June 10, 1958 C. H. PETERS 2,838,243

BLOWER SPEED CONTROL FOR FORCED AIR HEATING SYSTEMS

Filed Dec. 13, 1954

FIG. 1

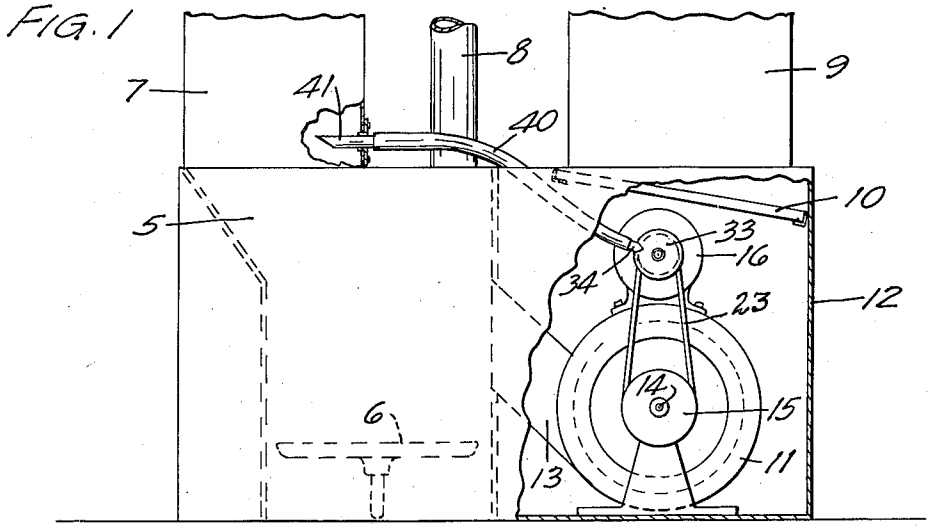


FIG. 3

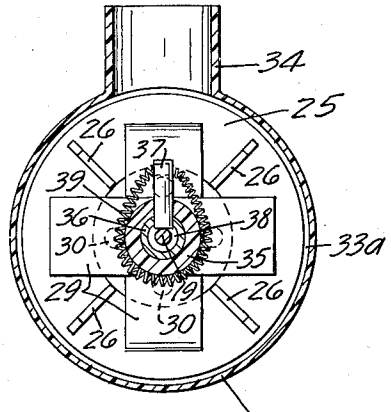


FIG. 4

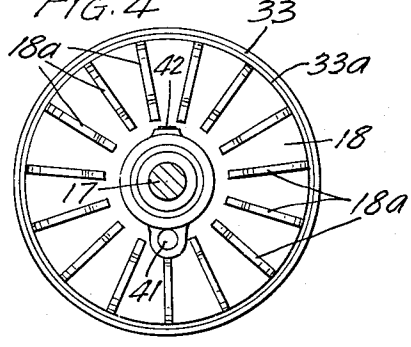
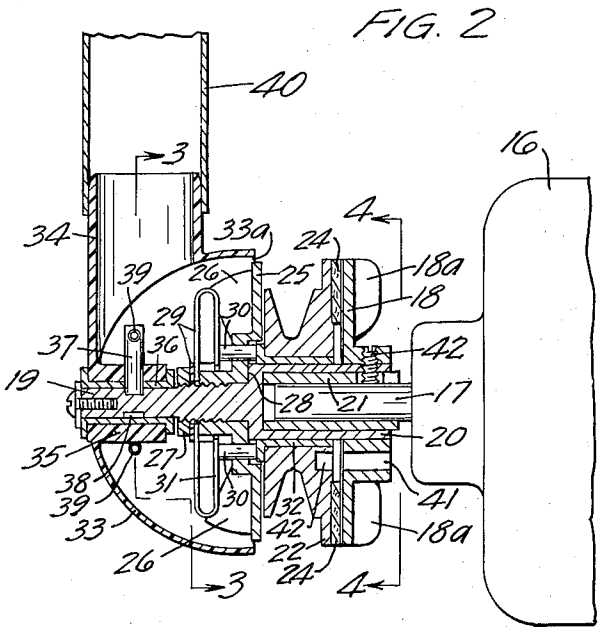


FIG. 2



INVENTOR
CLAUDE H. PETERS
BY John E. Thysen
ATTORNEY

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BLOWER SPEED CONTROL FOR FORCED AIR HEATING SYSTEMS

Claude H. Peters, St. Paul, Minn.

