

N. B. WALES.
 AUTOMATIC FAN SYSTEM FOR HOT AIR FURNACES.
 APPLICATION FILED APR. 11 1922.

1,424,958.

Patented Aug. 8, 1922.

5 SHEETS-SHEET 1.

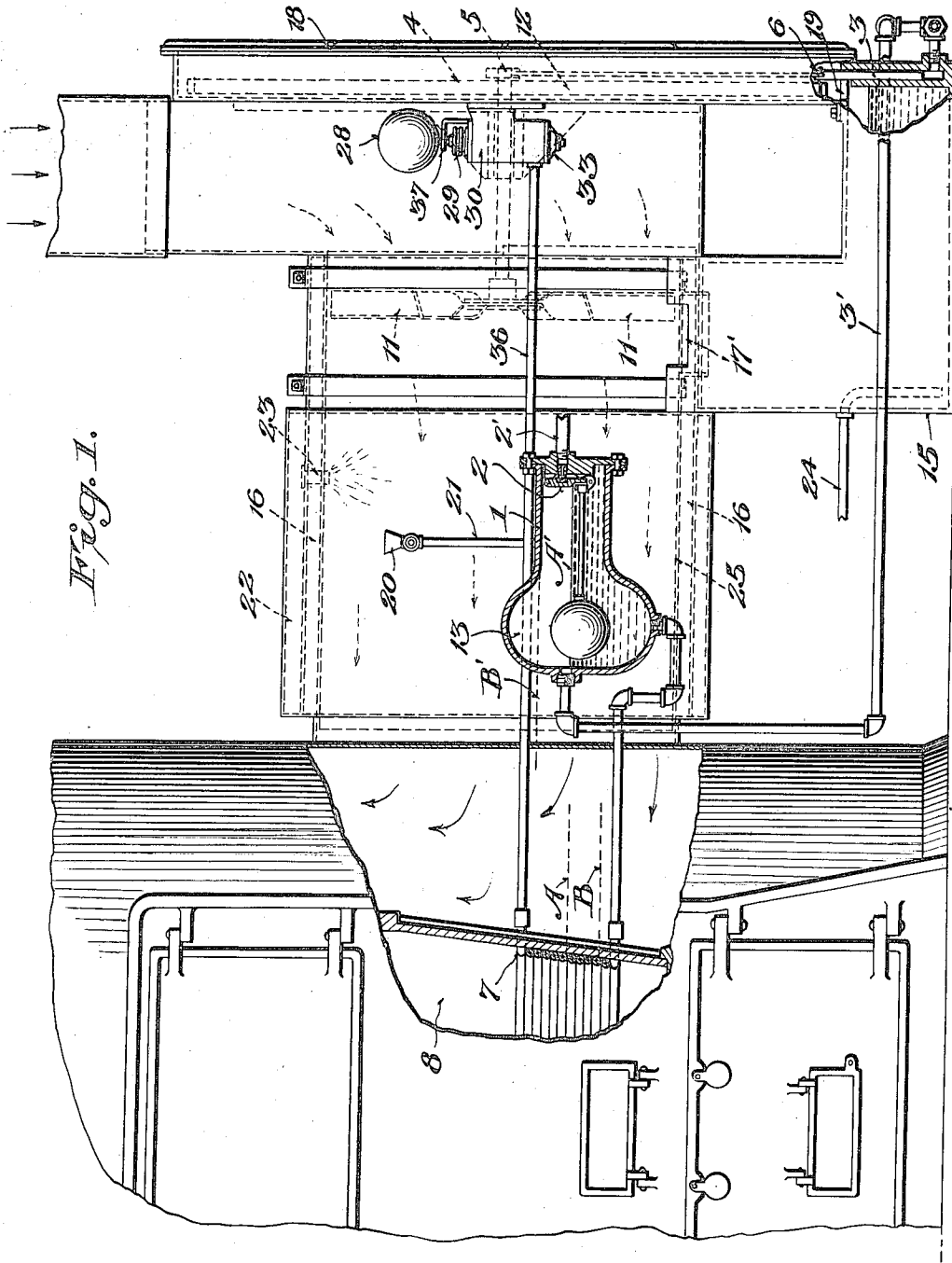


Fig. 1.

