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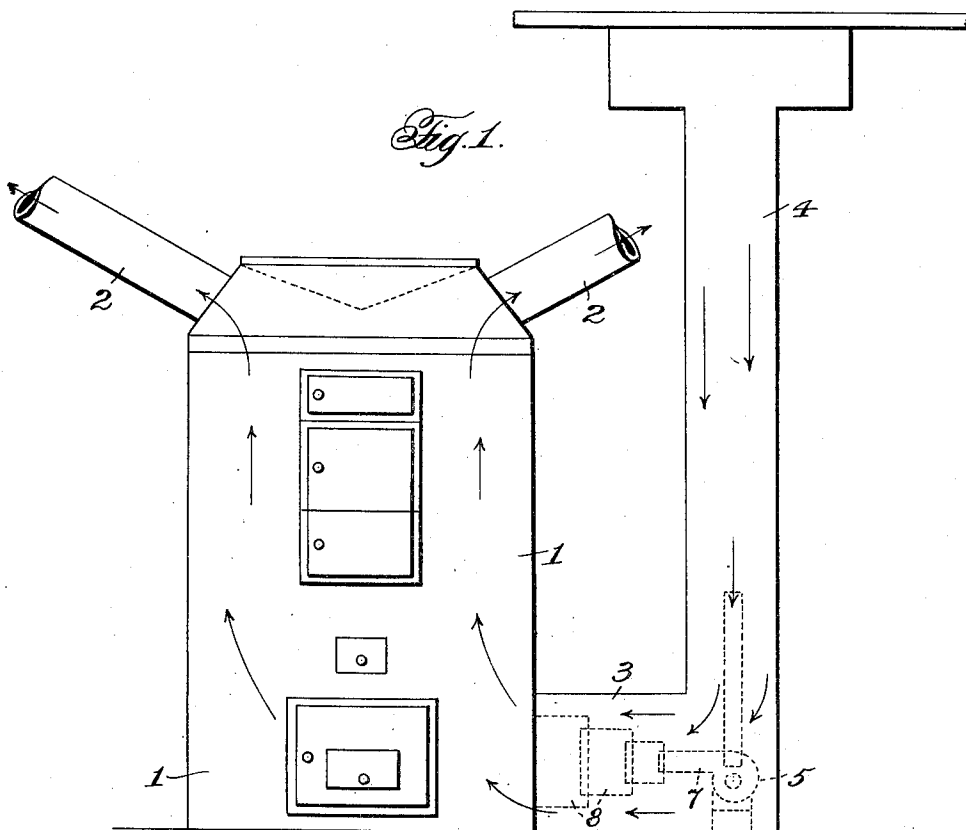
1,517,764

F. R. STILL

HEATING SYSTEM

Filed Sept. 3, 1921

4 Sheets-Sheet 1



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Witness:

