United States Patent

[11] 3,611,908

[72] Inventor **Hendrik J. Spoormaker**
56 Dorado Street, Waterkloof Ridge, Pretoria, South Africa

[21] Appl. No. **20,191**
[22] Filed **Mar. 17, 1970**
[45] Patented **Oct. 12, 1971**
[32] Priority **Nov. 14, 1969**
[33] **Great Britain**
[31] **55894/69**
Continuation-in-part of application Ser. No. 753,564, Aug. 19, 1968, now abandoned.

[54] **AIR-CONDITIONING TERMINAL UNITS**
4 Claims, 3 Drawing Figs.

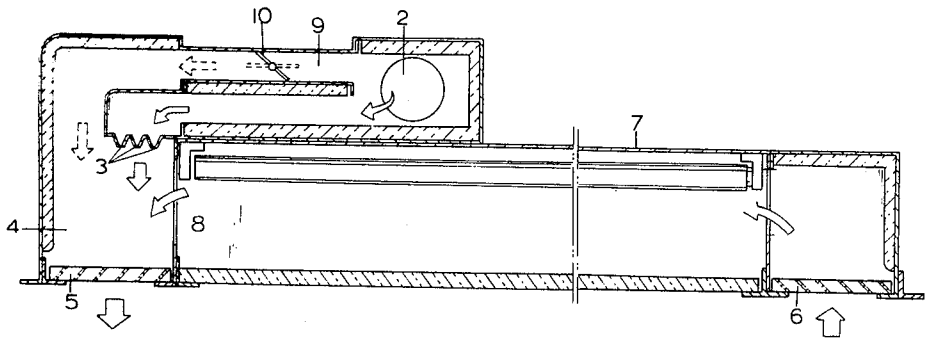
[52] **U.S. Cl.** ..... **98/38X,** 98/40 D, 137/604
[51] **Int. Cl.** **F24f 13/06**
[50] **Field of Search** ..... 98/38, 38 B, 38 E, 38 V, 40 D, 40 DL; 236/13, 49; 137/604

[56] **References Cited**
UNITED STATES PATENTS

3,114,505	12/1963	Kennedy	236/13
3,390,720	7/1968	Meckler	165/39
3,516,606	6/1970	Edwards	236/13

Primary Examiner—William E. Wayner
Attorney—Munson & Fiddler

ABSTRACT: The invention provides an air-conditioning terminal unit for use in a room topped by a false ceiling so as to provide a substantially constant air flow into the room and to take advantage, when necessary, of heat that passes from the room into the ceiling space. In the unit, conditioned air is caused to flow through induction nozzles into a discharge chamber which induces air from the ceiling space to flow into the room. A stream of conditioned air, usually from the same source, is passed along a passage containing a damper in opposition to the induced air, so that when the damper is fully open, no air is induced from the ceiling space and when the damper is closed, full induction is possible.



