(No Model.)

3 Sheets—Sheet 1.

G. J. CAPEWELL.

HOT AIR FURNACE.

No. 557,551. Patented Apr. 7, 1896.

Fig. 1.

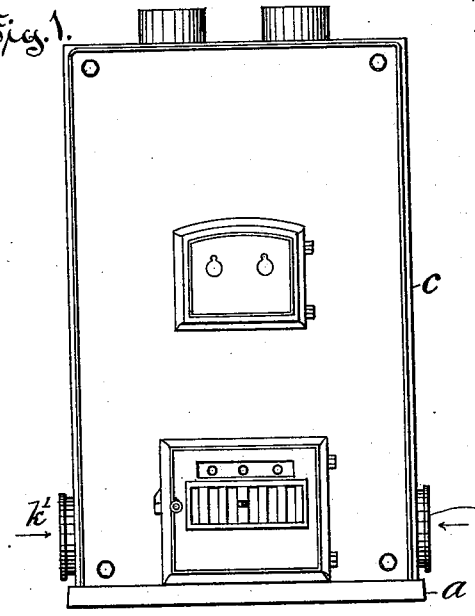


Fig. 2.

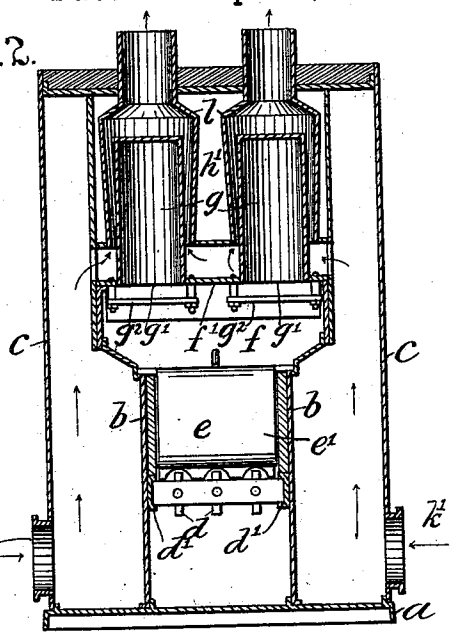
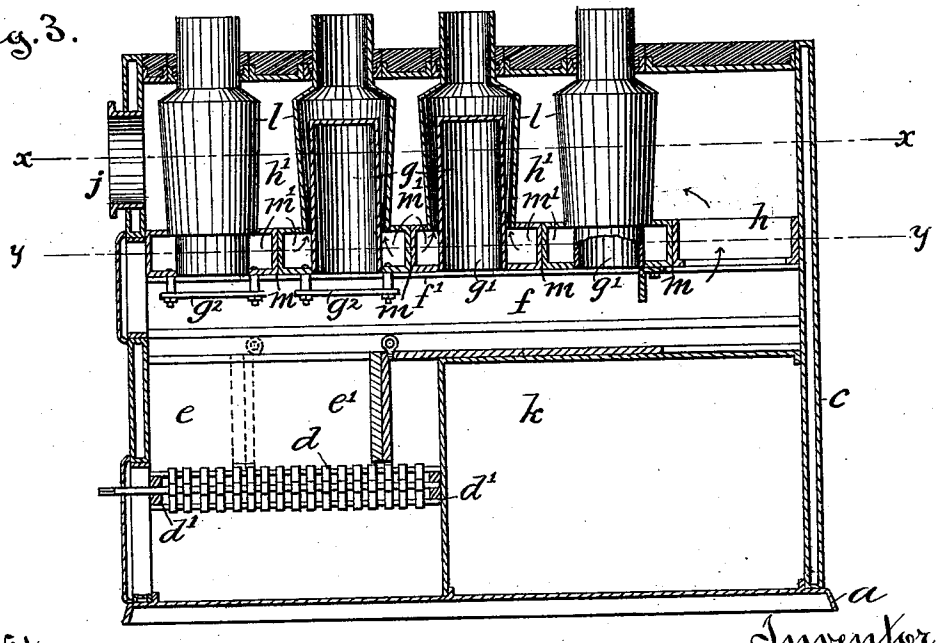


Fig. 3.