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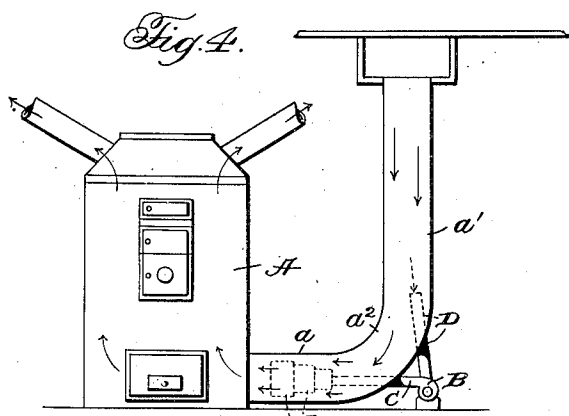
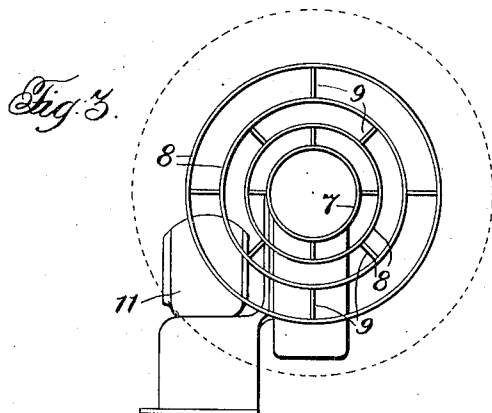
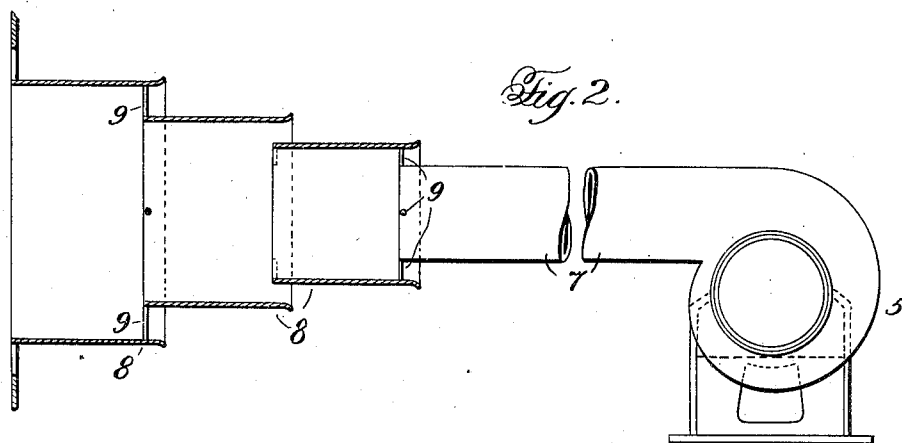
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Fig. 5.

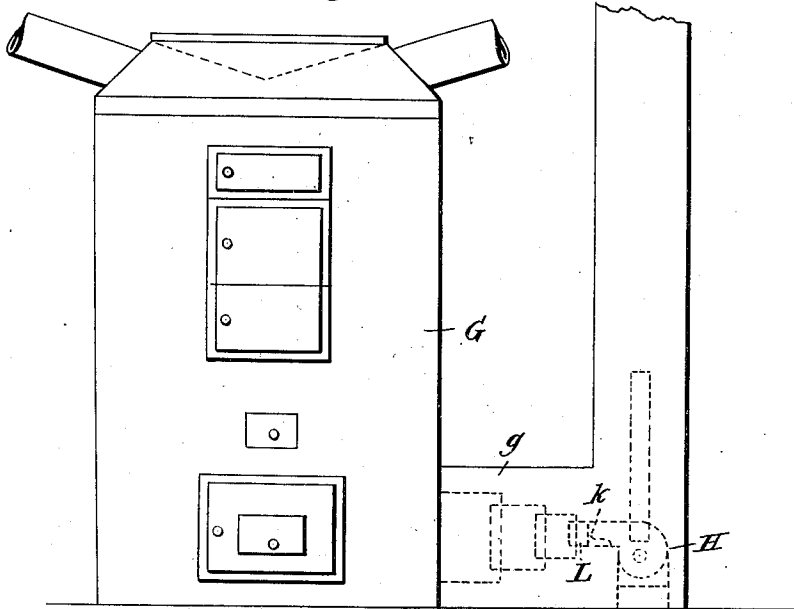
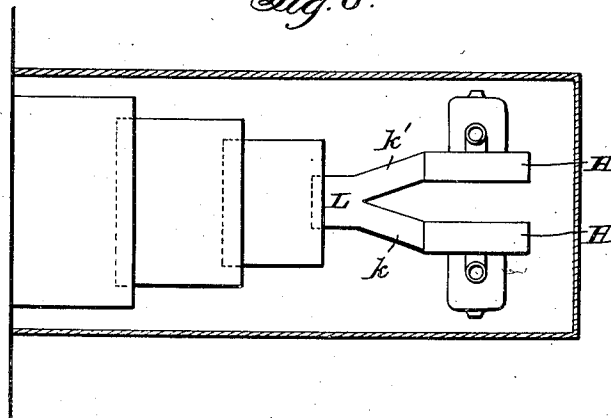


Fig. 6.