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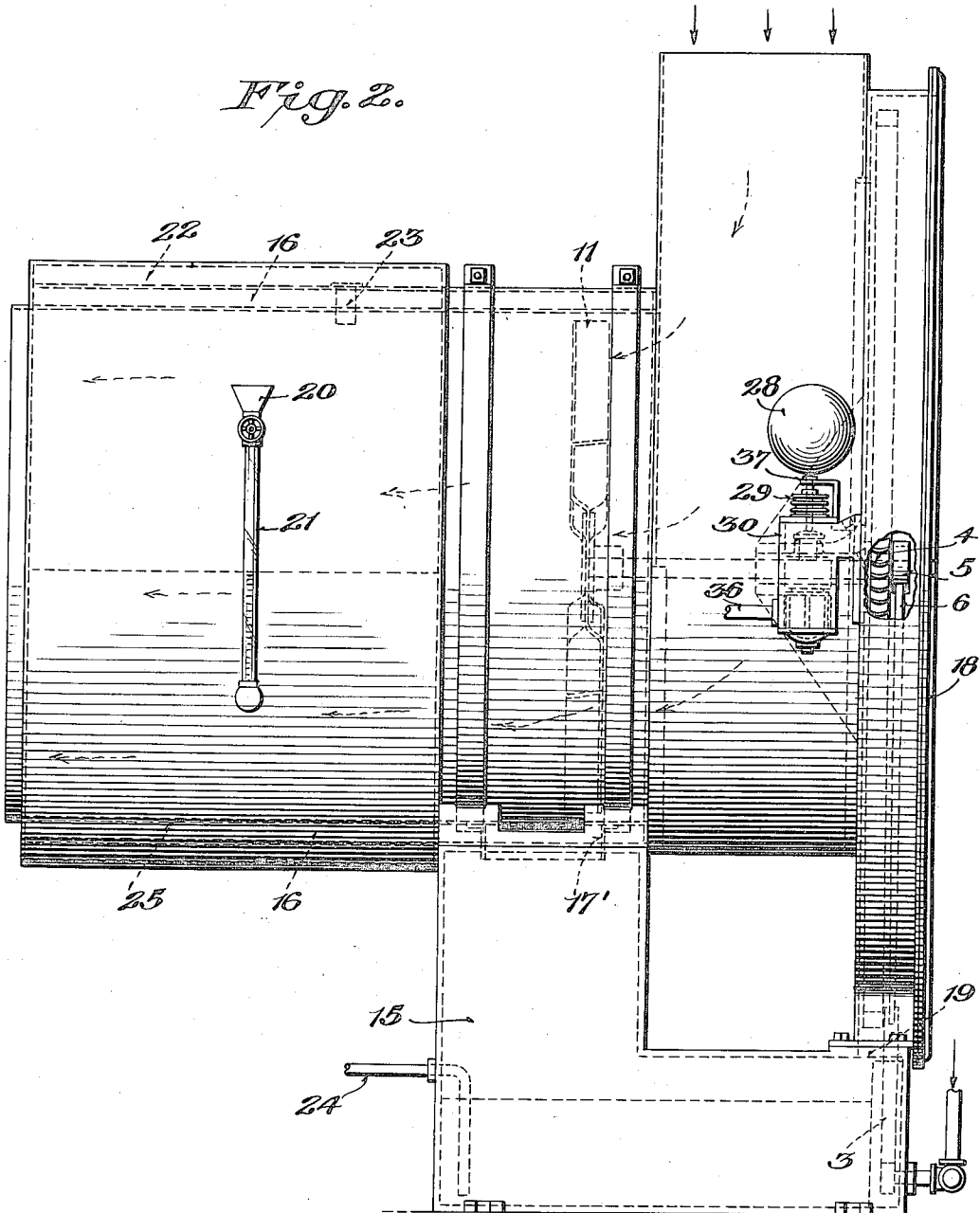
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5 SHEETS—SHEET 2.

Fig. 2.



