C. H. WHITE.

Furnace-Regulator.

No. 221,487. Patented Nov. 11, 1879.

Fig. 2.

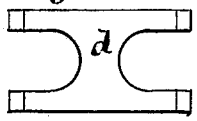


Fig. 3.

Fig. 4.

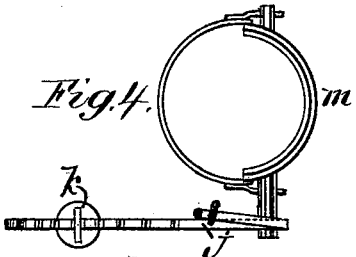
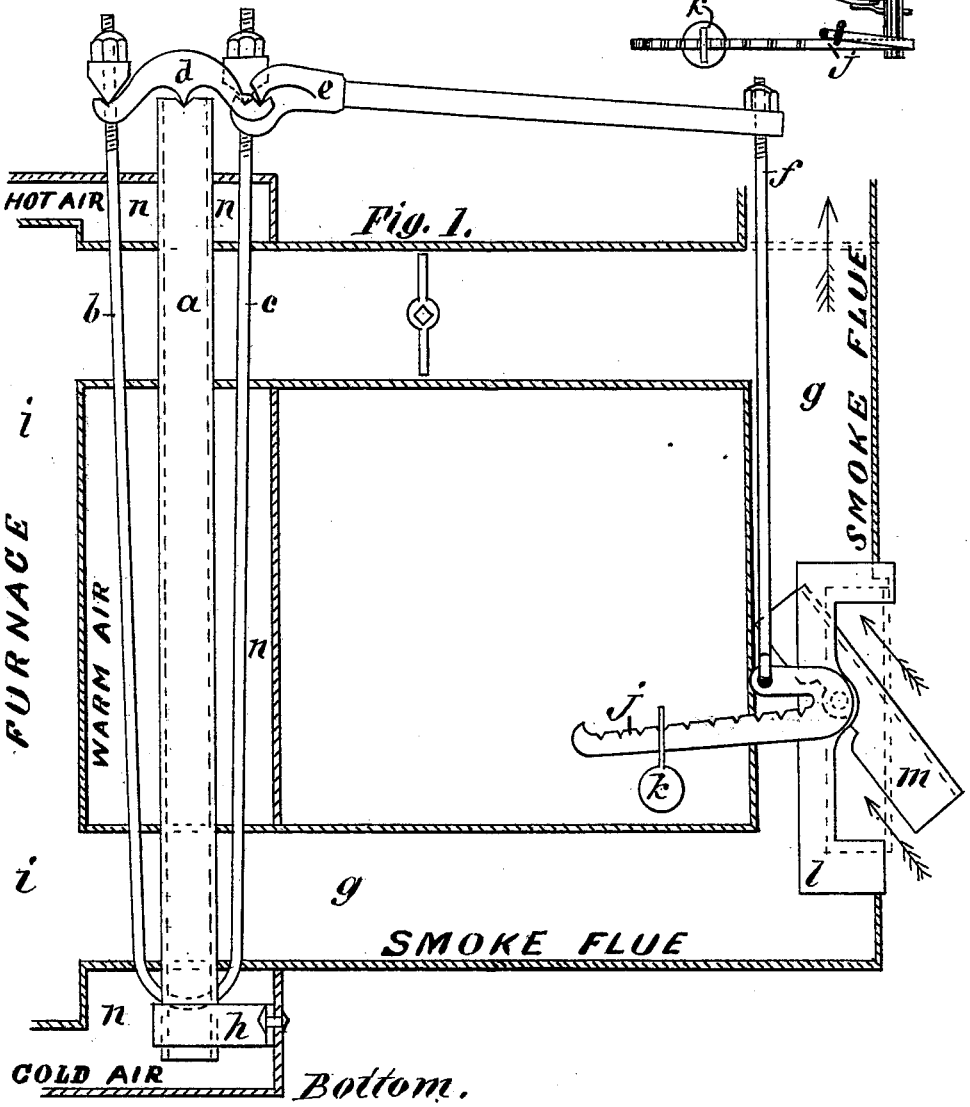


Fig. 1.



Bottom.

Witnesses.

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CHARLES H. WHITE, OF MALDEN, MASSACHUSETTS.

IMPROVEMENT IN FURNACE-REGULATORS.

Specification forming part of Letters Patent No. **221,487**, dated November 11, 1879; application filed March 14, 1879.

To all whom it may concern:

Be it known that I, CHARLES H. WHITE, of Malden, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Furnace-Regulators; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, which form a part of this specification, and to the letters of reference marked thereon.

With reference to the drawings, Figure 1 is a vertical sectional view of a furnace with which is combined an elevation of the regulator mechanism. Fig. 2 is a plan of lever *d*. Fig. 3 is a plan of lever *e*. Fig. 4 is a plan of the partly-cylindrical balance-regulating valve.

Like letters refer to the same or corresponding parts in all the figures.

The nature of my invention relates to the construction of the double expansion-rod *b c;* to the cold-air contracting flue or chimney *a;* to the partly-cylindrical balance-regulating valve for the admission of air into the smoke-flue; to the direct connection of the graduated and weighted arm *j;* to the regulating-valve *m;* to the approximately central pivoting or journaling of the regulating-valve both in relation to its length and in respect to the diameter or thickness of the smoke-flue *g*, and the arrangement of the valve-journals entirely outside of the smoke-flue; and to the arrangement and combination of parts, substantially as hereinafter more fully set forth.

