2 Sheets--Sheet 1.

J. WOODRUFF.

Draft-Regulator.

No. 160,498. Patented March 2, 1875.

Fig: 1

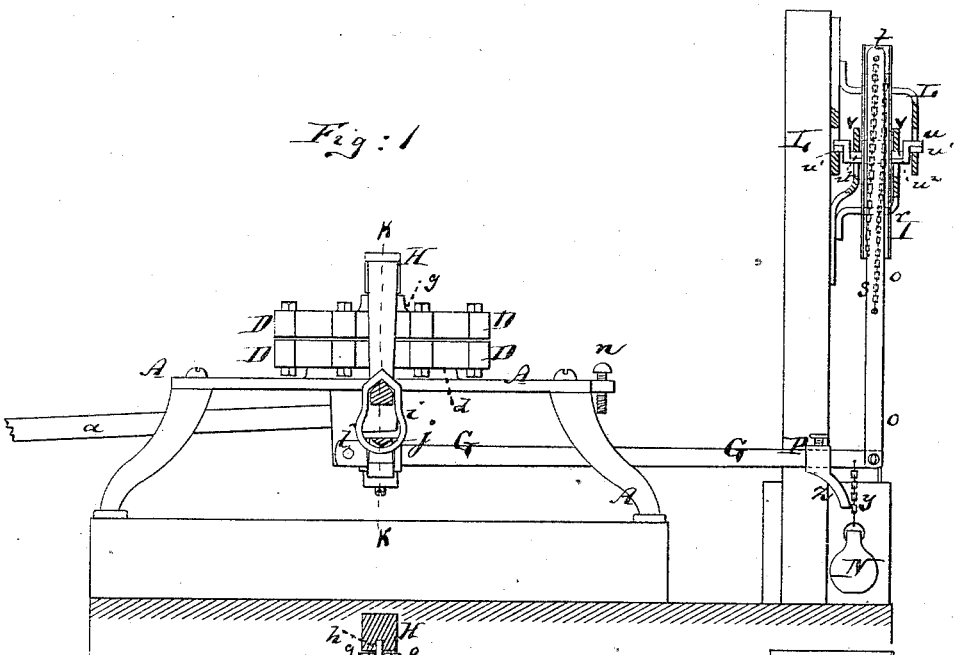


Fig: 3

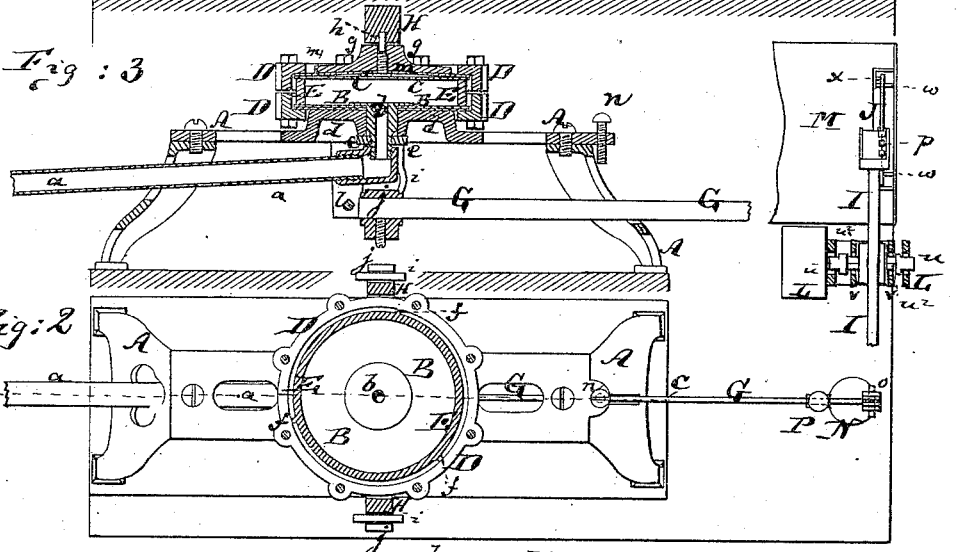


Fig: 2

Fig: 4

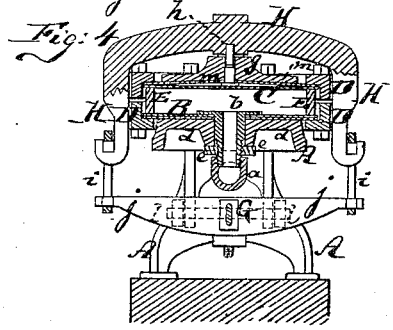
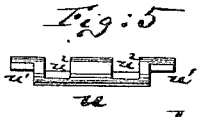


Fig: 5



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A. V. Briesen

2 Sheets--Sheet 2.

J. WOODRUFF

Draft-Regulator.