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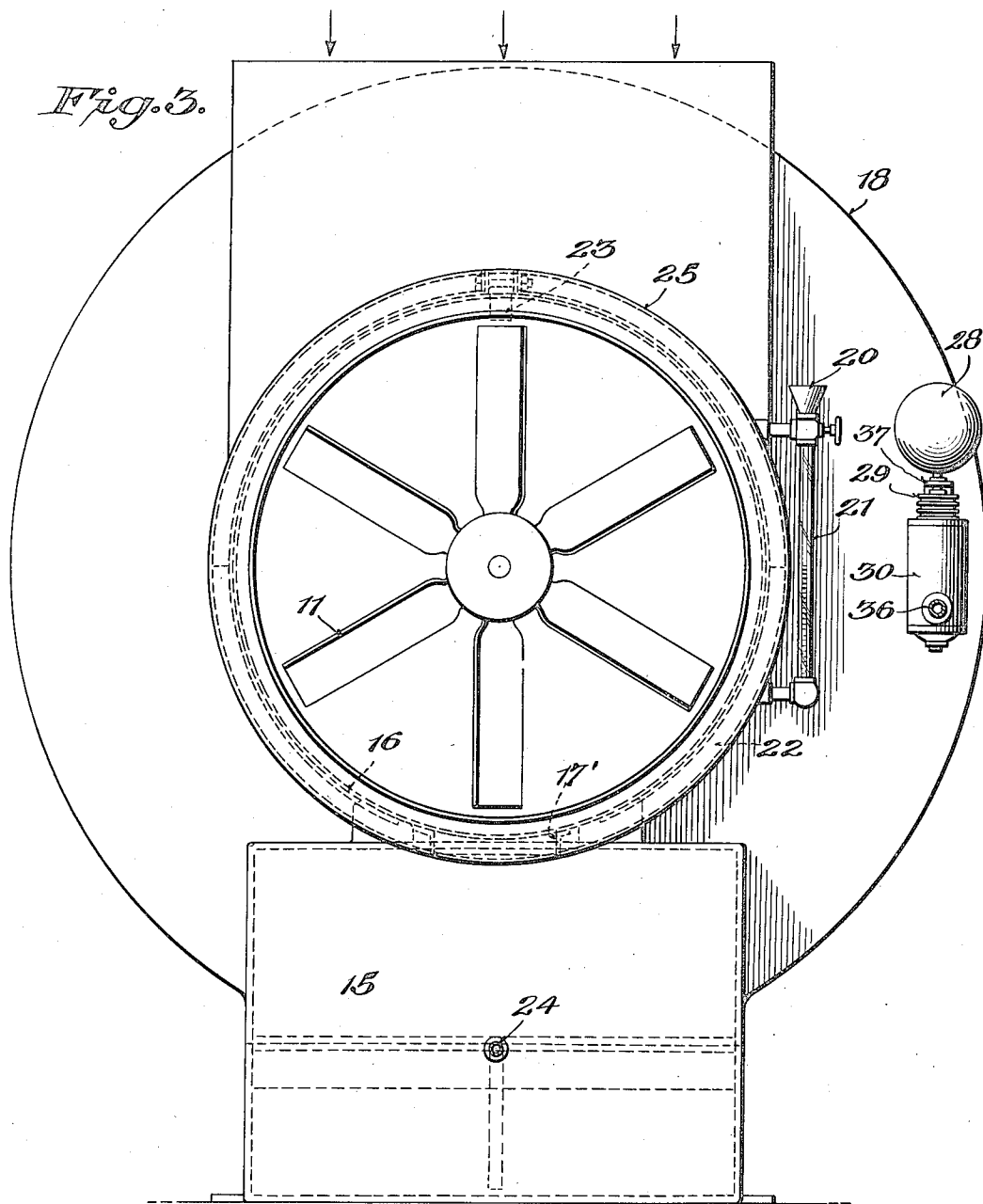
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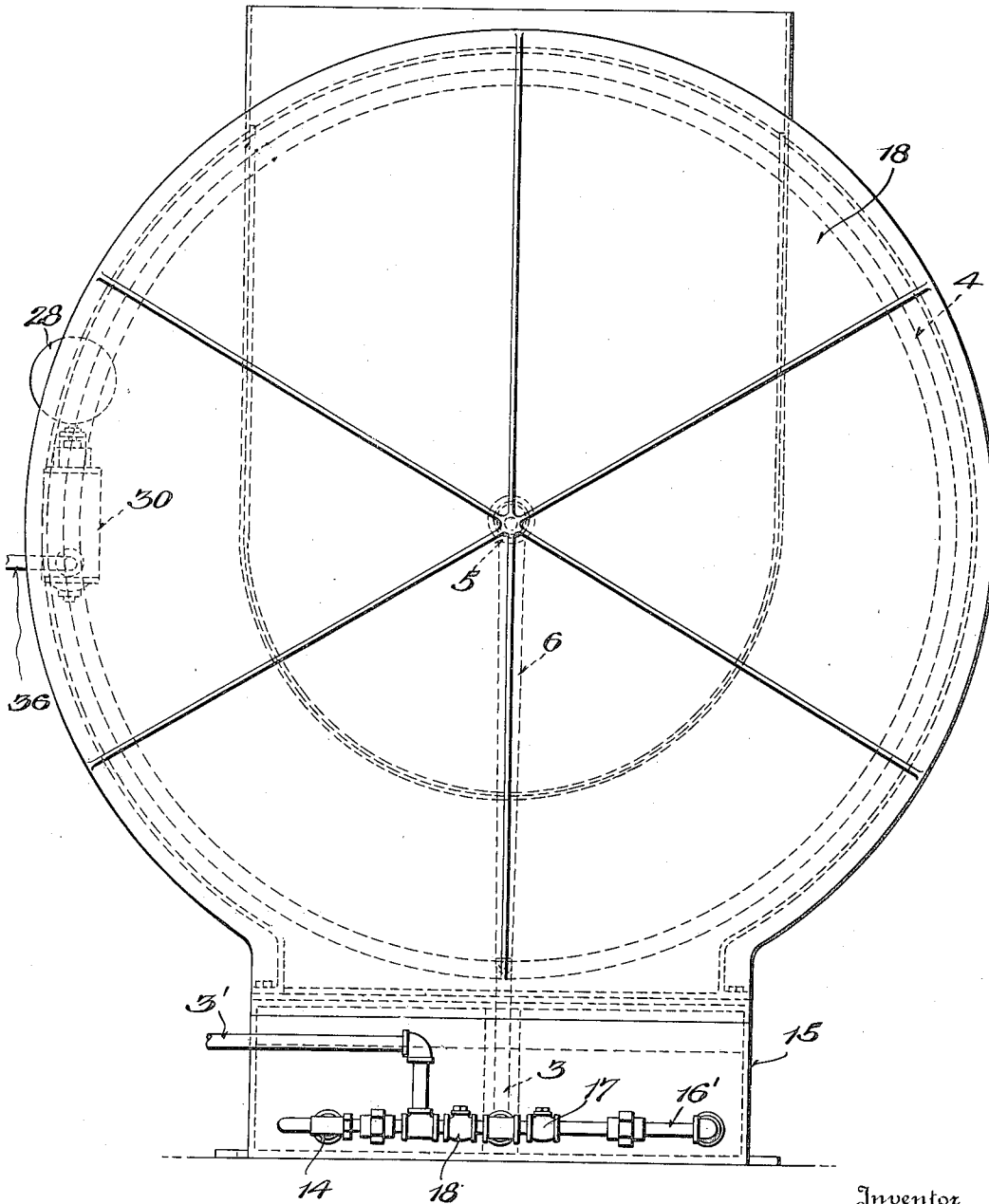
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Fig. 4.



