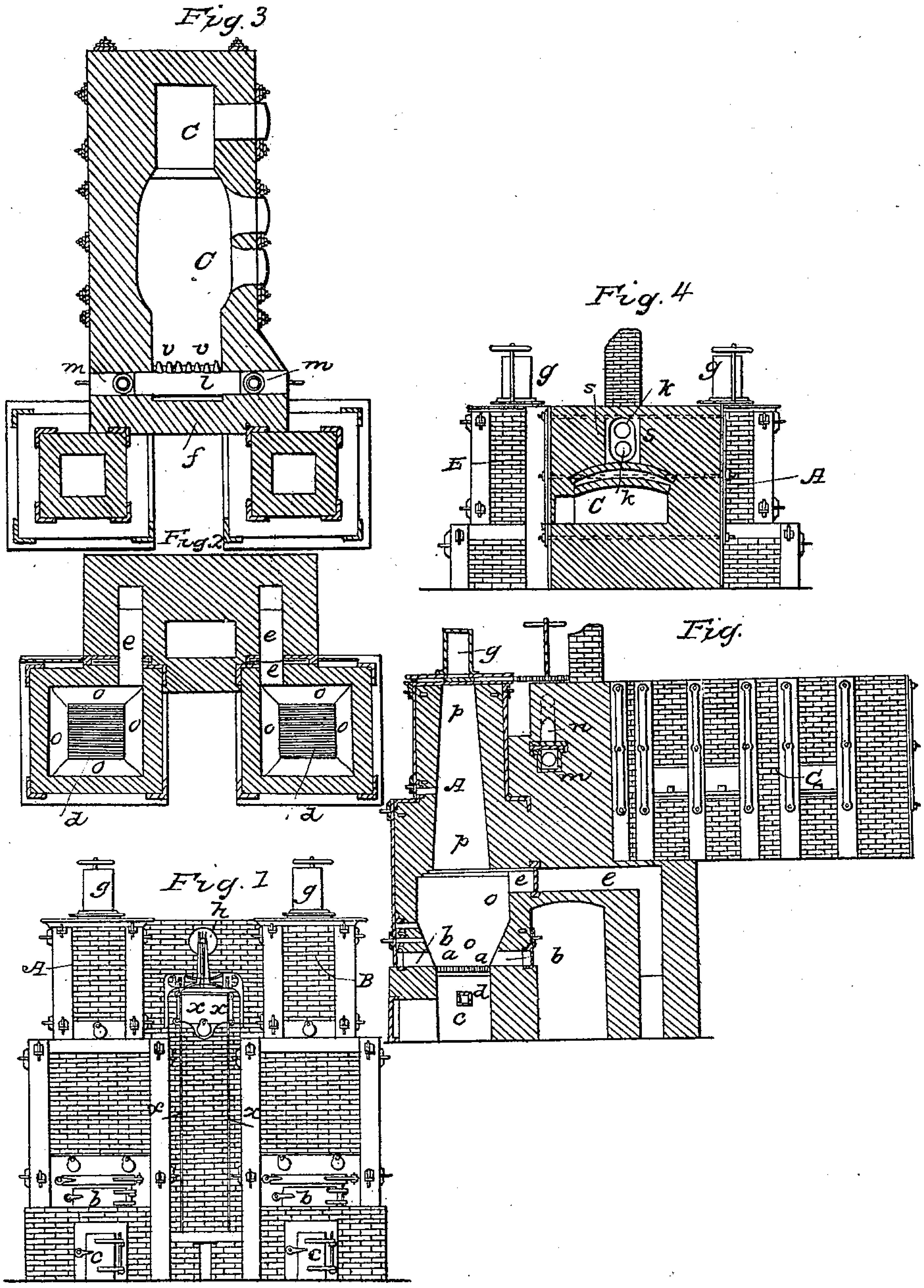
2 Sheets—Sheet 1.

C. SCHINZ.

Hot Blast Oven.

No. 13,887.

Patented Dec. 4, 1855.