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3 Claims. (Cl. 236—10)

This invention relates to blower speed controls particularly adapted for warm air heating systems wherein air is forced from a suitable source such as a furnace or other heater to the space to be heated by a blower operating at speeds which are proportional to the temperature of the air that is to be delivered to such space. The present invention is an improvement on the air conditioning system described and claimed in my Patent No. 2,158,250, granted May 16, 1939.

It is an object of my invention to provide a low cost control of this class which is unusually simple to install and reliable in operation.

A particular object is to provide a simple, compact, non-electrical blower speed control unit having means for modulating the velocity of the air circulated by the blower to avoid drafts of cold air and to minimize stratification of the air in the space to be heated.

The invention also includes certain other novel features of construction which will be more fully pointed out in the following specification and claims.

Referring to the accompanying drawing which illustrates, by way of example and not for the purpose of limitation, a preferred embodiment of my invention:

Figure 1 is a somewhat diagrammatic elevational view showing one of my inmproved blower speed controls associated with a heating system of common type;

Fig. 2 is a vertical sectional view showing details of my improved speed control;

Fig. 3 is a cross section taken approximately on the line 3—3 of Fig. 2, and

Fig. 4 is a section through the motor shaft taken on the line 4—4 of Fig. 2.

As shown in Fig. 1, my device may be used for a heating system of common type having a furnace 5, an intermittently operable burner 6, a hot air outlet duct or plenum chamber 7 to conduct the heated air to the several rooms of the space to be heated (usually through a plurality of branch ducts, not shown) and a smoke pipe 8. The air is usually circulated through the space to be heated and at least a part of it is returned to the furnace through a return air conduit 9, a filter 10, a blower 11 in a cabinet 12, and a blower discharge conduit 13 adapted to conduct the air to be heated to the furnace 5. The blower 11 may be of the common type having a shaft 14 upon which is fixed a driving pulley 15.

Such heating system has an electric motor 16 and a rotary motor shaft 17 upon which my improved speed control is mounted. This control includes a clutch disk 18 and an extension shaft 19 fixed on the shaft 17. The extension shaft 19 is formed integrally with a sleeve portion 20 containing a bushing 21 fitting on the shaft 17.

Revolubly mounted on the sleeve portion 20 of the shaft 19 is a pulley 22 adapted to be operatively connected by a belt 23 (Fig. 1) to the blower pulley 15. The face of the pulley 22 adjacent to the disk 18 has adhesively secured thereto an annular friction disk 24 adapted to slidably engage the face of the disk 18 whereby the pulley 22 may be driven at a multiplicity of speeds dependent upon the pressure exerted by the pulley on the fixed disk 18.

A fan indicated generally by the numeral 25 and having a plurality of radially extending blades 26 is fixed on the shaft 19. A portion of the shaft 19 is threaded and is fitted with a lock nut 27 adapted to clamp a hub portion of the fan against a shoulder 28 formed on the shaft.

Bimetallic heat responsive members 29 are fixed on the shaft extension 19 and arranged to actuate pins 30 extending through openings in the hub portion of the fan to actuate the pulley 22 toward the clutch disk 18. The bimetallic members 29 are perforated to receive the shaft extension 19 and are arranged to be clamped by the lock nut 27 against the hub portion of the fan 25 so that the members 29 rotate with the shaft extension 19. As best shown in Fig. 2, the elements 29 are approximately U-shaped and have end portions 31 engaging the pins 30. The latter are preferably constructed from material having a low coefficient of expansion and limited degree of compressibility, for example, nylon plastic composition. These pins project toward the pulley 22 from the openings in the hub portion of the fan 25 to engage an annular flange formed on an otherwise tubular bearing member 32. This bearing member may be of the porous, permanently lubricated type, for example, "Oilite."

The fan 25 and heat responsive elements 29 located adjacent to the fan are enclosed in a casing 33, preferably of approximately semi-spherical shape, adapted to be supplied with warm air through an intake port 34. To retain the casing 33 in place on the shaft extension 19, the casing may be formed with a bearing member 35 within which is mounted a self-lubricating bushing 36, the latter fitting over the extension 19 so that it is free to rotate while the casing is held stationary. To secure the casing on the shaft, a pin 37 may be extended through perforations in the bearing members 35 and 36 to engage the shaft extension 19 in an annular recess 38 formed therein. The pin 37 may be biased toward and held in the recess 38 by a spring 39. The pin 37 is accessible through the intake port 34 for insertion and removal. It will be evident that other means for retaining the casing 33 on the supporting shaft may be employed.