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3 SHEETS-SHEET 3.

Fig. 6.

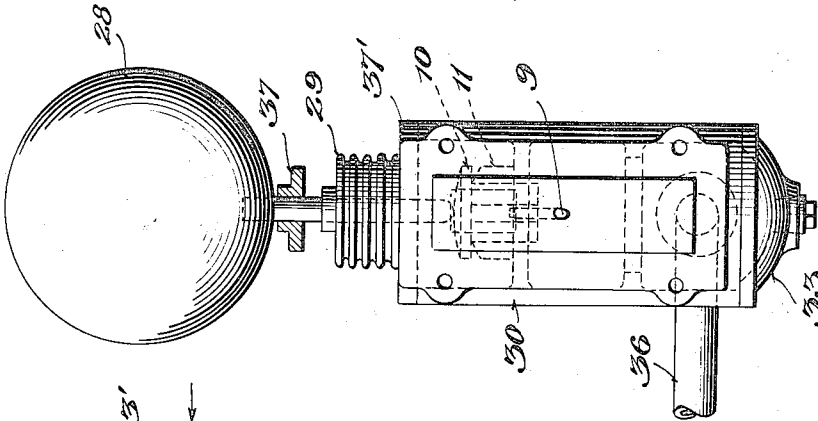


Fig. 7.