WITNESSES

INVENTOR

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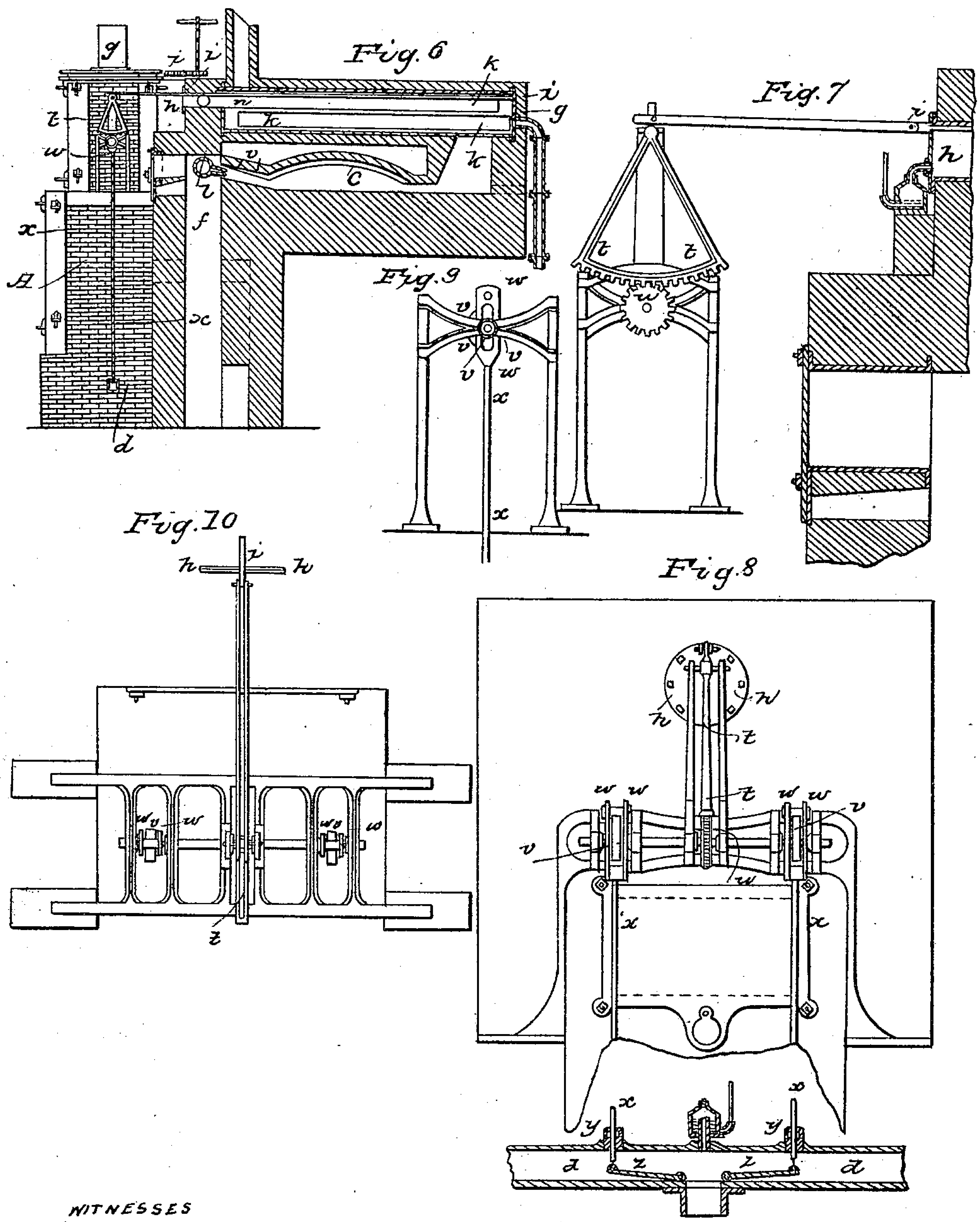

WITNESSES

Joseph Reakirt Jr.

John Reakirt

INVENTOR

C. Schinz

UNITED STATES PATENT OFFICE.

CHAS. SCHINZ, OF CAMDEN, NEW JERSEY.

SELF-REGULATING HOT-BLAST FOR FURNACES.

Specification forming part of Letters Patent No. 13,887, dated December 4, 1855.