Witnesses:
Joseph Arthur Cantin.
Arthur B. Jenkins.

Inventor:
George J. Capewell
by Chas. L. Burdett
Attorney.

(No Model.) 3 Sheets—Sheet 2.

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Fig. 4.

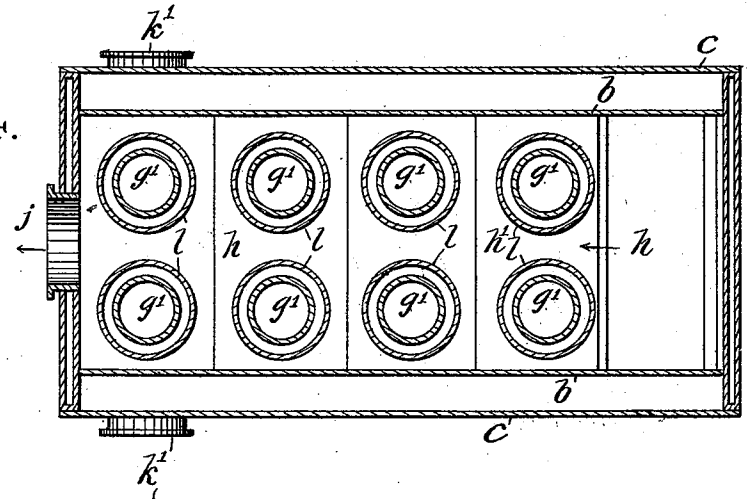
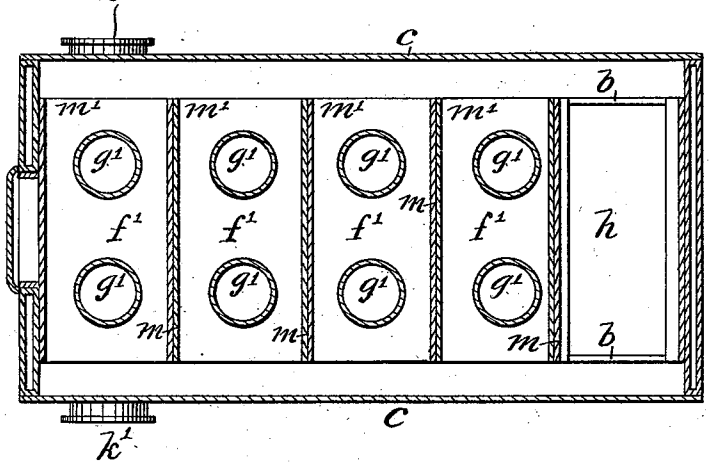


Fig. 5.



Witnesses:
Joseph Arthur Cantin.
Arthur B. Jenkins.

Inventor:
George J. Capewell.
by Chas. L. Burdett
Attorney.

(No Model.) 3 Sheets—Sheet 3.

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Fig. 6.

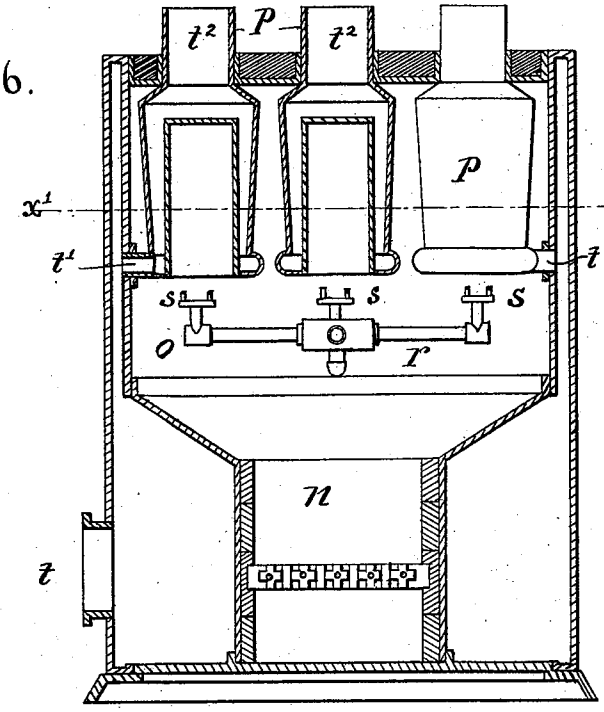


Fig. 8.