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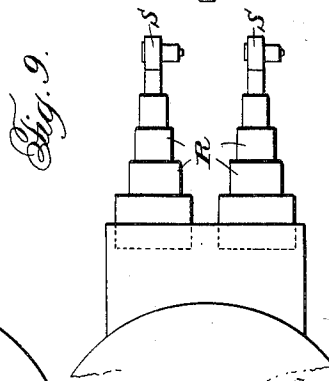
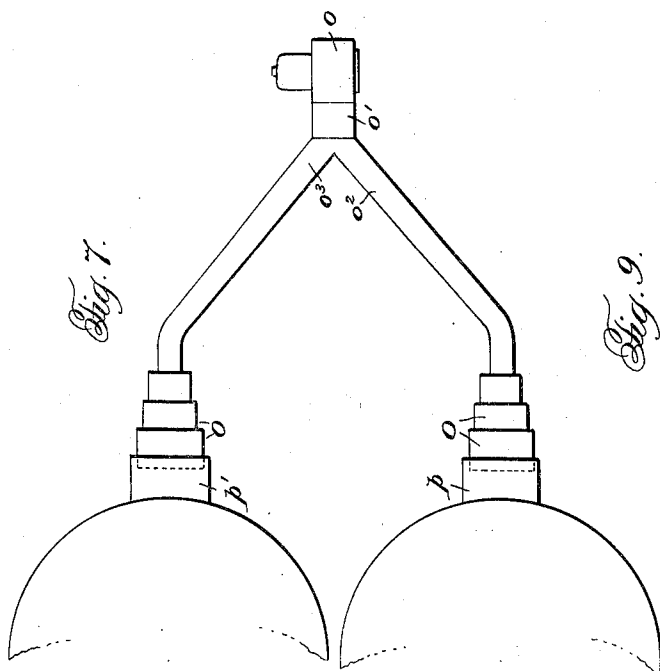
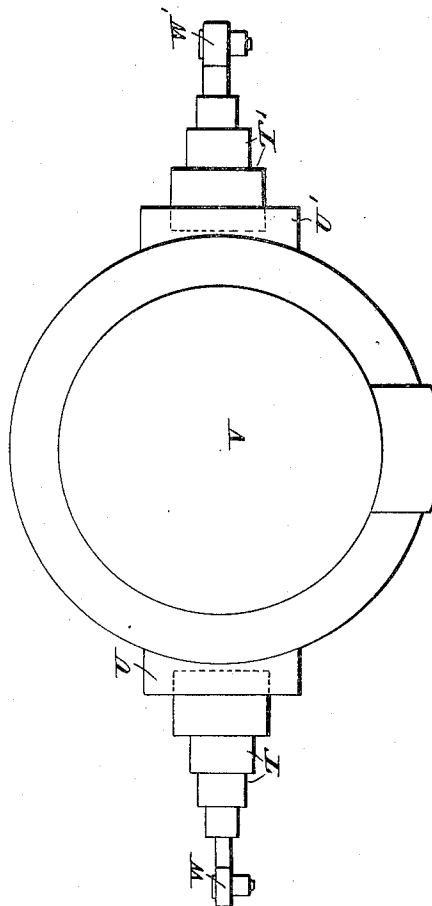
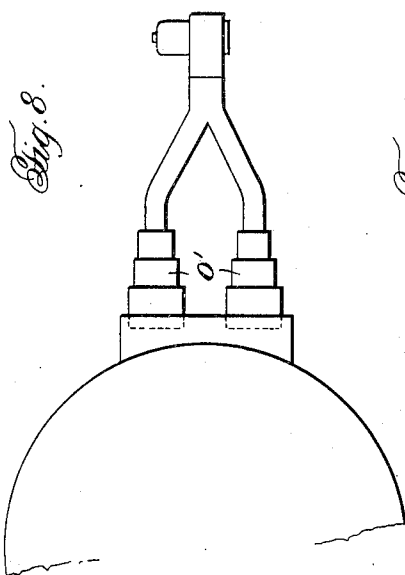
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE.