To all whom it may concern:

Be it known that I, CHARLES SCHINZ, of Camden, in the county of Camden and State of New Jersey, have invented a new Self-Regulating Hot-Blast for Furnaces; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The nature of my invention consists in a self-acting regulator for the admission of air to gas-furnaces. There is no doubt that the conversion of the fuel into gases, which, on being brought into contact with a new portion of air, produce the most intense heat ever attained, is a most important modern improvement; yet there is one difficulty which has not been overcome up to this day—namely, to divide the quantities of air required to produce the gas and to burn it with any degree of accuracy; and, however, the economy of a gas-furnace rests entirely upon this condition, inasmuch as each pound of carbon which escapes in the form of oxide of carbon unburned is equivalent to a loss of fourth-fifths of the heat it might produce, and if an excess of air is used the loss in intensity of the fire produces a still more disastrous result. The difficulty lies chiefly in the circumstance that that portion of air which serves the combustion of the gases has to be previously heated to a very high degree of temperature; hence its expansion varies between two and four times its original volume, and the pressure in the flues conducting that air and the quantities issuing from the tuyeres vary accordingly.

The object of my invention is to regulate the admission of air by laying a bar of metal in the pipe conducting the hot-air, so that this bar is itself expanded, and by working on a lever produces the motion of valves which regulate the issue of the air.

To enable others skilled in the art to make use of my invention, I will proceed to describe its construction and operation.

In the accompanying drawings, two gas-furnaces, A and B, and a fagoted iron furnace, C, are represented to illustrate the adaptation and operation of the regulator.

Figure 1 represents the front of two gas-furnaces, A and B. Fig. 2 is a horizontal section of the gas-furnaces with the flues conducting the gas. Fig. 3 is a horizontal section of the gas-furnaces and the fagoted furnace at the height of the tuyeres *l*. Fig. 4 is a perpendicular section of the fagoted furnace and air heater through its breadth. Fig. 5 is a perpendicular section through the gas-furnace A and a front view of the fagoted furnace. Fig. 6 is a perpendicular section of the fagoted furnace, the air-heater, and a side view of the gas-furnace A; Fig. 7, a perpendicular section of the mechanism producing the motion of the valves; Fig. 8, a perpendicular section of the same through its broad side; Fig. 9, a perpendicular section of the same through one of the eccentrics or curved plates *v v;* Fig. 10, a view of the same from above.

The same letters in the different figures represent the same things.

a a represent the grate, and *o o* the place in which lies the fuel. This is introduced by the feeders *g g*, which are provided with sliding valves and moved by a rack and cog-wheel, and passes through the flues *p p*.

b b are two doors, serving to clean the grate *a a*.

c c is the ash-pit, into which the cold-air pipe *d d* introduces the air.

e e represent the flues that lead the gas from the furnace to the gas-flue *f f*, from which it goes around the hot-air tuyeres *l l* into the flue *r r*, where the combustion takes place. The flame issuing from the fagoted furnace C goes into the flue *s s* above C, in which lies an oval cast-iron pipe, *g g*. In this are placed two other pipes, *h h* and *k k*. *k k* brings the cold air to one end of *g g*, and *h h* takes the heated air from the hottest end and conducts it to the boxes *m m*, connected with the hot tuyeres *l l*. It is in the hot-air pipe *h h* that the metallic bar *i i* is suspended. Outside of the pipe *h h* the bar *i i* is connected with the short lever &, standing out from the quadrant *t t*. This quadrant is provided with cogs which move the cog-wheel *u u*.

On the same axle that is moved by the cog-wheel *u u* are fastened two curved plates or eccentrics, *v v*. Round these plates are two shoulders, *w w*, which are lifted and sunk according to the motion of the curved plates *v v*, and from below these shoulders *w w* issue the bars *x x*, which, going through the stuffing-boxes *y y*, produce the motion of the regulating-valves *z z* in the cold-air pipe *d d*.