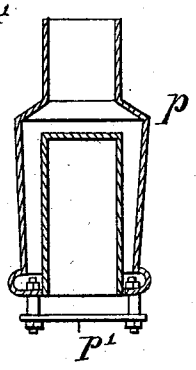
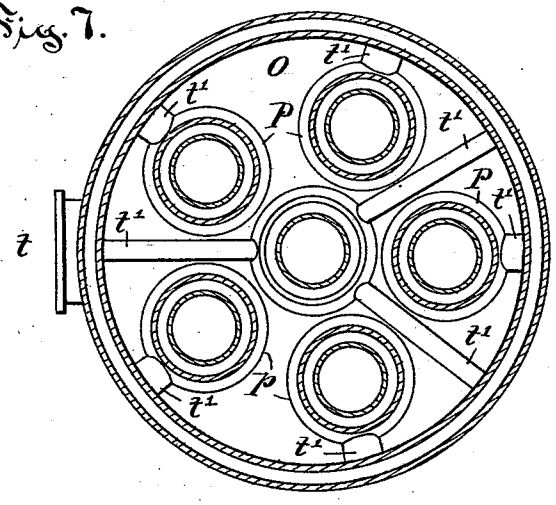


Fig. 7.



Witnesses:
Joseph Arthur Cantin
Arthur B. Jenkins

Inventor:
George J. Capewell.
by Chas. L. Burdett
Attorney.

UNITED STATES PATENT OFFICE.

GEORGE J. CAPEWELL, OF HARTFORD, CONNECTICUT.

HOT-AIR FURNACE.

SPECIFICATION forming part of Letters Patent No. 557,551, dated April 7, 1896.

Application filed January 8, 1894. Serial No. 496,060. (No model.)

To all whom it may concern:

Be it known that I, GEORGE J. CAPEWELL, of Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Hot-Air Furnaces, of which the following is a full, clear, and exact description, whereby any one skilled in the art can make and use the same.

My invention relates to the class of heating-furnaces in which a volume of air is directly heated and circulated throughout a building for the purpose of warming it, although the main circulating features of the apparatus herein described may be used for other purposes, as for drying.

The object of my invention is to provide an apparatus in which air shall be drawn and from which it is forced, owing to the peculiar construction of a part of the device through which the air is caused to flow while being heated; and my invention consists in the details of the several parts making up the heating apparatus and the circulatory apparatus, and in the combination of such parts, as more particularly hereinafter described, and pointed out in the claims.

Referring to the drawings, Figure 1 is a view in front elevation of one form of furnace embodying my invention. Fig. 2 is a detail view, in vertical section, through the front part of the furnace, cutting through the fire-box and two of the circulators. Fig. 3 is a detail view, in lengthwise central section, through the furnace, with parts of the circulators cut away to show construction. Fig. 4 is a view in horizontal section of the furnace on plane denoted by the broken line $x\ x$ in Fig. 3. Fig. 5 is a view in horizontal section through the furnace on a plane denoted by the broken line $y\ y$ in Fig. 3. Fig. 6 is a view in vertical section through a circular furnace, illustrating the embodiment of my invention in that form of furnace. Fig. 7 is a view in horizontal section through the furnace on plane denoted by line $x'\ x'$ of Fig. 6. Fig. 8 is a detail view, in vertical section, of a circulator provided with a deflector-plate.

In the accompanying drawings, the letter a denotes the base of the furnace, b the inner walls, and c the outer wall or jacket, between which and the inner walls an air-space is provided.

