Sept. 2, 1958 A. B. NEWTON 2,850,242

AUTOMATICALLY CONTROLLED AIR-MIXING CABINET

Filed May 3, 1956

Fig. 1

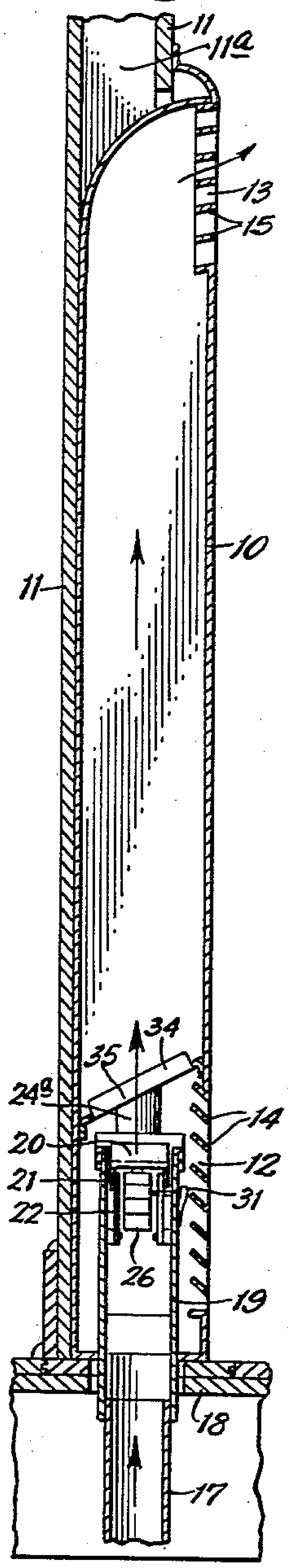


Fig. 2

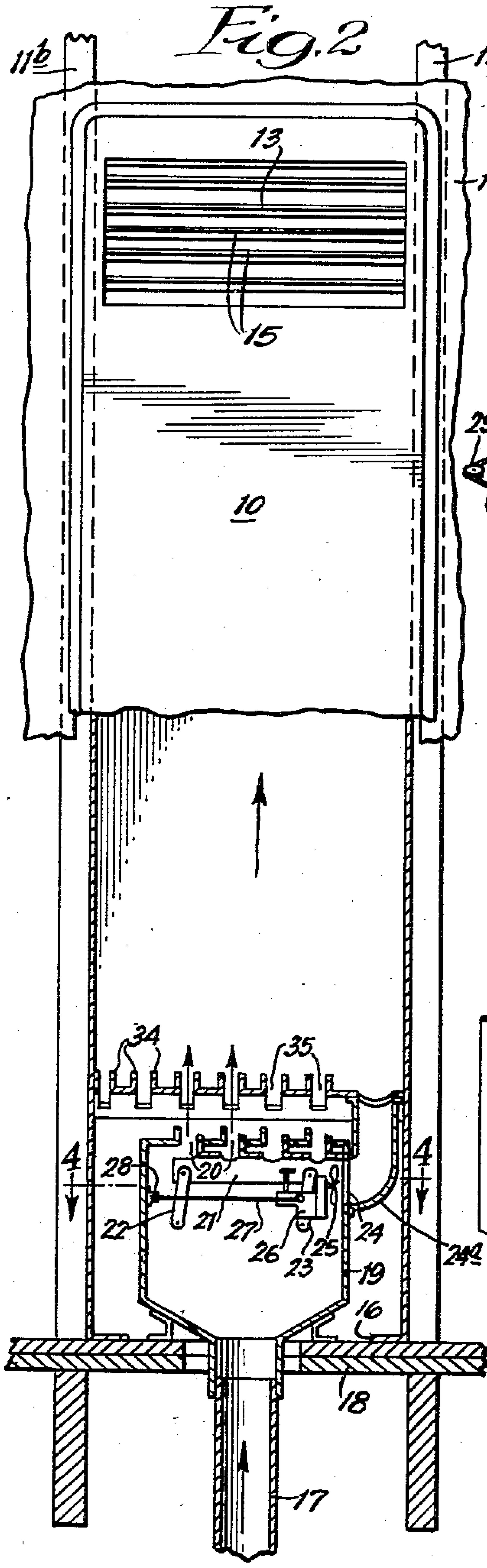


Fig. 3

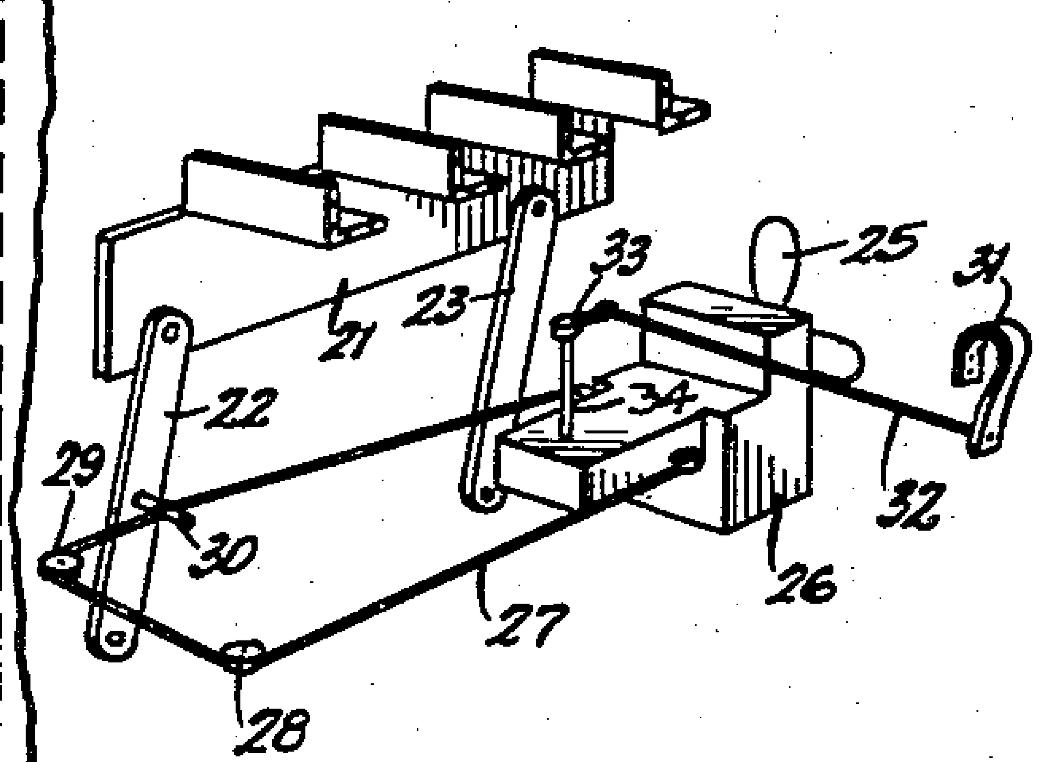


Fig. 4

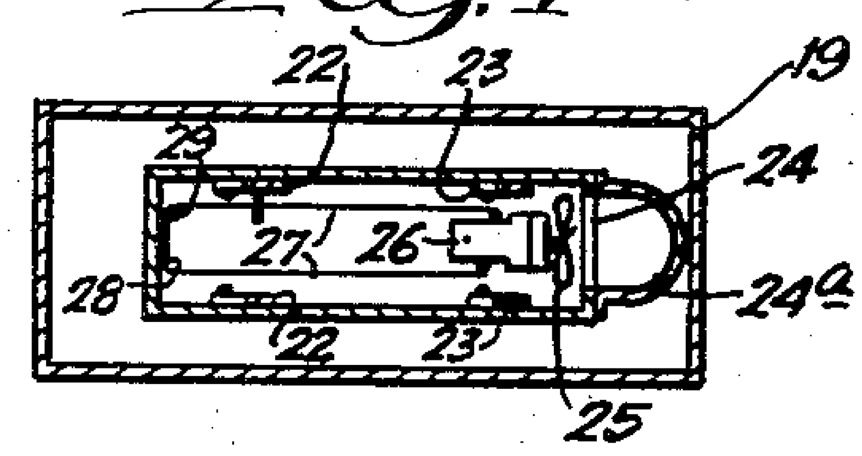
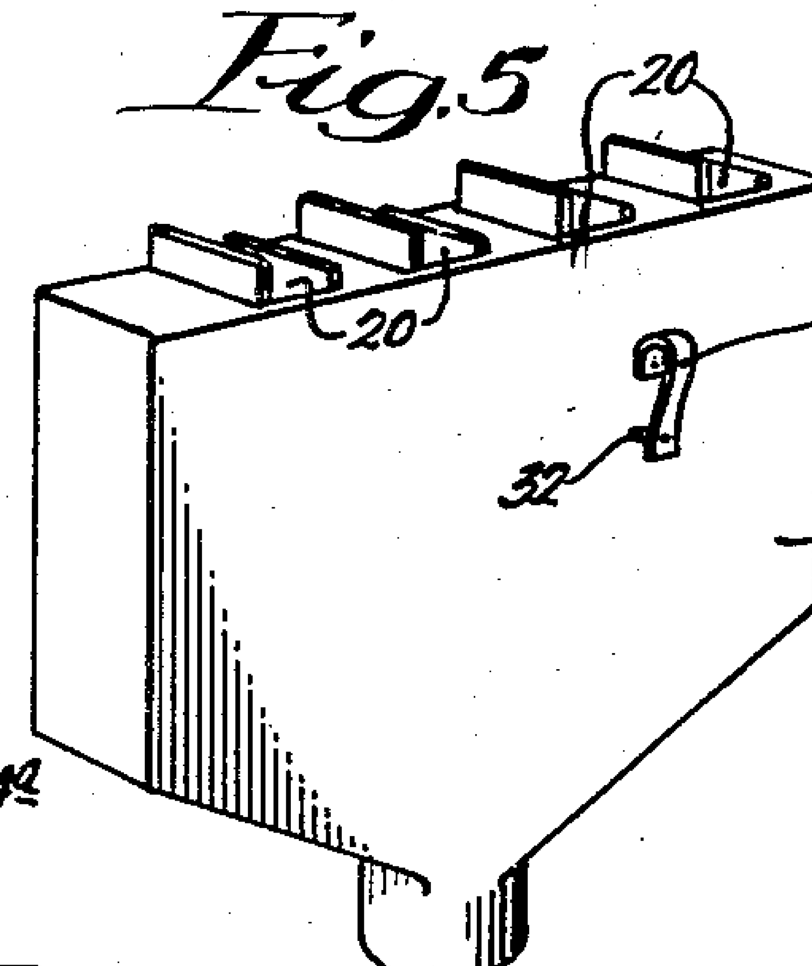


Fig. 5



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AUTOMATICALLY CONTROLLED AIR-MIXING CABINET

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This invention relates to an automatically controlled air-mixing cabinet, which has particular utility for use in supplying either heated or cooled air to rooms of a dwelling house.

So-called air-mixing cabinets are used most commonly in connection with forced air heating systems. The air-mixing cabinets are commonly mounted between the studding in the various rooms of a house, being connected to the furnace by means of air supply ducts. Such cabinets usually are in the form of hollow metal casings with openings at the upper and lower end portions of the front wall. These openings may be provided with a grill for directing the desired flow of air, one of the openings serving as the inlet for room air into the cabinet and the other opening has an outlet for the mixed air from the cabinet to the room. The duct from the furnace discharges the heated air into the cabinet at a point adjacent the room air inlet opening, thereby aspirating the room air into the cabinet and causing it to be mixed with the heated air before it is discharged into the room through the mixed air outlet opening. Cooled air can also be supplied in the same way.

While air-mixing cabinets of the type just described are quite advantageous for achieving and maintaining uniform air temperatures in the rooms of a house, they have not heretofore provided a satisfactory answer to the problem of maintaining approximately uniform air temperatures between different rooms. Consequently, there is a need for providing automatic control means for air-mixing cabinets which will make it possible to achieve this result, or to maintain a selected temperature in a particular room of a house substantially independently of the temperature being maintained in other rooms of the same house.