FREDERICK R. STILL, OF DETROIT, MICHIGAN, ASSIGNOR TO AMERICAN BLOWER COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF NEW YORK.

HEATING SYSTEM.

Application filed September 3, 1921. Serial No. 498,347.

To all whom it may concern:

Be it known that I, FREDERICK R. STILL, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Heating Systems (Case A), of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to improvements in hot-air furnaces or heating systems, and more especially to improved means for providing a forced circulation therefor.

The object of the invention is to provide improved means that will be highly efficient in producing the desired forced circulation while requiring only a small amount of power for operating the same, to provide a compact practical form of forced circulation-producing means that can be easily and cheaply installed in the various types of house heating systems, adapted to be readily brought into use as desired, and when not in operation offering substantially no resistance to gravity circulation.

A particularly important novel characteristic of the invention resides in the special construction and arrangement of parts, providing a compact structure in the form of a single portable unit, advantageous for handling and installation, and also in regard to efficient operation within the intake duct of the furnace.

An important novel feature of the invention also lies in the special injector means provided, and the particular association of the same with the other parts within the intake or recirculating duct of the system.

The invention, with other objects and advantages thereof, and the particular construction, combinations and arrangement of parts comprising the same, will be understood from the following detailed description, when considered in connection with the accompanying drawings, forming part hereof, and illustrating embodiments of the invention.

In the drawings:—

Figure 1 is a front elevation of a hot-air furnace equipped with means for producing a forced circulation in accordance with the present invention.

Figure 2 is a detail part section and side elevation, on an enlarged scale, of the means for producing a forced circulation.

Figure 3 is a detail end elevation of the forced air circulation producing means.

Figure 4 is a front elevation illustrating a modified construction.

Figure 5 is a front elevation illustrating another modification.

Figure 6 is a detail top plan view, on an enlarged scale, of the form of forced air circulating means illustrated in Fig. 5.

Figure 7 is a top plan view illustrating another modified arrangement.

Figure 8 is a similar view of a slight variation of the construction illustrated Figure 7.

Figure 9 is a top plan view of a further modification.

Figure 10 is a similar view of a still further modification.

While specific embodiments of the invention are illustrated in the drawings, by way of example, it will of course be understood that the invention is applicable for use generally with the various kinds of hot air furnaces, and that changes and variations in the particular constructions shown, and the carrying out of the invention in other forms, as will appeal to those skilled in the art and falling within the scope of the appended claims, may be practiced without departing from the spirit of the invention.

Referring particularly to Figs. 1 to 3 of the drawings, 1 designates any suitable construction of hot air furnaces, one of the conventional forms being shown having the usual warm air distributing flues 2, an intake duct or recirculating pipe, which may lead to any desired point, and shown in this instance with a lower horizontal part 3, and a vertical leg 4, extending to the upper floor (not-shown), the circulation being down through the vertical leg 4 through the horizontal part 3 into the furnace, and from thence through the distributing flues 2 in the customary way.

In accordance with the present invention, improved means is provided for producing a forced air circulation in the heating system at such times, when, for any reason, the gravity circulation is poor or insufficient, a condition commonly arising, for example, when the wind pressure is greater on one side of the building than on the other. The invention contemplates improved means for this purpose including a fan or blower 5 and eductor means associated therewith and con-

sisting of a plurality of tubular injector members 8. The tubular injector members 8 and the forward part of the discharge pipe 7 of the fan are of gradually increasing diameter, beginning with the discharge pipe 7, and the tubular injector members 8 are concentrically arranged with relation to each other and said discharge pipe with the outer end portion of the discharge pipe 7 of the fan projecting into the smaller of the tubular members 8, and each tubular member 8 in turn projecting into the next larger one, there being annular spaces or free areas around the forward end portion of the discharge pipe and each of the tubular injector members, and the parts into which they project.