The letter d denotes a grate, e the fire-box, and f the combustion-chamber, the latter being separated from the air-flues by a diaphragm f'. Along this diaphragm f' are arranged a series of openings g' leading into the hollow chambers g, which are adapted to receive and retain for a time the heated products of combustion, which rise from the fire-box and flow toward the smoke-outlet.

In the form of apparatus herein described the flame and heated products of combustion pass along toward the rear of the furnace, rise through the flue h and flow to the front through the flues h' toward the uptake j, which communicates with the chimney or other suitable outlet.

The space between the jacket and the side walls of the furnace and that part of the space k which is located directly back of the grate-chamber affords an equalizing-chamber, into which cold air is admitted through any suitable inlets, as k', formed in the jacket. The cold air flows from these equalizing-spaces into the drums l, which are so arranged as to surround the chambers g, the wall of the drum being preferably flaring, as shown in the sectional views of Figs. 2 and 3 of the drawings, the lower end of each drum having such relation to a chamber as to form an annular space about the wall of the chambers g, the upper part of the drum opening into a flue, and each one of these drums forming a circulating device. The area of the annulus measured on any given plane will increase in size from the lower edge of the drum toward the top, the object of this construction being to provide for the proper expansion of the air, which results from the application of heat, and it also provides for the free circulation and distribution of the heated air into the several flues which extend from each circulator to the room or part of the building to which heated air is to be conducted.

In the within form of apparatus there are several pairs of circulators arranged side by side, the cold-air space at the base of each of the pairs of circulators being separated from that of the adjacent pair by means of diaphragms m. The cold air flows from the equalizing-chamber into the spaces m' and rises within the drum as it is heated, expands as it rises, and serves to create a draft from

the equalizing-chambers toward and into the drums, the heated air being at the same time forced outward into the air-flues. The separation of the supply-chambers to the circulators in the manner described provides for a more equal distribution of the cold air to the several circulators.

In order to produce the best results, it is preferred that the area of the outlet from each circulator shall be at least twice the area of the annulus formed at the base of the circulator and between it and the walls of each chamber *g*, although that special proportion is not essential to the correct working of the apparatus.

By the system of circulation of the heated products of combustion as described provision is made for a thorough heating of the air, which does not come into contact at any place with or vitiate the air by carrying it directly into contact with superheated surfaces.

The grate *d* is removably supported in the furnace in ways *d'*, arranged on opposite sides of the fire-box, so that the grate may at any time be wholly removed for the purpose of repair or for renewal. An opening is left through the door of the ash-pit to allow a shaker to be applied to that part of the grate, which enables a shaking movement to be imparted to it for the purpose of clearing out the ashes from the fire-box.

The fire-box is preferably provided with an adjustable rear wall *e'*, suspended from a sliding part which is adapted to be moved in such manner as to either decrease or increase the capacity of the fire-box in order to control the quantity of coal required to heat the furnace at any time. When the adjustable back is moved forward into a position as indicated in dotted outline in Fig. 3 of the drawings, a quantity of coal which, if spread upon the whole surface of the grate would not be sufficient to maintain a fire for any length of time, would form a deep mass in the contracted fire-box and would last much longer than if spread over a larger surface and give out a sufficient quantity of heat for some purposes.

The drum is made in the flaring shape shown in the within apparatus in order to increase the area of the upper part of the annular chamber, which is located between the inner surface of the drum and the outer surface of the heated chamber; but this same result can be obtained by making either part cylindrical where the other part is tapered or by tapering both parts in opposite directions. If preferred, the walls of the drum and of the inner chamber may be made cylindrical and parallel with good results, although the construction shown is preferred.

The spaces shown at the front and rear of the furnace between the inner wall and the casing are dead-air spaces for the purpose of preventing a waste of heat by radiation.

The cover of the furnace is preferably made in sections, so as to form what may be termed "pans," extending crosswise, each dish-shaped section being filled with asbestos, mineral wool, or other non-conducting material. By making this cover in sections a readier means for giving access to the flues is provided.