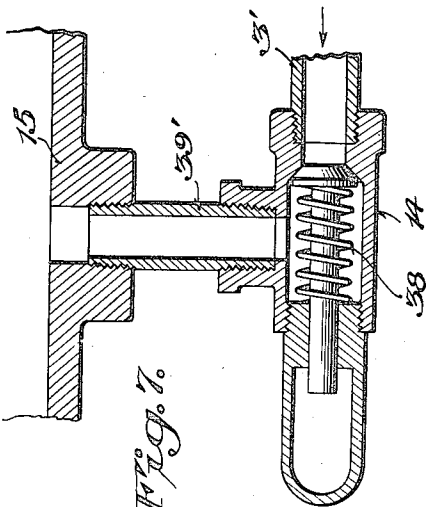
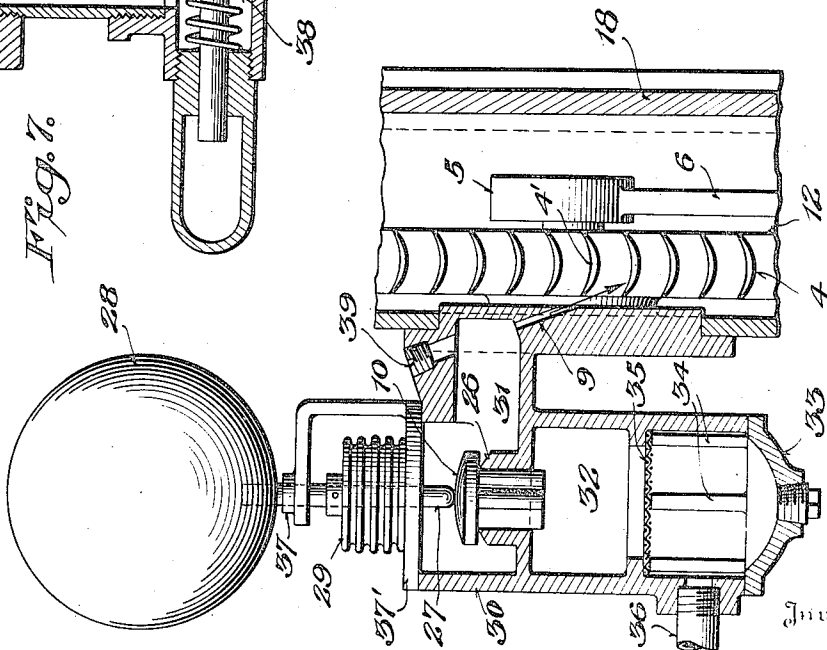


Fig. 5.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC FAN SYSTEM FOR HOT-AIR FURNACES.

1,424,958.

Specification of Letters Patent.

Patented Aug. 8, 1922.

Application filed April 11, 1922. Serial No. 551,441.

To all whom it may concern:

Be it known that I, NATHANIEL B. WALES, a citizen of the United States, residing at Kalamazoo, in the county of Kalamazoo and State of Michigan, have invented certain new and useful Improvements in Automatic Fan Systems for Hot-Air Furnaces, of which the following is a specification.

This invention relates to an automatically operated fan or blower system usually sold and marketed as an adjunct or attachment to the conventional hot air furnace used widely in house heating.

It has long been realized that the hot air furnace is deficient in causing a positive circulation through all of the air conduits, there being usually one or more rooms which are difficult to adequately heat, no matter how hard the fire may be forced. The location of this room or these particular rooms may change from day to day as the wind or general atmospheric and weather conditions vary on account of the shifting wind pressures on the exterior of the house, which nullify the weak circulative energy in the ducts of the hot air furnace.

For the above reasons it is very desirable to be able to install with any conventional hot air furnace a small compact, low-priced, self-operating fan system which can be easily located in the cold air duct leading to the base of the furnace and will operate to positively circulate a large volume of air to efficiently distribute the heat from the furnace throughout the entire building. Many engineering problems are involved in the development of a system which is practical, durable and very simple in its operation. This is especially true in view of the wide divergence in the conditions of the fire in the combustion chamber of a hot air furnace when depending upon this very variable heat factor for the generation of steam to operate the fan or blower continuously. This condition calls for a very sensitive and automatic control of the water feed and special devices to insure the self starting of the fan at all times. A minimum amount of water must also be maintained in the coil or heating element to safeguard it from being burned out.

