May 5, 1936. M. W. BEST 2,039,948

COMBINED AIR CIRCULATOR AND DRAFT REGULATOR FOR HOT AIR FURNACES

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FIG. 1.

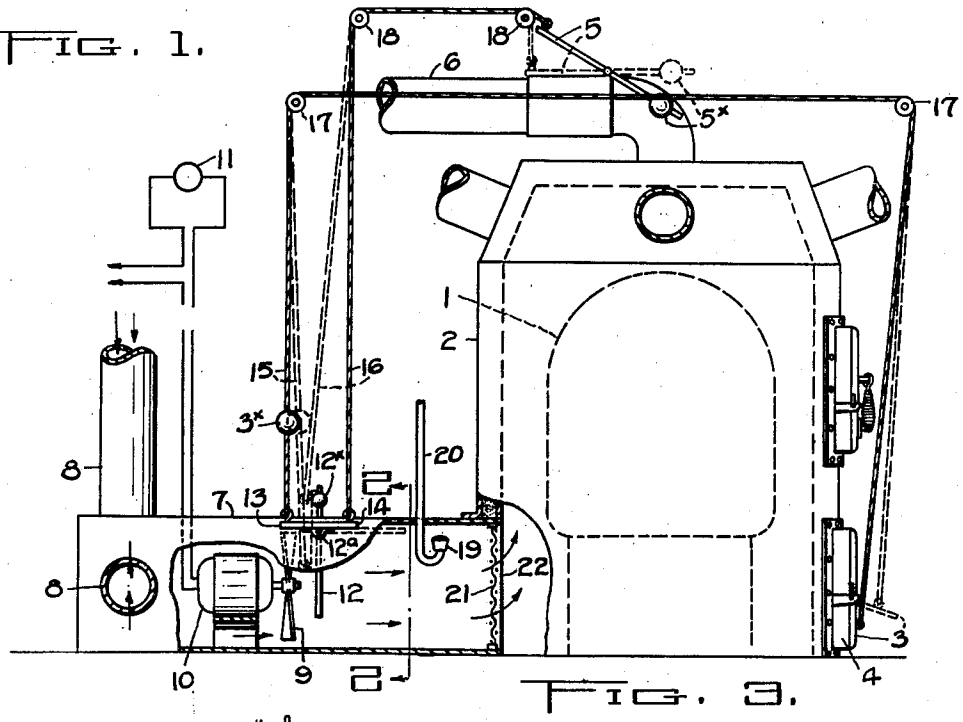


FIG. 3.

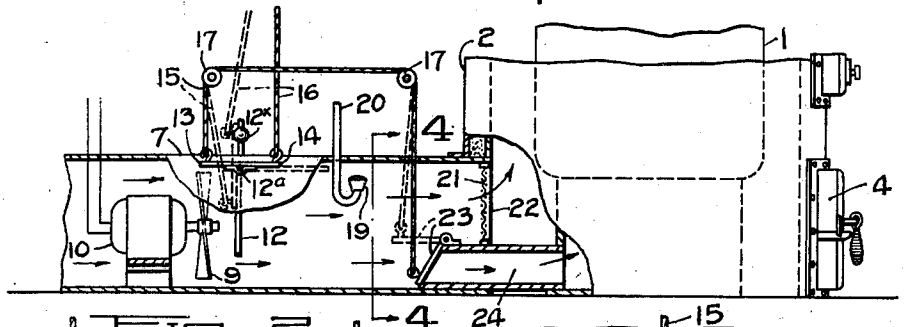
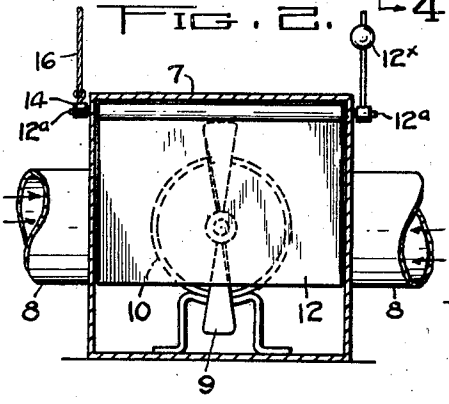


FIG. 2.



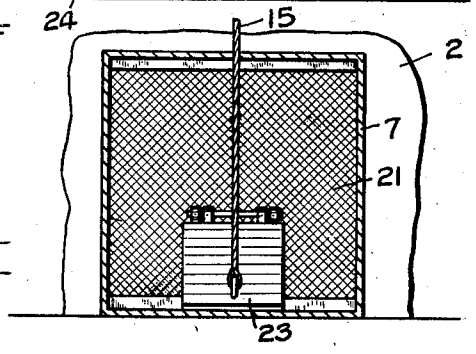


FIG. 4.