It is therefore a general object of this invention to provide an automatically controlled air-mixing cabinet which provides a means for overcoming the problems and difficulties and achieving the results which have just been discussed. More specifically, it is an object to provide an automatically controlled air-mixing cabinet which delivers mixed air for either heating or cooling the room in response to the existing temperature of the room air, and which is adapted to terminate or reduce the delivery of the mixed air to the room when a predetermined temperature is reached, thereby preventing overheating in winter and overcooling in summer. Further objects and advantages will appear as the specification proceeds.

This invention is shown in an illustrative embodiment in the accompanying drawing, in which—

Figure 1 is a vertical sectional view of a wall-mixing cabinet embodying the present invention, as it might appear installed in the wall of a room; Fig. 2, a front view of the installed mixing cabinet of Fig. 1, the front wall of the cabinet being partially broken away to disclose the elements of particular importance in connection with this invention; Fig. 3, a perspective view of certain key elements in the cabinet of Figs. 1 and 2, the elements being related to each other as in the assembled structure; and Fig. 4, a sectional plan view of the mixing cabinet, taken on line 4—4 of Fig. 2; and Fig. 5, a perspective view of the conditioned air duct extension in the structure of Figs. 1 and 2, showing the temperature-sensing element on the front wall thereof.

This invention is based in part on the concept of controlling the quantity of mixed air discharged into a room from an air-mixing cabinet by means of a damper associated with the outlet from the conditioned air duct into the mixing cabinet, and providing means for automatically positioning this damper in response to the temperature condition of the room air. The novel features, cooperative relationship, and specific functions embraced within my invention, as reduced to practice, will be brought out in the following detailed discussion of the embodiment thereof illustrated in the accompanying drawing.

Looking first at Figs. 1 and 2, there is shown a cabinet **10** which is adapted for the mixing of room air at one temperature with conditioned air at another temperature and then discharging the mixed air into the room at an intermediate temperature. As shown, cabinet **10** is installed in a wall **11** between studs **11***a* and **11***b*, the cabinet **10** extending vertically therebetween. On the front wall of cabinet **10** there extends a room air inlet opening **12** and a mixed air outlet opening **13**. While the room air inlet is preferably at one end of the cabinet and the mixed air outlet at the other end of the cabinet, as shown, the relative positions of these inlet and outlet openings can be reversed. Usually, however, the wall cabinets will be installed with the room air inlet adjacent the bottom end portion thereof and the mixed air outlet adjacent the top end portion thereof. Also, these openings will usually be provided with grills, such as the grill **14** for opening **12** and the grill **15** for opening **13**, in the embodiment shown in the drawing. It will be understood, however, that the present invention can be used in combination with other forms and types of mixing cabinets and air blenders. The recirculated air inlet may be closely associated with the mixed air outlet.

In the bottom wall of the cabinet **10** there is provided a conditioned air inlet **16**, which is adapted to communicate with an air duct **17**. In the illustration given, duct **17** extends downwardly from floor **18** to a furnace or airconditioning unit (not shown). It will be noted that duct **17** is of relatively small cross-sectional area compared to cabinet **10**, thereby being adapted for supplying conditioned air under pressure to the interior of cabinet **10**. In other words, the furnace or airconditioning unit would be equipped with a blower for delivering air through distribution ducts therefrom, such as duct **17**, at a relatively high pressure and velocity compared to a gravity distribution system.

In the illustration given, duct **17** has an extension **19** within cabinet **10** terminating in a conditioned air outlet **20** adjacent the room air inlet **12**. As is preferred, the conditioned air outlet **20** is oriented to discharge the conditioned air in the direction of the mixed air outlet **13**, thereby aspirating a stream of room air into the cabinet through room air inlet **12**.

There is also provided mechanically operable damper means disposed across the conditioned air outlet **20** for controlling the discharge of conditioned air into cabinet **10**. In the illustration given, the damper means consists of a swingably supported plate **21**, which is mounted for horizontal or transfer swinging movements on pivot arms **22** and **23**. The open position of the plate damper **21** is shown in Fig. 2 of the drawing, and it will be understood that the damper can move to the left as shown in this figure to substantially close the outlet **20** from duct extension **19**.