The desirability of humidifying the air forced by the fan is obvious and I have devised means to do this without the continual additions of water that would otherwise be

necessary to offset the constant evaporation from the small fan steam power circuit. I have found that in certain parts of the country where the salt contents in the water are excessive, constant additions to the water circuit of the system would quickly cause a clogging up of the water and steam circuit. I have therefore completely separated the humidifying water circuit from the steam generating circuit, using the same water repeatedly to supply the steam for operating the fan.

An important feature of my system is the automatic change in level of the water in the coil or heating element in respect to the changing intensity of the fire surrounding the same in order to keep the steam pressure approximately constant at all times, since this pressure factor controls the speed of the fan and excessive speed or wide variations in speed are objectionable on account of the noise caused thereby.

It is not only desirable to keep the fan in constant operation through wide firing divergence, but it is also desirable to maintain the fan in operation during periods when the fire is banked, as at night or in mild weather. Heating surface adequate to accomplish this would be excessive in its steam generation during cold weather when the fire is forced. In order to meet this condition, I have utilized well known principles of physics embodied in the simplest of mechanical form.

In the following description, I shall refer to the accompanying drawings, in which—Figure 1 is a side elevation partly in section, showing the entire fan system as installed in a conventional hot air furnace; Fig. 2 is an enlarged side elevation, partly in section, of the fan and the turbine engine; Fig. 3 is an end view showing the location of the fan or blower in the duct leading to the furnace jacket; Fig. 4 is an end elevation showing the arrangement of the pump check valves and the by-pass and feed line; Fig. 5 is a detail view in sectional elevation of the self starting valve in the steam feed line and showing its relation to the nozzle in the turbine engine; Fig. 6 is an end elevation of the same; and Fig. 7 is a cross section in plan of the by-pass valve to the fan sump.

Referring to the drawings, 1 designates a special form of float feed mechanism which is supplied by an automatic float feed valve

2 and water supply connection 2' as well as by water supply pump 3 through the water conduit 3', pump 3 being operated by the turbine engine 4, by means of the eccentric 5 and link 6. When the fan system is cold and latent the hydrostatic level of the water in the float feed chamber 1 is the same as that in the coil or heating element 7, as indicated by the dotted lines A and A'. When fire is started in the furnace combustion chamber 8, the coil generates steam, but this steam is restrained from entering the nozzle 9, of the turbine engine 4 by the automatic self starting engine valve 10, see Fig. 5, until the steam pressure has reached approximately ten pounds in the coil or heating element 7. This insures the automatic self starting of the turbine engine, due to the impact of the jet of steam at this pressure through the nozzle 9 on the turbine buckets 4', the jet being sufficient to overcome the inertia of the turbine wheel 12, thereby starting the fan 11. When a pressure of ten pounds or thereabouts has been reached in the coil 7, by virtue of the closure of the valve 10 in the steam line, this steam pressure forces the water back through the coil into the chamber 13, at the top of the special float water feed mechanism 1, until the air pressure caused by the rise of water in the chamber 13, equals the pressure of the steam in coil, or heating chamber 7. The respective heights of liquid then in the coil 7 and in the chamber 13 might be then indicated by the dotted lines B and B'.

In this manner as the fire increases in intensity, the pressure of the steam thereby increasing, due to the increasing evaporation factor, the liquid level line in the coil or heating element 7 automatically lowers, due to the greater pressure therein as compared with the pressure in chamber 13, the volume of the chamber 13 having been specially designed in respect to the volume of the coil 1, so that at the maximum operating pressure of the system of approximately 14 pounds, the water has practically been lowered out of all the coils 7 and correspondingly rising into chamber 13, thereby reducing the effective evaporative capacity of the coil or heating element 7, in order to maintain the steam pressure within predetermined limits. The hot water feed line 3' entering into feed mechanism 1 from the pump 3, is entirely by-passed into the sump 15 at this upper limiting pressure-level, owing to the adjustment of the relief valve 14, as shown in detail in Fig. 7, the piping connections of which are shown in detail in Fig. 4. The water pump 3 is supplied from the sump 15 by means of the pipe 16 and inlet valve 17, check valve 18 being the discharge check from the pump supplying pipe 3' which connects to the float feed chamber 1. This automatic reduction of the liquid level in coil 7

therefore automatically reduces the volume of the steam generated per unit of time and superheats that generated, which is not harmful to the type of turbine engine employed.