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Fig. 6.

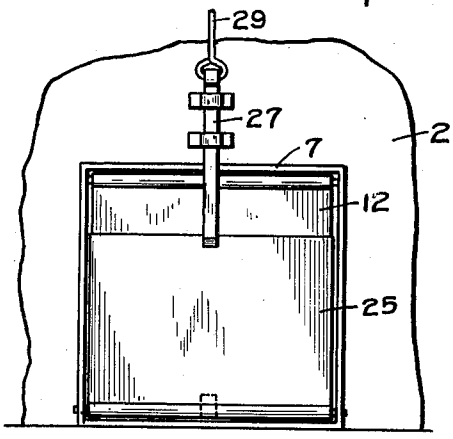
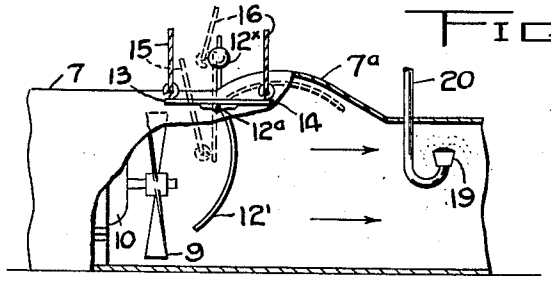


Fig. 5.

Fig. 7.



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UNITED STATES PATENT OFFICE

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COMBINED AIR CIRCULATOR AND DRAFT REGULATOR FOR HOT AIR FURNACES

Millard Whyte Best, Hamilton, Ontario, Canada

Application January 26, 1935, Serial No. 3,598

10 Claims. (Cl. 236—11)

My invention relates to improvements in combined air circulators and draft regulators for hot air furnaces and the object of the invention is to devise improved means for circulating the air through the casing of the furnace, which air may be the cooled air from the respective rooms of the house.

A further object is to provide a thermostatically controlled electric fan for circulating or recirculating such air.

A still further object is to provide means for washing and conditioning such air to be recirculated to the rooms.

Another and a particular object is to provide means controlled by the air flow created by the fan for automatically opening the furnace draft damper and closing the furnace check damper when the fan is actuated, said means automatically closing the draft damper and opening the check damper when the fan ceases to function.

And yet another object is to devise means for normally constricting the cross-sectional area of the air inlet to the furnace casing from the fan even after the latter commences to function and until the draft is opened for sufficient time to enable the furnace to heat up whereupon such inlet is automatically and fully opened.

With the above and other objects in view which will hereinafter appear my mechanism consists, in its preferred embodiment, of the construction and arrangement, all as hereinafter more particularly described and illustrated in the accompanying drawings in which:—

Fig. 1 represents a side elevation of a hot air furnace showing one form of my mechanism (partly in section) applied thereto.

Fig. 2 is a vertical cross-section through the line 2—2 (Fig. 1).

Fig. 3 is a similar view to Fig. 1 showing another form of my mechanism.

Fig. 4 is a vertical cross-section through the line 4—4 (Fig. 3).

Fig. 5 is a similar view to Figs. 1 and 3 only drawn to a larger scale showing a further adaptation of my invention which may be the preferred form.

Fig. 6 is a vertical cross-section thereof taken on the line 6—6 (Fig 5), and

Fig. 7 is a fragmentary longitudinal section of a further modified form.

Like characters of reference indicate corresponding parts in the different views.

The furnace 1 is provided with the usual surrounding casing 2 for heating the air introduced thereinto for circulation to the respective rooms of the house. A draft damper 3 is provided on the ash-pit door 4 and a typical check damper 5 having a counterbalance 5^x is also provided in the smoke-pipe 6.

Communicating with the casing 2 at the lower part thereof is a casing 7 provided at the end remote from the furnace with air inlets 8 which may be for the cooled air from the rooms to be reheated and recirculated to such rooms. A fan 9 operated by an electric motor 10 is provided in the casing 7 which is in circuit with a thermostat switch 11 positioned in one of the rooms of the house. A depending hinged apron 12 of very light material, such as aluminum, is transversely located in the casing 7 between the fan and the furnace casing. The area of such apron is preferably considerably less than the cross-sectional area of the casing 7.

The ends of the hinge rod 12^a protruding exteriorly of the casing 7 are provided with an adjustable counterbalance 12^x and with opposed arms 13 and 14 which are connected respectively by means of cables 15 and 16 passing over pulleys 17 and 18 with the furnace draft damper 3 and the check damper 5. The cable 15 is preferably provided with a weight 3^x to counterbalance the weight of the damper 3.

A water atomizing nozzle 19 is also provided in the casing 7 between the apron and the furnace casing, which nozzle is connected with a source of water supply 20. A screen 21 may be provided to cover the air inlet 22 from the casing 7 to the furnace casing 2.