In addition to conditioned air outlet **20**, duct extension **19** provides a by-pass opening or outlet **24** through which a portion of the conditioned air from within extension **19** can pass into cabinet **10**. By-pass opening **24** is also arranged so that the portion of the conditioned air discharged therethrough will also tend to aspirate a stream of room air into cabinet **10** through room air inlet **12**. An air turbine **25** is arranged in relation to by-pass **24** so that the conditioned air discharged through the by-pass drives the air turbine. With the construction shown, air will be discharged through by-pass **24**, thereby operating turbine **25**, whenever air is being supplied through duct **17**, since the by-pass **24** is open at all times and is not subject to damper control.

Any suitable mechanical means can be provided in accordance with this invention for operably connecting turbine **25** with the damper **21** which is constructed and arranged so that the turbine can selectively shift the damper to any position between its open and closed positions. Since the specific mechanical means for accomplishing this result are not critical for the present invention, and since a variety of such mechanical means are well known in the art, it is not believed that it will be necessary to describe a specific mechanical means in detail. However, in the embodiment shown in the drawing, I have illustrated a mechanical means which was heretofore developed by me, and is described in my Patent No. 2,537,367, issued January 9, 1951. Reference is thereby made to this patent for the specific constructional details. For present purposes it should be sufficient to point out that the rotary motion from turbine **25** is transferred through a gear box **26**, and is applied to a cord loop **27** which extends from gear box **26** around pulleys **28** and **29**, and is attached to pivot arm **22** by means of a pin **30**. With this arrangement, when cord loop **27** is pulled in one direction, damper **21** will be opened, while upon the cord loop being moved in the other direction, damper **21** will be closed. As a substitute actuating means, reference is made to my Patent No. 2,533,175, issued December 5, 1950.

A mechanical selector means is also provided and associated with the mechanical actuating means, as described in my cited Patent No. 2,537,367. This selector means includes a temperature-sensitive element **31**, which in the illustration given consists of a hook-shaped bimetallic strip, which has its upper end rigidly connected to the front wall of duct extension **19**. The lower free end of strip **31** thus moves toward or away from the front wall of duct **19** as its temperature varies due to the differential expansion and contraction of its metallic components, as is well known in the art. Extending into duct **19** and connected to the free end of strip **31** is a connecting rod **32** which operates a crank arm **33** that is connected to the top of a control shaft **34**, as shown more clearly in Fig. 3. In the manner described in detail in my Patent No. 2,537,367, the rotation of control shaft **34** produced by the temperature-responsive movements of strip **31** deflects the selective reversal of the gear drive within gear box **26**, so that the rotation of turbine **25** will selectively open and close damper **21** in response to the movements of strip **31**. It will be understood that gear box **26** also includes a clutch device which allows turbine **25** to continue to rotate after it has either completely opened or completely closed damper **21**, and this is also described in detail in my Patent No. 2,537,367.

For best results, it is preferred that the front wall of duct extension **19**, as shown in the drawing, should be spaced from the front wall of cabinet **10** and directly opposite the room air inlet **12**. Also, the temperature-sensitive element **31** should be mounted on the front wall of duct extension **19** so that it will be directly in the path of the incoming room air through opening **12** for responding to the temperature of the room air. In this way, the selector means can operate to selectively open and close the damper means automatically at certain predetermined temperature conditions of the temperature-sensitive element and thereby of the room air. It is also desirable to have at least one other wall, and preferably all of the other walls of the duct extension **19** spaced from the adjacent walls of cabinet **10**. This permits the by-pass **24** to be located in one of the other walls of the duct extension **19** than the front wall, while at the same time assuring that the air discharged through by-pass **24** will flow upwardly towards the mixed air outlet **13**, rather than coming into contact with the temperature-sensitive element **31**. If desired, a small duct **24*a*** can extend from opening **24** in an upwardly direction to minimize mixing of the by-passed air with the air entering opening **12**.

