve in this case, by the additional

weight, compensates for the absence of the spring; but of course if the spring is employed the valve need not be so heavy.

From the chamber *k*, below valve E, a passage, *l*, leads diagonally up through the walls of case A to a cylindrical chamber, G′, and from chamber D another passage, *m*, leads downward diagonally through the walls of case A to the cylindrical chamber G′.

In chamber G′ is placed a sleeve, H, with segmental projections *n* on opposite sides, which bear against the walls of chamber G′, and thereby divide chamber G′ into two parts, *o o′*.

Through sleeve H are made holes *p*, which furnish communication between the two parts *o o′* of chamber G′. I is a cylindrical perforated valve placed within sleeve H, and having its stem *q* projecting through a suitable stuffing-box, *r*, and provided with a lever, J, which is intended to be connected in any suitable manner with the governor, so that as said governor rises and falls the valve I is oscillated on its axis, and the perforations in said valve are thrown more or less in and out of line with the holes *p* in the sleeve H. The sleeve H is held from turning by a set-screw, *s*, passed through the walls of chamber G′.

L is a hand-wheel, which is screwed to a flange, M, on the cover G, surrounding the stuffing-box *i*. By screwing the hand-wheel down it presses against the valve-stem F and forces the valve E on its seats; but when the hand-wheel is unscrewed the stem is relieved of pressure and the valve E is permitted to move up and down without restraint from the hand-wheel.

The operation of the valve is as follows: The steam from the boiler is permitted to enter the neck B either from the steam-pipe directly or from the steam-jacket of the cylinder. On unscrewing the hand-wheel L the valve is permitted to rise from its seats, and the pressure of the steam in neck B, exerted through the opening or space *e* on that part of the valve between the seats *a b*, forces the valve up from its seats, and thereby the steam is allowed to pass down under the valve into chamber *k* and neck C, but not above the valve from neck B. From chamber *k* and neck C the steam passes down into the steam-chest, and also, when the engine is running, up through passage *l* into space *o*, thence, through holes *p* and the perforations in valve I, into space *o′*, and from thence, through passage *m*, into chamber D, where it presses on the upper side of said valve. When the pressure of the steam in chamber D on the top of valve F, added to the force exerted by the spring *k′* and the weight of the valve, exceeds the pressure against the under side of the valve, the valve falls on its seats and cuts off the steam from the boiler. As soon as the valve E closes, the steam that has passed into the cylinder expands, and the steam in chamber D, above the valve, also expands. When the engine is first started, the governor being down, the valve I is held so as to allow the steam to pass freely through passages *l m* and the holes *p* in the sleeve to the upper side of the valve E, and when the valve is forced down by the pressure on its upper side the steam, expanding, passes back through passages *m l*, &c., into the neck C, and thus relieves the pressure on the upper side of the valve; and when this pressure is less than the pressure of the steam in the neck B the valve rises again and allows more steam to pass through to neck C and through the passages to the upper side of the valve. Thus, by the pressure below, the valve E is opened, and by the pressure above it is closed, so as to cut off the steam and allow it to act expansively in the cylinder. Owing, however, to the passages *l m*, &c., being quite narrow, the passage of the steam to the upper side of the valve is comparatively gradual, so that ample time is allowed for filling the steam-chest before the valve shuts down. This is the action of the valve E when the engine is working slowly. As the speed increases, the governor, acting through lever J, turns the valve I so as to partially close the holes *p* in the sleeve H, whereby less steam is allowed to pass from chamber D back through passages *m l*, &c., to the neck C below the valve; consequently the pressure on the upper side of valve E is not so quickly relieved, and it remains on its seats longer; but when the pressure above is relieved and the valve rises, the valve is so nearly balanced that it takes but a small quantity of steam to throw it down on its seat again, and thereby cut off the steam.

From the above it will be readily seen that when the steam enters the space below the valve it immediately passes through the passages *l m*, &c., to the upper side of the valve, and by its pressure, added to the weight of the valve and the force of the spring *k′*, the valve is closed and the steam cut off, so that the steam in the cylinder will act expansively. At the same time the steam above the valve, also expanding, passes back through the passages by which it entered, and thereby relieves the valve of pressure, and allows it to rise again and admit more steam to the space and neck below it. This action, when the valve I is fully open, is comparatively gradual; but as the speed increases, the valve I partially closes the openings *p*, and thereby interrupts the passage of steam back and forth through the passages *l m*, and the valve is thereby held so nearly in equilibrium that it is sensitive to the slightest increase or decrease of pressure.

To stop the engine, the hand-wheel is screwed down on the stem F, so as to force the valve on its seats, and thereby prevent it from rising by the pressure of the steam.

When the engine is running too rapidly the governor acts to close the valve I, and thereby prevent the escape of steam from chamber D, so that the pressure of steam in said cham-

ber holds the valve down. As the speed decreases, the valve I opens and the valve E is allowed to operate again.

In the valve E are perforations q', for steam to pass through from the under side to the upper side. These perforations are additional to the passages l m, &c. When the valve is down on its seats, the perforations q' are closed by the seat b, as shown in Fig. 1, so that while they facilitate the passage of steam above the valve they do not allow any steam to escape or pass below the valve. This arrangement is useful, as it is desirable that the pressure above the valve should be regulated by the steam passing out from chamber D through the perforated valve I, since the position of this valve, as regulated by the governor, governs the escape of steam from the chamber D above the valve.

It must be observed that the size and number of the perforations q', as well as the capacity of the passages l m, should be so regulated that the excess of pressure of steam above the valve E shall take place exactly at the moment when the period of admission of steam to the cylinder, corresponding to the power to be developed by the engine, should cease.

It will be evident that this improved valve may be applied, with suitable modifications, to all kinds of steam-engines, as well as to hydraulic motors, and also to the distribution of fluids generally.

In locomotive, marine, mining, and other engines provided with reversing-gear, the valve I will be rotated by a hand-lever, thus affording a ready means of regulating the degree of expansion so as to insure the proper working of the engine.

The sleeve H, by means of the set-screw s, can be set at such an angle that the holes p will be placed in a relation to the valve I which will prevent the said holes p from ever being entirely opened by the valve I. It follows from this that, with a certain pressure in the boiler, the passages connecting the chambers above and below the valve can be adjusted to allow such a passage of steam back and forth as to hold the valve so nearly in equilibrium that the action will be so delicate in opening and closing as to insure a nearly uniform rate of speed.

I claim—

1. The double-seated valve E, in combination with the case A, having necks B and C, seats a and b, passages l m, chamber G′, sleeve H, provided with holes p, and perforated valve I and spring k', constructed and operating in the manner substantially as described.

2. The perforated valve I, in combination with the perforated and adjustable sleeve H, passages l m, and double-seated valve E, for the purpose of regulating the admission of steam to the chamber D, above the valve, and the emission of steam from said chamber, substantially as described.

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Witnesses:

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