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Fig: 6

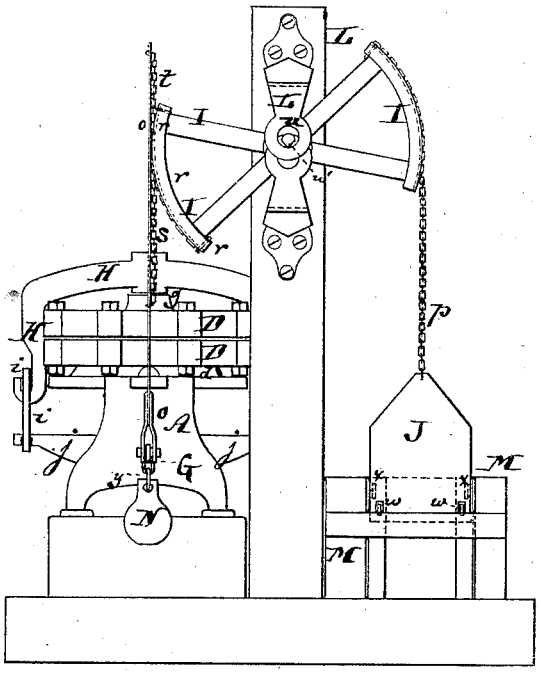
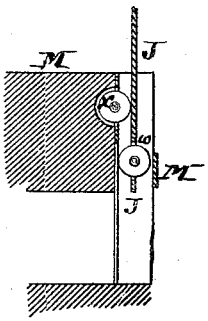


Fig: 7



Witnesses:

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UNITED STATES PATENT OFFICE.

JOSEPH WOODRUFF, OF RAHWAY, NEW JERSEY.

IMPROVEMENT IN DRAFT-REGULATORS.

Specification forming part of Letters Patent No. 160,498, dated March 2, 1875; application filed February 1, 1875.

CASE C.

To all whom it may concern:

Be it known that I, JOSEPH WOODRUFF, of Rahway, in the county of Union and State of New Jersey, have invented a new and Improved Draft-Regulator, of which the following is a specification:

Figure 1 is a side elevation, partly in section, of my improved draft-regulator. Fig. 2 is a plan or top view, partly in section, of the same. Fig. 3 is a vertical longitudinal section thereof on the line C C, Fig. 2. Fig. 4 is a vertical transverse section thereof on the line K K, Fig. 1. Fig. 5 is a detail side view of the rock-shaft supporting the transmitting-lever, hereinafter described. Fig. 6 is a face view of the transmitting-lever and of the mechanism connecting the draft-regulator with the damper, and Fig. 7 is a detail vertical transverse section through the damper.

Similar letters of reference indicate corresponding parts in all the figures.

The object of this invention is, principally, to improve the draft-regulator described in Letters Patent No. 128,836, granted to me on the 9th day of July, 1872; and, further, to provide improved mechanism for transmitting the motion from the regulator to the damper, and an improved means of operating such damper.

The invention consists, in the first place, in connecting the lever of the regulator with a yoke in such a manner that the lever will be beneath the regulator, whereas heretofore it was invariably above the same.

By this arrangement I enjoy several advantages, particularly those of simpler construction and more definite operation over the devices heretofore used.

The invention also consists in various improvements in the mechanism used between the regulator and the damper, for reducing friction, increasing the speed of transmission, and imparting generally such exactness to the movement of all the parts that the damper will be more sensitive to the variation of steam-pressure than in any other apparatus heretofore proposed.