11 designates an electric motor operatively connected with the fan 5 to drive the same, flexible cord and plug connections of any of the conventional forms, not shown, being provided to connect the motor 11 with the house service circuit.

In the particular construction shown, the tubular injector members 8, the motor, fan, and its inlet and outlet pipe 7 are all located within the intake duct of the furnace. The tubular injector members 8 are connected together and to this discharge pipe 7 of the fan in any suitable way, for instance that shown by radial arms 9, said injector members 8 being illustrated in the drawings in the form of cylinders.

At moderately high velocities the air discharged into the first tubular injector member injects or induces a certain amount of flow of air thereinto, which in turn induces a flow of air into the next tubular injector member and so on throughout the series until finally the volume of air discharged into the intake duct of the furnace is multiplied several times as much as the fan itself handles.

While, as will be understood, the proportions for the tubular injector members 8, and the discharge pipe 7, may be varied to meet different conditions, proportions that have been found to give especially satisfactory results are that the diameters of the injector tubes and the discharge pipe be such that there is a free area around the forward end portion of each injector tube at least equal to the area of said tube, and the length of each injector tube being not less than one-half of its diameter.

Referring to the modification illustrated in Figure 4, A designates a hot air furnace, in which the horizontal part a and vertical leg a' of the intake duct is connected by an elbow a^2 . A fan and motor unit B, similar to that illustrated in detail in Figures 2 and 3, is employed, but in this instance is located outside of the intake duct at the rear of the elbow a^2 , the inlet of the fan being shown connected to the intake duct by a

pipe C, and the discharge pipe D extends through the intake duct to the fan outlet, the construction and arrangement of the tubular injector members F and forward part of the discharge pipe C being the same as that illustrated in Figures 1 to 3.

Figures 5 and 6 illustrate another modified construction, particularly useful in cases in which the obstruction to the flow of air to the system is greater than that ordinarily encountered. In these Figures 5 and 6, G designates the furnace having the intake duct g . In this form of the apparatus a plurality of fans are employed, two fans H, H, being shown, the fan outlets being connected by branch pipes h, h' to a common discharge pipe L, the latter, in this instance being of larger size than in the constructions previously described, and the injector tubes, being correspondingly of increased size, the construction being otherwise the same as that illustrated in Figures 1 to 3, in the form of a unitary structure located wholly within the intake duct.

The invention also comprehends such modified constructions as that illustrated in Figure 7 of the drawings, in which a plurality of sets of inductor pipes are employed. Two sets of inductor pipes O, O, are shown, in this instance, associated with a single fan o , the latter having an outlet o' provided with branches o^2, o^3 , leading to the respective sets of inductor pipes O, O, which are associated, as shown, with inlets p, p' , of two separate furnaces, the inlet of the fan, in this modified construction, communicating with the room (not shown) in which the furnace is located, and the air supply being taken therefrom.

In the modified construction illustrated in Figure 8 of the drawings, a plurality of sets of inductor pipes O', O' are employed, as shown, in connection with a single inlet of one furnace.

The modified arrangements illustrated in Figures 9 and 10 are adapted for large furnaces. In Figure 9 a duplex construction is shown employed at a single inlet of one furnace. R, R, designate the sets of inductor pipes, and S, S, are the fans and motor units, one connected with each set of inductor pipes. In Figure 10 two sets of inductor pipes T, T', are employed with a single furnace, in this instance, the sets of inductor pipes being associated with separate inlets U, U', at opposite sides of a single furnace V. W, W' designate the fan and motor units for each set of inductor pipes T, T'.