A condenser shell and fan duct 25 condenses the steam as it enters the pipe 16' through the connecting passage 17' from the sump chamber 15, the steam passing down from the turbine casing 18 through an opening 19 therein. Water supplied at the orifice 20 into the water level indicator 21, either by automatic or by manual means as shown, forms the humidifying medium which is vaporized in the annular chamber 22 the vapor entering the forced air duct through the opening 23 as indicated in Figures 1 and 2. 24 is an emergency overflow from the sump 15.

The automatic self-starting engine valve 10, see Fig. 5, is held to its seat 26 by the pin 27 which sustains the weight 28, the flexible diaphragm 29 acting as a steam seal. The valve seat 26 is formed in the valve casing 30, which has two distinct chambers 31 and 32, the valve 10 being positioned therebetween. A cleanout cover 33 is provided with spidered legs 34, which support a screen 35 operating to free the steam passing through of all entrained solids which might clog the small nozzle opening 9. Steam enters from the coil 7 through pipe 36. Arm 37 projecting from the cover 37' serves as an upper pressure limiting stop for diaphragm 29, as well as a cross head for pin 27. 39 is a cleanout entry for nozzle 9. The relief valve 14, Fig. 7, consists of a spring pressed valve 38, which is set to open at the desired relief pressure by passing the water from the pump 3 into the sump 15 through pipe 39'.

In considering the operation of the system it is to be noted that as long as the heat factor in the combustion chamber is sufficient to generate steam at a pressure of approximately eight pounds, the area of the diaphragm 29 being slightly larger than the valve area 26, the fan or blower is in continuous operation. When the fire intensity has so lowered that it will not supply steam at this pressure, the valve 10 closes. Then ensues a period of intermittent operation, the fan system starting when the pressure has increased to eight pounds, operating for a few minutes and then stopping as the pressure again falls.

It is apparent from the above that I have a perfectly automatic system, the operation of the fan being intermittent below certain intensities of fire and the water level in the heating chamber 7, being automatically lowered, the evaporation factor therein being decreased proportionately as the fire intensity increases over a certain normal degree. This fan system can be readily in-

stalled in any make of hot air furnace. For purposes of illustration, I have shown a coil as the steam generating chamber, but it will be evident to engineers that other forms may be employed. Likewise, I may use other types of engines to operate the fan or blower.

I claim:—

1. An automatic air circulator for a hot air furnace, comprising a steam generating chamber positioned within the fire-pot of the furnace, a steam engine operatively connected to said chamber, means actuated by the engine for controlling the volume of air passing through the air ducts of the furnace, and means controlled by the intensity of the fire within the fire-pot to start the engine and maintain it in continuous operation at normal and high intensities.

2. An automatic air circulator for hot air furnaces as set forth in claim 1, and means for automatically maintaining the water in said chamber at different levels with respect to the intensity of the fire in the furnace.

3. An automatic air circulator for hot air furnaces as set forth in claim 1, and means for automatically varying the water level

in said chamber inversely with the steam pressure generated therein.

4. An automatic air circulator for hot air furnaces as set forth in claim 1, and a water feed chamber connected to said generating chamber and positioned to feed water to said chamber by hydrostatic balance, said water feed chamber being supplied by two sources, one feeding when the water falls below a predetermined level in said chamber and the other feeding only when the pressure in the top of said chamber is below a predetermined pressure.

5. An automatic air circulator for a hot air furnace, comprising a steam generating chamber positioned within the fire-pot of the furnace, a steam engine operatively connected to said chamber, means actuated by the engine for controlling the volume of air passing through the air ducts of the furnace and means controlled by the intensity of the fire within the fire-pot to start the engine and maintain it at an intermittent action at low fire intensities and in continuous operation at normal and high intensities.

In testimony whereof I affix my signature.

NATHANIEL B. WALES.