The construction illustrated in Figs. 3 and 4 only differs from that shown in Figs. 1 and 2 in that the cable 15 instead of being connected to the draft damper 3 is connected to a similar flap damper 23 hinged to the air inlet end of a conduit 24 leading from the casing 7 to the ash-pit of the furnace, which damper serves to control the draft to the furnace and which, in this instance, is a forced draught created by the air flow from the fan.

In the construction illustrated in Figs. 5 and 6, the air inlet 22 to the furnace casing 2 from the casing 7 is provided with a hinged flap damper 25 having the weight 26 to keep it normally in the closed or upright position, said damper 25 being less in area than the cross-sectional area of the casing 7 to leave always an unclosured portion of the inlet 22, or alternatively perforated if the same size as the cross-sectional area of the casing.

A latch 27 normally engages the damper 25 to retain it normally upright even though the fan is functioning, such latch being connected to and operated by a thermostatically controlled actuating member which may well consist of a bi-metallic strip 28 mounted on the furnace proper and having a link 29 connecting its free end to the latch 27.

The modification illustrated in Fig. 7 only differs from the remaining forms in that the apron 12' is curved in cross-section, the concave side being towards the fan 9 and the top of the casing 7 has a boss 7ª to receive such apron when swung up by the air flow from the fan.

My mechanism operates as follows:—when the temperature in the rooms of the house is sufficiently high to keep the thermostatic switch 11 open, the flow of the air circulating into the casing 7 and through it into the furnace casing 2 is insufficient to operate the apron 12 and the damper 25 where such is employed, even though in the case of the latter damper the latch 27 has been actuated into the free position by the action of the furnace heat on the bi-metallic strip 28. Thus the apron 12 and the damper 25 constrict the area of the air inlet 22. The apron 12, in such circumstances is in the position illustrated in full lines in Figs. 1, 3 and 5 of the drawings with the result that the draft damper 3 or its alternative 23, where such is employed, are closed and the check damper 5 in the smoke pipe 6 is open. Consequently, the fire in the furnace is checked off.

When the temperature in the rooms of the house falls below a predetermined point the thermostatic switch 11 closes and the motor functions actuating the fan 10 causing a forced draft of the air in the casing 7 towards the inlet 22. Such air flow from the fan impinging upon the apron 12 swings it up into the position illustrated in dotted lines in Figs. 1, 3 and 5 of the drawings. The arms 13 and 14 are consequently swung downwardly and upwardly respectively with the result that the cables 15 and 16 respectively operate the furnace draft damper 3 (or its alternative 23, Figs. 3 and 4) into the open position and the check damper 5 into the closed position.

When the fan commences to operate, in the case illustrated in Figs. 5 and 6, there is an appreciable delay action to the opening of the damper 25 which, even though the air flow from the fan is impinging thereon, remains closed until the fire in the furnace burns up sufficiently to cause the heat generated to distort the bi-metallic strip 28 and lift the latch 27 clear of the damper 25, when the air flow swings the latter into the open position indicated in dotted lines in Fig. 5 against the weight 26. Thus the flow of air from the fan through the inlet 22 into the furnace casing 2 and thence to the registers is unrestricted.

Upon the temperature of the rooms rising to the required extent the thermostatic switch 11 opens throwing the motor 10 out of circuit and stopping the fan 9. The apron 12 thereupon drops to its normal upright position causing the cables 15 and 16 respectively to close the draft damper and open the check damper, and where the damper 25 is employed causing such damper to again assume the closed position under the influence of the weight 26. When the heat in the furnace again drops the bi-metallic strip restores itself to its initial position causing the latch 27 to again engage the damper 25.

The provision of the water atomizing nozzle 19 causes an aqueous mist to be produced in the casing 7 with the result that the recirculated air from the air inlet 8 passing through such casing is washed and conditioned before being reheated and passed again to the rooms ensuring that such heated air shall always be clean and of the requisite moisture content.

The counterbalancing weights 3ˣ, 5ˣ and 12ˣ are respectively preferably slightly less than the weights of the damper 3, damper 5 or apron 12 so that the latter will assume their normal positions when their actuating means is inoperative and when operating the only effort necessary for the actuating means to achieve is the actual swinging of these members, the actual weight thereof being substantially taken care of by the counterbalances.

A mechanism constructed according to my invention will be automatic in operation providing an increased supply of air when the motor driven fan is functioning and the drafts are opened up. Moreover, such fan ensures a positive circulation of warm air to all the registers of the house irrespective of their location. Furthermore, when the fan is not functioning and the drafts are therefore closed, the cross-sectional area of the air inlet to the furnace casing is automatically reduced thus preventing the furnace overheating the house or building in mild weather. In addition the control of the dampers being mechanically effected dependent upon the air flow from the fan, much economy is achieved in the construction of the mechanism, and complicated and expensive electrical appliances for operating the dampers are avoided.