As just indicated, it is important that the temperature-sensitive element **31** during all of the time when air is being supplied to duct **17** should be kept in contact with and at substantially the same temperature as the air in the room. To prevent the conditioned air discharged through outlet **20** or the mixed air from coming into contact with the temperature-sensitive element **31**, it is desirable to provide a backflow control plate **34** within cabinet **10**, as shown more clearly in Figs. 1 and 2. Plate **34** is disposed across cabinet **10** inwardly of but closely adjacent to room air inlet **12** and conditioned air outlet **20**, and also inwardly of the temperature-sensitive element **31**. Plate **34** is provided with a plurality of openings **35** therethrough which are arranged to promote a unidirectional flow of mixed air towards the mixed air outlet **13**, thereby tending to prevent the contacting of the temperature-sensitive element **31** with the mixed air. The slots of opening **20** preferably should be vertically aligned with slot openings **35**. In the illustration given, duct **24*a*** extends through one side of plate **34**.

The operation of the air-mixing cabinet of this invention has already been largely indicated, but it will now be briefly summarized for purpose of clarity. Whenever air is being supplied under pressure through duct **17** to duct extension **19**, it will flow through by-pass **24**, thereby causing turbine **25** to rotate. The by-passed air will also flow upwardly through duct **24*a*** toward the mixed air outlet **13**, thereby tending to aspirate some of the room air into cabinet **10** through inlet **12** and over sensitive element **31**. Thus, for example, if the room air is at a lower temperature than that desired and heated air is in duct **17**, damper **21** will automatically be shifted to its open position by the effect of the room air on temperature-sensitive element **31**, the movement of temperature-sensitive element **31** transferred through rod **32** and crank **33** to control shaft **34** which sets the gear within gear box **26** to move cord loop **27** in the necessary direction to open damper **21** by means of the power generated with turbine **25**. On the other hand, whenever the temperature of the incoming room air reaches a predetermined maximum temperature, the temperature-sensitive element **31** will have moved sufficiently to reposition shaft **34** for the reversal of the gear drive within gear box **26**, and thereby cord loop **27** will be driven in the opposite direction to close damper **21**. However, damper **21** will automatically open again as soon as the temperature in the room falls to the minimum temperature for causing element **31** to return to its original position. This is due to the fact that air continues to flow through by-pass **24**, driving turbine **25**, and aspirating sufficient room air to inlet **12** to keep the temperature-sensitive element **31** directly responsive to changes in room air temperature exteriorly to cabinet **10**.

If cooled air is being supplied through duct **17**, the action will be reversed. Instead of the slots at **20** being closed by a temperature rise in the room, they are opened. This reversing can also be effected through the action of temperature-sensitive element **31**, as described more fully in my Patent No. 2,537,367. Further, the changeover from heating to cooling is automatically effected.

One of the important advantages of the construction just described is that the temperature-sensitive element can be located inside the air-mixing cabinet and need not be visible within the room, while at the same time it remains fully and directly responsive to changes in room air, whenever forced air is being supplied to the duct communicating with the air-mixing cabinet. Another advantage is that relatively high pressure air is available for driving turbine **25**, thereby providing additional power for the mechanical actuation of the damper. Still another desirable feature of the preferred embodiment, as shown in the drawing, is that the temperature-sensing element is protected against coming into contact with the incoming conditioned air or the mixed air.

As can be seen from the above description, this invention is based on a new principle. The heated or cooled air is delivered to the blender at a relatively high pressure, higher than that at which it can be delivered directly to the room. This added pressure is used to operate a damper means to control the quantity of air in response to changes in room air aspirated past a sensing element by flow from the high pressure air system.

While in the foregoing specification this invention has been described in relation to a specific embodiment thereof and many details have been set forth for purpose of illustration, it will be apparent to those skilled in the art that the invention is susceptible to other embodiments and that many of the details described herein can be varied considerably without departing from the basic concepts of the invention.