A in the drawing represents the frame of the regulator proper, which frame serves to support the rabbeted rings D D, between which two flexible diaphragms, B and C, are secured, said diaphragms being held apart by means of a ring, E, interposed between them, all of which parts, in their general outline, are substantially like those described in the aforementioned Letters Patent; but in their specific arrangement those parts vary to an important extent from those mentioned in said patent. Thus, the steam-supply pipe *a*, instead of entering a cylindrical chamber, as described in said patent, enters and joins merely a short tube, *b*, which passes through a rigid stationary bottom plate, *d*, that serves directly to support the lower diaphragm B, and which tube *b* has a flange resting on said diaphragm B, all as indicated in Figs. 3 and 4. A screw-thread is cut around the lower part of the tube *b*, to receive a nut, *e*, by means of which the flange at the upper end of said tube can be drawn tight against the lower diaphragm, thus locking the latter firmly in the center to the supporting-plate *d*. The next difference is that the ring E, instead of fitting with its outer edge close to the inner peripheries of the rabbeted rings D D, is made of a smaller diameter than necessary to fit such rings, but has three or more projecting lugs, *f*, which are clearly shown in Fig. 2, which lugs reach to the inner peripheries of the rings D D, and serve thus to hold the ring E central. The advantage of this arrangement of lugs on the ring E is that it is easier to place said ring in position, easier to remove it for the repair of the diaphragms, &c., and also to center it in the proper manner, allowing, also, the edges of the diaphragm to curl up and pack better. The third material difference between the present invention and the former patent as to the parts named has reference to the connection of the upper diaphragm C with the lever G, that transmits the motion of said upper diaphragm to the damper, for it will be observed that in my former patent the lever G was pivoted in the frame A above the diaphragm C, and suspended by links from the upper part of the eye, into which a stem projecting from the upper diaphragm terminated. In this way it was necessary to actually perforate both diaphragms—the lower for connection with the steam-pipe, and the upper for connection with the lever

G—and to enlarge the supporting-frame A to a material extent; but in the present case I am enabled to dispense with the perforation of the upper diaphragm, and at the same time to obtain a more direct and satisfactory effect on the lever G than could be done by the former arrangement of parts. I place now upon a secondary diaphragm, *m*, which is above the main upper diaphragm C, a metallic plate, *g*. (Clearly shown in Figs. 3 and 4.) The upper or false diaphragm *m* is, as clearly shown in Figs. 3 and 4, as large in diameter as the main upper diaphragm C, and is clamped between the upper ring D and the ring E, together with the diaphragm C, so that the upper diaphragm is really a double diaphragm, of which the lower portion is entirely solid, *i. e.*, unperforated, whereas the upper portion is properly connected with the plate *g* by suitable means. I connect to the center of that plate *g* an upwardly-projecting vertical pin, *h*, whose upper end enters a socket in the middle of a yoke, H, serving as a pivot for said yoke. With its downwardly-projecting arms the yoke H straddles the cylindrical chamber formed and inclosed by the rings D D, in the manner clearly shown in Fig. 4. The ends of the arms of the yoke serve to support on knife-edges links *i i*, which, in their turn, serve to support the ends of a cross-bar, *j*, that is rigidly connected with the lever G, said lever being, at *l*, pivoted in the frame A beneath the cylinder B D C.

In operation, the steam-chamber formed within the ring E and diaphragms B C will tend to lift the diaphragm C, and thereby to raise the yoke, and raise also the free end of the lever G, to affect, by such motion of the lever G, the position of the damper in the requisite manner. The pivot *l*, and also the parts of the yoke H and of the cross-bar *j* that enter the links *i*, are preferably made with knife-edges, to avoid unnecessary friction during the motion of the parts.

It will be observed that the greater the steam-pressure between the diaphragms B C, the more will the yoke be elevated, and the more also will the free end of the lever G be raised. Now, of course, the effect of such motion is to be that the elevation of the lever G will produce a proportionate closing of the damper, reduction of draft of fire, and consequent reduction of steam-pressure between the diaphragms; whereas, if the steam-pressure between the diaphragms is below a certain desired degree, the dropping of the lever G, consequent upon such low pressure, and under the influence of a weight, N, will cause the elevation or opening of the damper, and consequently an increase of draft and of steam-pressure; but, of course, if the steam-pressure is altogether too great, it might, without proper remedy, raise the lever G so far as to close the damper entirely, and extinguish the fire, which is not desirable. To prevent such extinction, and retain, even under the greatest steam-pressure, a desired minimum opening of the damper, I have applied a set-screw, *n*, to the frame A above the lever G. This set-screw can be screwed down more or less. The more it is screwed down the more will it limit the upward motion of the lever G and the closing of the damper, and so this screw *n* may be used to allow the damper to remain open at least far enough, under great steam-pressure, to prevent total extinction of the fire.