What I claim as my invention is:

1. In a mechanism of the character described, the combination with the draft and check dampers of a hot air furnace and the air heating casing thereof, of means for introducing cold air into the air heating casing under forced draught, and means directly actuated by the impingement of the incoming forced draught cold air thereon for opening the draft damper and closing the check damper.

2. In a mechanism of the character described as claimed in claim 1, wherein the means directly actuated by the impingement of the incoming forced draught cold air thereon for opening the draft damper and closing the check damper comprises a hinged apron in the path of the air flow of the cold air, and operative connections between the apron and the draft and check dampers.

3. In a mechanism of the character described, the combination with the draft and check dampers of a hot air furnace and the air heating casing thereof, of a cold air casing communicating with the air heating casing and having a cold air inlet, a fan assembly including an actuating electric motor therefor in said cold air casing, said electric motor being connected to a source of current, a thermostatic control for said motor circuit adapted to close the motor circuit upon the temperature of the rooms falling below a predetermined point, a hinged apron transversely disposed in the cold air casing between the fan and the air heating casing, and operative connections between the apron and the draft and check dampers for opening the draft damper and closing the check damper upon the air flow from the fan, when operating, swinging the apron.

4. In a mechanism of the character described as

claimed in claim 3 wherein a subsidiary means is provided in the cold air casing between the apron and the air heating casing for constricting the cross-sectional area thereof, said air flow from the fan when operating being adapted to move the means whereby the cross-sectional area of the cold air casing is unrestricted, and means for temporarily preventing the said means so functioning until the heat of the furnace has reached a predetermined degree as a result of the regulation of the draft and check dampers.

5. In a mechanism of the character described as claimed in claim 3, a swingable damper or flap transversely mounted in the cold air casing between the apron and the air heating casing and adapted to be swung open by the air flow from the fan when operating, means for normally retaining said swingable damper in the closed position, and a thermostatic controlled latching means associated with the furnace for temporarily holding said swingable damper closed even though the fan is operating until the furnace heat has risen to a predetermined degree as a result of the regulation of the draft and check dampers.

6. In a mechanism of the character described, the combination with the draft and check dampers of a hot air furnace and the air heating casing thereof having a cold air inlet, of means directly actuated by the impingement of the incoming cold air thereon for actuating the draft damper into an open position and the check damper into a closed position.

7. In a mechanism of the character described, the combination with an air heating casing of a hot air furnace, of a cold air casing communicating with the air heating casing for receiving cold air to be delivered to the latter, a fan in the cold air casing, an electric motor for driving the fan connected to a source of current supply, thermostatic controlled means for closing the motor circuit upon the room temperature falling below a predetermined point, a hinged apron extending transversely of the cold air casing normally constricting its cross-sectional area, said apron upon the fan being operated due to the air flow therefrom being swung to an inoperative position, a second means for normally constricting the cross-sectional area of the cold air casing, said means upon the fan being operated due to the air flow therefrom being moved into an inoperative position, and thermostatic means associated with the furnace and connected to the second means for restricting the opening of the same under the influence of the air flow from the fan until the heat of the furnace has reached the required degree to heat the full amount of cold air delivered to the air heating casing.

8. In a mechanism of the character described, the combination with an air heating casing of a hot air furnace having a cold air inlet, of movable means for normally constricting the area of the cold air inlet, and thermostatic means associated with the furnace for temporarily holding said cold air inlet area constricting means in its operative position until the air in the air heating casing reaches a predetermined temperature whereupon the said cold air inlet area constricting means is moved into an inoperative position by the impingement of the cold air thereon.

9. In a mechanism of the character described, the combination with an air heating casing of a hot air furnace, of a cold air casing communicating with the air heating casing for receiving cold air to be delivered to the latter, a fan in the cold air casing, means for driving the fan to impel the cold air received into the cold air casing into the air heating casing, means for normally constricting the cross-sectional area of the cold air casing, said means upon the fan being operated due to the air flow therefrom being moved into an inoperative position, and thermostatic means associated with the furnace and connected to the second means for restricting the opening of the same under the influence of the air flow from the fan until the heat of the furnace has reached the required degree to heat the full amount of cold air delivered to the air heating casing.

10. A construction as claimed in claim 9 wherein the means for constricting the cross-sectional area of the cold air casing comprises a swingable damper or flap, and a thermostatic controlled latching means associated with the furnace for temporarily holding the swingable damper closed even though the fan is operating until the temperature of the furnace heat has risen to a predetermined degree.

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