A flexible conduit 40 is provided to supply warm air to the casing 33 from the plenum chamber 7 or other source of warm air. The intake end of the conduit 40 may be provided with an expansible fitting 41 adapted to be extended into the plenum chamber through an opening in the wall thereof. In most installations it is also necessary to extend the conduit 40 through an opening in a wall of the blower cabinet 12 in order to reach the plenum chamber or other source of warm air. Air drawn into the casing 33 through the conduit 40 and port 34 is discharged from the casing through an annular opening 33a between the rim of the casing and periphery of the fan 25.

The friction disk 24 may be constructed from suitable wear resistant material such as cork or brake lining material and the fixed clutch disk 18 is preferably formed with heat dissipating blades 18a. As hereinbefore indicated, the disk 24 is preferably secured to the face of the pulley 22 and arranged to slidably engage the opposing face of the clutch disk 18. Formed in the hub portion of the clutch disk 18 is a hole 41 which may be aligned with a recess 42 in the pulley 22 to receive a locking pin or set screw (not shown) for rendering the clutch inoperative when it is desired to use the blower for cooling purposes or when for any reason variable blower speeds are not required.

Installation of my improved blower speed control is usually simple, easy and requires a minimum of skill. The

control unit assembly shown in Fig. 2 is merely substituted for the ordinary motor pulley on the motor shaft **17**. The unit may be secured in place on the motor shaft by means of a set screw **42** or by other suitable means. The casing **33** is then connected by the flexible member **40** to receive warm air from the plenum chamber or other source, after cutting suitable openings through the cabinet **12** and wall of the plenum chamber **7** to permit the extension of the conduit **40** to the source of heated air.

In forced air heating systems of the common or conventional types the blower motor is under control of a thermostatic element located in the plenum chamber or warm air stream whereby the blower is caused to start when the temperature at such control element reaches a predetermined degree, usually at some point between 80 degrees F. and 100 degrees F. This thermostatic control also operates to stop the blower motor when the temperature drops to a predetermined degree which is usually a few degrees lower than the starting temperature. One such control is illustrated and described in my Patent No. 2,158,250. The present invention is designed for use with a heating system having such a thermostatic blower control and the usual burner controls for starting and stopping the burner in response to increasing and decreasing demands for heat, as indicated by a thermostat located in the space to be heated. It is desirable to set the blower control so that the blower motor will start when a temperature of approximately 90 degrees is reached in the plenum chamber and will stop when the temperature therein drops to a degree or two below the starting temperature.

Operation

With my improved blower speed control installed as hereinbefore described, the fan **25** and adjacent heat responsive members **29** are rotated at the speed of the blower motor whenever the latter is in operation. Consequently heated air from the plenum chamber or other source is drawn through the flexible conduit **40** into the casing **33** and is discharged through the annular opening **33***a*. The heat responsive members **29** are so designed and arranged in relation to the clutch and pulley on the motor shaft **17** as to exert little or no pressure through the pins **30** upon the pulley when the temperature of the air in the casing **33** is at or below the minimum for blower operation. Thus, in normal operation when the blower is started, the pulley **22** rotates freely on the shaft **17** and the blower does not circulate air through the system until the temperature of the air in the casing causes flexing of the bimetallic members **29** and resulting pressure on the clutch surfaces sufficient to rotate the pulley **22** at a low speed. Thereafter, as the temperature of the heated air rises, the bimetallic elements **29** gradually exert progressively increasing pressure on the pulley and clutch surfaces. This results in increases in blower speed which are approximately proportional to the increases in temperature of the air passing through the casing **33**. When the temperature in the plenum chamber reaches a predetermined maximum desirable degree the members **29** exert sufficient pressure on the pulley **22** and clutch surfaces to turn this pulley at the full motor shaft speed, i. e., with no slippage between the contacting surfaces of the friction disk **24** and clutch disk **18**.