In the apparatus illustrated in the accompanying drawings each pair of circulators is removably held within the furnace, and by making these circulators in removable sections, as described, the capacity of the furnace may be at any time increased or decreased by the introduction or removal of two or more of the circulators.

The circulators which are located directly over the fire-box may be provided with a deflector g^2, interposed between the opening of the chamber *g* and the surface of the fire to prevent the direct entrance into the chamber of too large a proportion of heat from the fire. Such deflectors may be made adjustable and their position controlled from the outside of the furnace, if desired.

My invention is not limited to a furnace of any particular shape, but may be embodied in a furnace of circular outline, as shown in Figs. 6, 7, and 8, as well as in a rectangular outline, as shown in the other figures. When the circular form is used, the circulators are preferably arranged within a combustion-chamber *o* directly over a fire-pot *n*, the circulator *p* being substantially identical in construction with the circulator already described in connection with the other form of furnace. A deflector-plate *p'* may be suspended from a circulator where needed in order to prevent the inflow to a chamber within the circulators of too great a supply of heated air.

The furnace may be provided with a supplemental heating device for the use of gas instead of coal, this apparatus comprising a system of pipes *r* and burners *s*, which may be removably arranged within the combustion-chamber over the fire-box of the furnace, the burners being arranged with particular reference to each circulator, so as to supply it with the needed heat. The heated products of combustion pass through the furnace through suitable outlets, as before described. The cold air is supplied through inlets *t* through the wall of the furnace and flows through inlet-pipes *t'* into the circulator, where it is heated and from which it is delivered through the outlets t^2 into the hot-air flues, by means of which it is conveyed to any part of the building in which the furnace is situated.

I claim as my invention—

1. In combination in a hot-air furnace, a fire-box, a combustion-chamber and the circulators each appurtenant to a hot-air flue and comprising a chamber with open bottom looking into the combustion-chamber, and a drum or enlargement in the hot-air pipe, the inlet formed between the wall of the drum and the wall of the chamber completely sur-

rounding the former and being larger in area at the outlet of the circulator than at the inlet, all substantially as described.

2. In combination in a hot-air furnace, a fire-box, a combustion-chamber and a circulator appurtenant to a hot-air flue and comprising a chamber with open bottom looking into the combustion-chamber and a drum or enlargement in the hot-air pipe, the inlet formed between the wall of the drum and the wall of the chamber completely surrounding the former and being larger in area at the outlet of the circulator than at the inlet, all substantially as described.

3. In combination in a hot-air furnace, a fire-box, a combustion-chamber, a circulator appurtenant to a hot-air flue and including a chamber with open bottom looking into the combustion-chamber, a drum or enlargement in the hot-air pipe, the inlet formed between the wall of the drum and the wall of the chamber completely surrounding the former and being larger in area at the outlet of the circulator than at the inlet, and a deflector at the mouth of the circulator-chamber, all substantially as described.

4. In combination in a hot-air furnace, a fire-box, a combustion-chamber, a circulator appurtenant to a hot-air flue and including a chamber with open bottom looking into the combustion-chamber, a drum or enlargement in the cold-air pipe, the inlet formed between the wall of the drum and the wall of the chamber completely surrounding the former and being larger in area at the outlet of the circulator than at the inlet, and an adjustable deflector at the mouth of the circulator-chamber, all substantially as described.

5. In combination in a hot-air furnace, a fire-box, a combustion-chamber, and a circulator appurtenant to a hot-air flue and including a chamber with open bottom looking into the combustion-chamber, a drum or enlargement in the hot-air pipe with walls inclined with respect to the walls of the inner chamber, whereby the area of the annulus near the top of the circulator is greater than the area of the annulus near the inlet of the circulator, all substantially as described.

GEORGE J. CAPEWELL.

Witnesses:
CHAS. L. BURDETT,
ARTHUR B. JENKINS.