The following is the way of calculating the dimensions of the different parts of the regulator: The expansion of the metallic bar, supposed to be copper, amounts to 0.0126 inch for 110° Fahrenheit for each foot, and at the temperature, between 32° and 142° Fahrenheit; 0.0130 inch for 110° Fahrenheit for each foot, and at the temperatures between 142° and 252° Fahrenheit; 0.0136 inch for 110° Fahrenheit for each foot, and at the temperatures between 252° and 362° Fahrenheit; 0.0140 inch for 110° Fahrenheit for each foot, and at the temperatures between 362° and 472° Fahrenheit; 0.0145 inch for 110° Fahrenheit for each foot, and at the temperatures between 472° and 582° Fahrenheit; 0.0150 inch for 110° Fahrenheit for each foot, and at the temperature between 582° and 692° Fahrenheit. We design these coefficients of expansion with y, y', y'', y''', y^{iv}, and y^{v}, and the length of the bar of copper with B. Then y^{w} B equals the length in inches the bar expands at the respective temperatures. The short lever &, which is affected by the motion of the bar i i, must take different positions and describe an arc according to the amount of expansion. This amount of expansion is equal to the sine of the angles belonging to these arcs. The quadrant t t of course follows the same motion, and describes the same arcs; but the cog-wheel u u being made of such dimensions as to perform one revolution for the motion impressed to the lever & between the temperatures of 32° and 692° Fahrenheit, this describes larger arcs for each interval of temperature than the lever &, in such proportion that the sum of the arcs described by & becomes equal to a whole circle of 360° Thus the sine of the largest angle formed by x (B supposed to be ten feet) is equal B $(y+y'+y''+y'''+y^{iv}+y^{v})=0.827$ inch, and the arc belonging to this sine equals 56° 50′, and the arc described by the cog-wheel u u is equal to a whole circle of 360°. Hence the sine B $y=0.126$, corresponding with 7° 15′. The arc described by the cog-wheel u u in that instance must be equal to 56° 50′: 360°=7° 15′: x=45° 52′, and so on. The curved plates v v, making the same revolutions as the cog-wheels u u, may therefore be constructed by dividing a circle in six arcs, each of so many degrees as correspond to the motions produced at each temperature by radii, and marking on these radii the height to which the valves z z have to be lifted at these temperatures. These marks give, then, the form of the curve. Supposing the hot-air tuyeres l l to present to the air a total surface of fourteen square inches, this figure has to be reduced by multiplying it with the coefficient of contraction belonging to short conical tubes or tuyeres—viz., 0.94=13.16 square inches or 0.0914 square feet, which number we designate by s. Now, if, for instance, the pressure of the heated air is equal six inches on the water-indicator equal h, the velocity of the air equal v is: $v^2=2gh=64.3\times\frac{0.5}{0.0013}=3846$, and $\sqrt{3846}=62$ feet$=v$, and the quantity blown out is equal $v\ s=62\times0.0914=5.6668$ cubic feet. Now, the quantity of cold air equivalent to these 5.6668 cubic feet of hot air supposed at 600° Fahrenheit is $\frac{5.6668}{1+0.002036\times600}=2.55$ cubic feet. Admitting this to be the quantity of cold air to be introduced into the gas-furnaces, and there being the same pressure of air behind the valves z z as behind the tuyeres l l, we have to calculate the section s' of the pipe d d, diminished by the valves z z, by dividing the velocity v into the number of cubic feet to be blown out—viz., $\frac{2.55}{.62}=0.041$ square feet$=0.041\times144=5.904$ square inches, and as there are two branches conducting the air to the two gas-furnaces the section of each, by lifting the valves z z, is to be made $\frac{5.904}{2}=2.952$ square inches. In this way the sections for all temperatures between 32° and 692° Fahrenheit may be calculated, and the curved plates v v constructed accordingly.

What I claim as my invention, and desire to secure by Letters Patent, is—

The use of the pipe h h and the bar i i when arranged as set forth, and operating conjointly, by means of suitable gearing upon the eccentrics v v for opening and closing the valves z z, substantially as described, so as to divide a given volume of air of varying temperature and pressure into proportionate parts, and for the purpose set forth.

CHS. SCHINZ.

Witnesses:
JOSEPH REAKIRT, Jr.,
JOHN REAKIRT.