The burner supplying heat to the furnace **5** is usually cut off when the demand for heat is satisfied, thereby causing a more or less gradual drop in the temperature of the air in the plenum chamber **7**. The lower temperature air, being conducted to the heat responsive members **29**, causes these members to exert less pressure toward the pulley **22** and increasing slippage between the friction clutch surfaces so that there is a corresponding reduction in the speed of the pulley **22**.

It will thus be apparent that the speed of the blower driven from the pulley **22** is at all times approximately proportional to the temperature of the warm air at the source or in the plenum chamber **7**. Since the blower operates only when the air supply is appreciably warm, I thereby eliminate drafts of cold air and minimize stratification of the air in the space to be heated.

By mounting my multiple speed clutch, heat responsive elements and fan on the motor shaft and in a compact casing supplied with warm air from the source I greatly facilitate the installation of my control on warm air heating systems of various capacities and I improve the efficiency, sensitivity and reliability of the control. This will be evident when it is considered that the great majority of the ordinary domestic forced air heating systems have motor shafts of one of two sizes, i. e., either one-half inch or three-quarter inch diameter. My control unit may be mounted on either size shaft by using the bushing **21** on the smaller shaft and by omitting the bushing where the hollow portion **20** of the shaft extension **19** is to be mounted directly on a shaft **17** of the large common size.

Greater sensitivity, reliability and efficiency are obtained by reason of the fact that the motor shaft is rotated at a higher speed than the blower shaft, thereby making it feasible to use a small fan **25** to circulate air between and around the heat responsive members **29** at a velocity sufficient to insure quick and accurate correspondence of the air temperature in the casing **33** with that in the plenum chamber **7** or other source of heated air.

The power or capacity of my control unit may be adjusted to suit heating systems of various capacities by providing bi-metallic elements **29** of suitable size and power for the several installations. The required range of clutch operating pressures for each installation may thus be provided in a single, otherwise standardized, control unit.

I claim:

1. For a forced air heating system having a blower, a motor for operating said blower and a source of warm air, said motor having a rotary shaft, the improved blower speed control which comprises, driving means for the blower revolubly mounted on said motor shaft, a multiple speed clutch for operatively connecting said driving means to said shaft, heat responsive means carried by said shaft and operatively connected to said clutch, a fan mixed on said shaft adjacent to said heat responsive means, a normally stationary casing enclosing said heat responsive means and fan, and an auxiliary conduit for air extending from said source of warm air to said casing and having one end connected to said casing and the other end communicating with said source, said shaft being freely revoluble relative to said casing and said casing having an unrestricted intake opening communicating with said auxiliary conduit, said fan being operative to force air from said source through said conduit and casing while the motor is operating to thereby subject said heat responsive means to the temperatures of air drawn from said source.

2. For a forced air heating system having a blower, a motor for operating said blower and a source of warm air, said motor having a rotary shaft, the improved blower speed control which comprises, driving means for the blower revolubly mounted on said motor shaft, a multiple speed clutch for operatively connecting said driving means to said shaft carried by said shaft, heat responsive means comprising bimetallic elements carried by said shaft, a fan fixed on said shaft adjacent to said heat responsive means and formed with a plurality of spaced openings extending through the fan from one side to the other in parallel relation to said shaft, clutch actuating pins slidably fitting in said openings and disposed to transmit thurst from said bimetallic elements to said clutch, a casing enclosing said heat responsive means and fan, and a conduit for air extending from said source of warm air to said casing, said fan being operative to force air from said source through said conduit and casing while the motor is operating to thereby

subject said heat responsive means to the temperature of the air drawn from said source.

3. For a forced air heating system having a blower, a motor for operating said blower and a source of warm air, said motor having a rotary shaft, the improved blower speed control which comprises, driving means for the blower revolubly mounted on said motor shaft, a friction clutch adapted to operate said driving means at a multiplicity of different speeds carried by said shaft, heat responsive means carried by said shaft and operatively connected to said clutch, a fan fixed on said shaft adjacent to said heat responsive means, a normally stationary casing enclosing said heat responsive means and fan, interengaging means on said casing and shaft confining said casing against longitudinal movement relative to the shaft and permitting the shaft to rotate relative to the casing, and a conduit for air extending from said source of warm air to said casing, said fan being operative to force air from said source through said conduit and casing while the motor is operating, to thereby subject said heat responsive means to the temperature of the air drawn from said source and to operate said blower at speeds which are proportional to the temperatures of the air in said casing.

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