It will be noted that the tubular injector members increase to a material extent the volume of air circulated, the capacity of the fan being multiplied several times over, this special combination of parts making it possible to secure the necessary forced circula-

tion by a relatively small sized fan, which can be advantageously employed within the intake duct, the apparatus as a whole offering substantially no obstruction to the gravity circulation in the system when the forced air circulation means is not in operation.

While only a relatively small amount of electric current is required to drive the fan, the apparatus is capable of producing sufficient pressure in the system to overcome the resistance of the furnace or distributing flues throughout the system. The pressure produced will be far in excess of what could be produced with a furnace working by gravity alone as ordinarily installed, even when the furnace is fired so as to produce the maximum rise in temperature, the heating efficiency of the furnace being materially increased, as it is unnecessary to operate the same at such high temperatures, a greater volume of air being circulated at a lower temperature, resulting in a considerable saving in fuel and a more uniform positive distribution of warm air throughout the system.

It will also be observed that the special construction and arrangement of parts hereinafore described, affords an efficient forced air circulating apparatus of compact construction and in the form of a single portable unit that can be conveniently handled and installed at low cost in the various types of hot air heating systems.

What I claim is:

1. The combination with a hot air heating system including a furnace and air circulating ducts, said system being adapted to operate by gravity circulation, of means for providing at times a forced circulation for the system, said means including a plurality of tubular injector members of gradually increasing diameter, and concentrically arranged with relation to each other with the outer end portion of one projecting into the next larger tubular member, said tubular injector members being located within a duct of the system, a blower, and a discharge pipe connected with the blower outlet and having an outlet portion disposed concentrically to and adjacent one end of the smaller of said tubular injector members within the said duct.

2. The combination with a hot air heating system including a furnace and air circulating ducts, said system being adapted to operate by gravity circulation, of means for providing at times a forced circulation for the system, said means including a fan, a discharge pipe connected with the fan outlet, a plurality of tubular injector members, said tubular injector members and the outlet end portion of the discharge pipe of the fan being of gradually increasing diameters beginning with the outlet end portion of the discharge pipe, and being concentrically ar-

ranged with relation to each other and said outlet portion of the discharge pipe with the outlet portion of the discharge pipe projecting into the smaller of the tubular injector members, and each tubular injector member in turn projecting into the next larger one, said tubular injector members and the outlet end portion of the discharge pipe of the fan being disposed centrally within and spaced from the wall of one of the ducts of the system, and means for driving the fan.

3. The combination with a hot air heating system including a furnace and air circulating ducts, said system being adapted to operate by gravity circulation, of means for providing at times a forced circulation for the system, said means including a relatively small sized fan located within one of the circulating ducts of the system, a discharge pipe within said duct leading from the fan outlet, a plurality of injector tubes within said duct, said injector tubes and the outlet portion of the discharge pipe being of gradually increasing diameters beginning with the outlet end portions of the discharge pipe, and being concentrically arranged with relation to each other and the outlet end portion of the discharge pipe with the outlet end portion of the discharge pipe projecting into the smaller of the injector tubes, and each injector tube projecting into the next larger one, and an electric motor for driving the fan located within the intake duct.

4. The combination with a hot air heating system including a furnace and air circulating ducts, said system being adapted to operate by gravity circulation, of means for providing at times a forced circulation for the system, said means being in the form of a single portable unit located within one of the intake ducts of the furnace and comprising a supporting base, a relatively small sized fan mounted thereupon, an electric motor mounted upon the base at one side of the fan and operatively connected with the fan, the fan having a discharge pipe extending forwardly therefrom, above the base, a plurality of tubular injector members, said tubular injector members and said discharge pipe being of gradually increasing diameters, beginning with the discharge pipe and being concentrically disposed with relation to each other and the discharge pipe with the discharge pipe projecting into the smaller tubular injector member, and each of said tubular injector members projecting into the next larger one, and means securing the tubular injector members to each other and to the discharge pipe.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

FREDERICK R. STILL.

Witnesses:

E. C. EVANS,
A. MEYERS.