I claim:

1. In combination with a cabinet adapted for the mixing of room air at one temperature with conditioned air at another temperature and then discharging the mixed air into the room at an intermediate temperature, said cabinet providing a room air inlet, a mixed air outlet, and a conditioned air inlet adjacent said room air inlet, a duct communicating with said conditioned air inlet thereof and being adapted for supplying conditioned air under pressure to the interior of said cabinet, said duct having an extension within said cabinet terminating in a conditioned air outlet adjacent said room air inlet, said conditioned air outlet being oriented to discharge the conditioned air in the direction of said mixed air outlet, thereby aspirating a stream of room air into said cabinet through said room air inlet, mechanically-operable damper means disposed across said conditioned air outlet for controlling the discharge of conditioned air into said cabinet, said duct extension also providing a by-pass for a portion of the conditioned air from within said extension to within said cabinet arranged and disposed adjacent said room air inlet so that the portion of the conditioned air discharged through said by-pass also tends to aspirate room air into said cabinet, air turbine means arranged in relation to said by-pass so that the conditioned air discharged through said by-pass drives said air turbine means, mechanical means operably connecting said means and said damper means, said mechanical means being constructed and arranged so that said turbine means can selectively shift said damper means between its open and closed positions, mechanical selector means associated with said mechanical means and including a temperature-sensitive element positioned within said cabinet in the path of the incoming room air so as to be directly responsive to the temperature thereof, and said selector means operating to automatically and selectively direct the opening and closing of said damper means by said turbine means in response to variations in the temperature of incoming room air at said room air inlet.

2. The combination of claim 1 in which there is also provided within said cabinet a mixed air backflow control plate, said plate being disposed across said cabinet inwardly of but closely adjacent to said room air inlet and said conditioned air outlet and also inwardly of said temperature-sensitive element, said plate having openings therethrough arranged to promote a unidirectional flow of mixed air towards said mixed air outlet, thereby tending to prevent the contacting of said temperature-sensitive element with said mixed air.

3. The combination of claim 1 in which said duct extension has its front wall spaced from the front wall of said cabinet and facing said room air inlet, said temperature-sensitive element being mounted on the front wall of said duct extension, said duct extension having at least one other wall spaced from the adjacent wall of said cabinet, and said by-pass extending through said other spaced wall.

4. In combination with a mixing cabinet having a room air inlet and a spaced mixed air outlet, said cabinet also providing a conditioned air inlet through the bottom wall thereof, a duct communicating with said conditioned air inlet and being adapted for supplying conditioned air under pressure to the interior of said cabinet, said duct having an extension within said cabinet terminating in a conditioned air outlet adjacent said room air inlet, said duct extension also having a by-pass outlet, adjacent said room air inlet, both said conditioned air outlet and said by-pass outlet being disposed and arranged to direct air toward said mixed air outlet and to aspirate room air into said cabinet through said room air inlet, mechanically-operable damper means disposed across said conditioned air outlet for controlling the discharge of conditioned air into said cabinet, air turbine means arranged in relation to said by-pass so that the conditioned air discharged therethrough drives said air turbine means, mechanical means operably connecting said turbine means and said damper means, said mechanical means being constructed and arranged so that said turbine can selectively shift said damper means between its open and closed positions, mechanical selector means associated with said mechanical means and including a temperature-sensitive element positioned within said cabinet in the path of the incoming room air so as to be directly responsive to the temperature thereof, and said selector means operating to control the operation of said mechanical means so that said turbine means will selectively open and close said damper means automatically at certain predetermined temperature conditions of room air at said room air inlet.

5. The combination of claim 4 in which there is also provided within said cabinet a mixed air backflow control plate, said plate being disposed across said cabinet above but closely adjacent to said conditioned air outlet and also above said temperature-sensitive element, said plate having openings therethrough arranged to promote a unidirectional flow of mixed air toward said mixed air outlet, thereby tending to prevent the contacting of said temperature-sensitive element with the mixed air.

6. The combination of claim 5 in which there is also provided duct means extending from said by-pass outlet to a point adjacent said backflow control plate.

References Cited in the file of this patent

UNITED STATES PATENTS

1,343,330	Miles	June 15, 1920
2,045,790	Midyette	June 30, 1936
2,345,536	Keep	May 16, 1942
2,533,175	Newton	Jan. 3, 1947