The combustion-chamber of the furnace is represented by the space marked *i*. The smoke-flue is marked *g*. The air-heating chamber with cold air admitted at the base is marked *n n n n*. In this air-heating space is located a vertical flue or chimney, *a*, made of iron or other metal, which expands less than brass by the action of heat. This hollow chimney or flue has its lower part in the base of the air-space *n*, where it comes in contact with and is surrounded by the cold air, near its entrance into the furnace. The upper end is at the top of the furnace extending entirely up through the column of air, leaving or having its upper portion in the hot air at the top. On the top of this chimney *a*, or an annular cap resting on its top, is formed a seat for the fulcrum or knife-edge of the lever *d*. This lever *d* has a seat on each end, one for the fulcrum of lever *e*, the other for the fulcrum attached to part *b* of rod or rods *b c*. The lever *e* has another seat bearing the fulcrum or knife-edge attached to part *c* of rod or rods *b c*.

It is obvious that these fulcrums or knife-edges and their seats or bearings may be inverted or transposed without materially changing their functions.

The rods *b c* may better be formed or constructed in one piece, as shown, forming a loop at the lower end. They take hold of the chimney or cold-air flue *a* near the bottom in the cold-air space, and both may be supported in any convenient way, as by stand *h* or a pin or shoulder on the top of the furnace.

A rod, *f*, takes hold of the long arm of lever *e*, and is connected to the short arm of the graduated lever *j*, both arms of which extend from the journal or pivot of the regulating-valve *m* in a similar direction, so that their weight, as well as the graduating-weight *k*, shall both act directly to turn the valve *m* when permitted by the expansion of the rods *b c*, allowing lever *e* to droop.

Suitable adjustment of the parts is easily made by means of screw-nuts, as indicated.

Great advantage is gained by attaching arm *j* directly to the valve, so that its action is immediate and not through other connections, as has heretofore been done in connection with other kinds of valves and apparatus.

The valve *m* is partly cylindrical, as illustrated, by which means its pivots or journals are brought toward the middle of the smoke-flue, and its upper portion made to fall nearly across and nearly close the passage in the smoke-flue with a small movement of the valve, the curved form always insuring the proper opening or passage-way to carry off the gas. The lower end at the same time gives advantageous form to the lower inlet of air. The lever *j* is graduated and carries an adjustable weight, *k*.

The valve *m* has a peculiar action in admitting air to the smoke-flue to check the draft, so checking the combustion and reducing the heat. It not only admits by its upper end a flow of air to supply the draft in the usual way, but also furnishes by the action of its

lower end a supply of air back of the check or throttling part of the valve, so as to counteract a certain tendency which even the inflowing air has to draw other air and products of combustion through the partly-closed opening or passage in the smoke-pipe, whereby a most perfect action is secured.

Another peculiarity is that the bearings which support the journal or pivots of the valve *m* are attached outside of the smoke-flue or placed entirely outside out of the way of the corroding action of the acids and other products of combustion.

The operation is somewhat as follows, so far as performance is at present reduced to theory, viz: The chimney or flue *a* stands in the air-space, and must, of course, become more or less warm, sufficiently so to produce an upward current of air within it, while at the same time it is prevented from becoming much heated by the cool current within, taken directly from the cold air at the bottom. Its lower end also is constantly surrounded with cold air. For these reasons it becomes an excellent differential expansion member to combine with brass rods or other more expansible members under the action of heat. The rods *b c* are of the latter class, and extend with *a* through the entire column of air, the cold at bottom, the intermediate, and the hot air at the top.

It is obvious that as the air in chamber *n* gets heated the excess of expansion in the double rod *b c* over that of the chimney *a* will permit the long arm of lever *e* to droop, and allow weight *k* and arm *j* to fall and open valve *m* in a degree proportionate, first, to the temperature of the hot air, and, secondly, modified proportionately to the intensity of the cold in the cold air acting on the lower parts of the differential expansion agents or members *b c* and *a*. The double current is therefore admitted by the valve *m*, as indicated and explained, proportionately checking the draft, and consequently the combustion, and modifying the heat.

As the heat is lessened below the degree required, and for the maintenance of which the weight *k* has been adjusted upon the graduations of lever or arm *j*, the rods *b c* contract faster than *a*, and close, or partially close, valve *m* always in the complex proportion relative to the intensity of the cold in the cold air, as well as the degree of heat in the hot air.

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

1. The vertical air-flue or chimney, in combination with the more expansible rod or rods *b c*, substantially as and for the purpose set forth.

2. The combination of the differential expansion members, arranged vertically in the air-heating space, with their lower ends in the cold air or base of the column and extending upward through the heated air, substantially as described, for the purpose set forth.

3. In a differential metallic expansion furnace-regulating device, the partly-cylindrical construction of the regulating-valve pivoted at or near the semi-circumference of the smoke-pipe, substantially as shown, and for the purpose set forth.

4. The graduated arm *j* in immediate connection with the regulating air-valve of a furnace-regulator, substantially as described.

5. The regulating air-valve of a furnace-regulator, having its pivots or journals outside of the smoke-flue, substantially as described.

6. The looped rod *b c*, in combination with the less expansible differential member and compound levers of a furnace-regulator, substantially as described.

7. The combination of the chimney *a*, rod or rods *b c*, lever *d*, lever *e*, rod *f*, or equivalent, lever or arm *j*, and valve *m*, substantially as described.

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Witnesses:
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