As to the connection of the lever G with the damper of the furnace, I have illustrated one mode which appears to me of great advantage. This consists in connecting the free end of the lever G, by an upwardly-projecting rod, *o*, with one segmental end of a rocking lever, I, which I call the transmitting-lever. The other end of said lever, which is also preferably segmental, as in Fig. 6, is connected by means of a chain or cord, *p*, with the damper J, which is shown to be vertically movable, but may be of other kind. The rod *o* connects by two chains, *s* and *t*, with opposite ends of the segment *r*, formed on one end of the lever I, one chain, *s*, connecting the middle or lower part of the rod *o* with the upper end of said segment, while the other chain, *t*, connects the upper part of the rod *o* with the lower end of such segment, as clearly indicated in Fig. 6. By this double-chain connection *s t* I am enabled to vibrate the lever I both by the upward and downward movement of the lever G, and to vibrate also, if need be, the lever G by the motion of the lever I, and thus to close and open the damper J in the desired manner.

The pivot or arbor *u* of the transmitting-lever I, and which is more clearly illustrated in Fig. 5, has lower knife-edges u^1 formed at its ends where it rests in the fixed frame L, and has central upper knife-edges u^2 formed on it where it bears from below against ears *v*, that are attached to the same frame. The knife-edges u^2 and u^1 are in line, as indicated in Fig. 5, to properly center the shaft, and allow the lever I to vibrate either under a downward pressure or under an upward pressure without any noticeable friction. To avoid friction, also, the damper J is, or may be, provided with friction-rollers *w*, as indicated in Fig. 7; or similar friction-rollers *x* may be applied to the furnace M, in contact with the damper J.

Now, it is evident that in order to make this mechanism herein described operative, the lever G must be weighted, or at least the damper, so that the weight will tend to overbalance an insufficient degree of steam-pressure. Such weight I have shown to be applied, at N, to the lever G, near its free end, the said weight N being suspended by means of a chain, *y*, from the lever; and in order to regulate the effect of such weight without shifting it or requiring it to be handled, I have applied to said lever a slide, P, which terminates in a curved toe, Z. This slide can be moved toward the weight N, or rather chain *y*, so that the toe Z will bear against such chain, and finally bend such chain, thereby raising the weight

and crowding it farther away from the pivot *l* of the lever G. The farther, therefore, the slide is moved outward, the farther will the toe Z crowd the weight N away from the pivot *l*, and consequently the greater will be the effect of the weight on the lever, all of which is produced without actually handling the weight.

A special advantage of the projecting toe Z is, that by its means the weight N can be practically thrown beyond the end of the lever.

A suitable set-screw is applied to the slide P, or other means to fasten the same in any suitable position on the lever G.

I claim as my invention—

1. The lever G of a draft-regulator, arranged beneath the diaphragm C, with which it is combined, for transmitting the effect of steam-pressure on said diaphragm to a damper, and to dispense with a superstructure of the supporting-frame, substantially as described.

2. In a draft-regulator, the combination of the lever G and cross-bar *j* with the links *i i*, yoke H, and upper flexible diaphragm C, the yoke straddling said diaphragm, substantially as described.

3. The lower diaphragm B, combined with the flanged tube *b*, nut *e*, supporting-plate *d*, and steam-supply pipe *a*, substantially as described.

4. The combination of the inner ring E, having the projecting lugs *f f*, with the outer rings D D, and with the diaphragms B C, substantially as and for the purpose described.

5. The upper diaphragm C, arranged beneath and combined with a secondary or false diaphragm, *m*, which connects directly with the lifting-plate *g* and yoke-pivot *h*, substantially as described.

6. The combination of the lever G of a draft-regulator with the rod *o*, chains *s t*, and segmental transmitting-lever I, substantially as and for the purpose specified.

7. The damper J, combined with the segmental lever I and chain *p*, and with the chains *s t* and rod *o*, substantially as set forth.

8. The combination of the slide P, which carries the projecting toe Z, with the lever G, for affecting the suspended weight N, substantially in the manner herein shown and described.

JOSEPH WOODRUFF.

Witnesses:

E. C. WEBB,

F. V. BRIESEN.