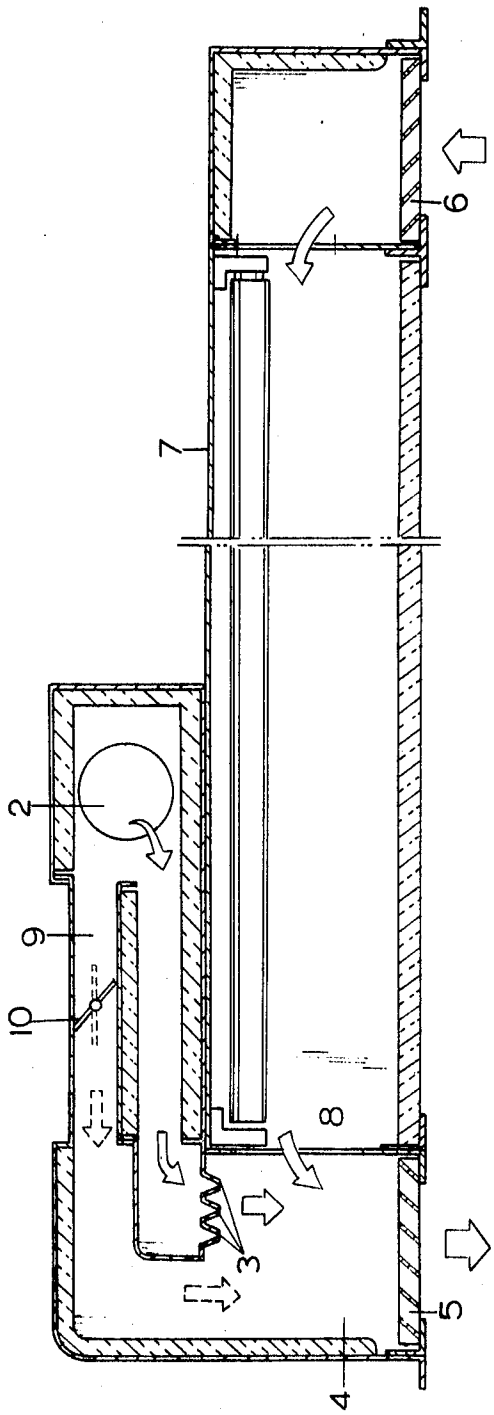


Fig. 1

HENDRIK JACOBUS SPOORMAKER,
Inventor
MUNSON & FIDDLER,
Attorneys

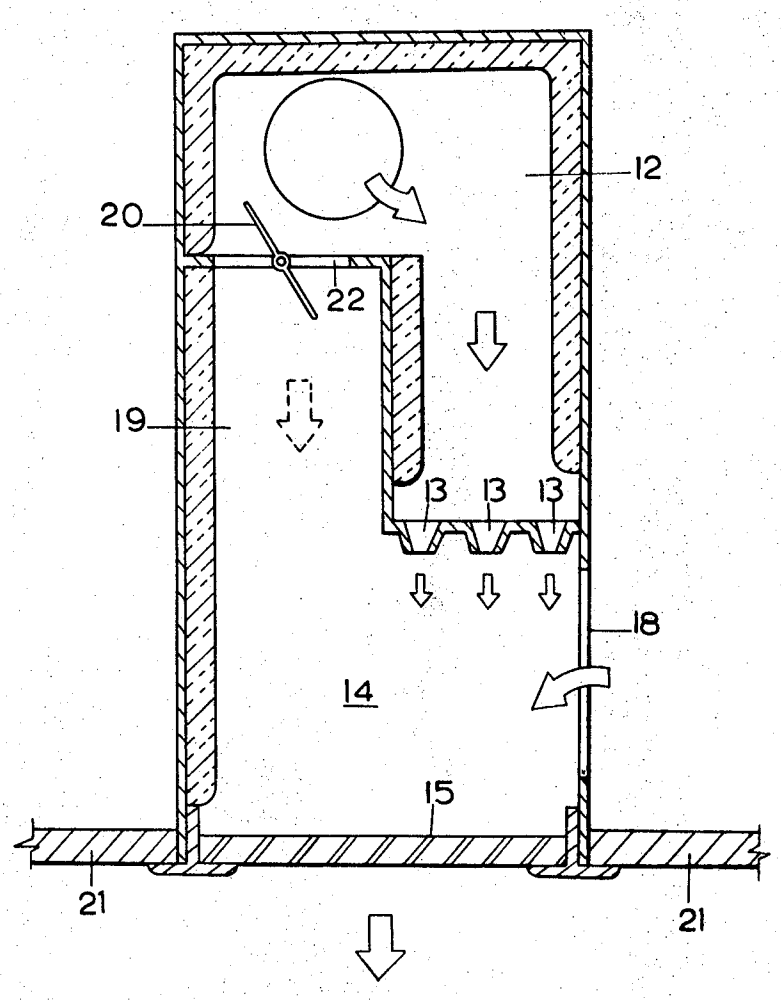


Fig. 2

HENDRIK JACOBUS SPOORMAKER,
Inventor

MUNSON & FIDDLER,
Attorneys

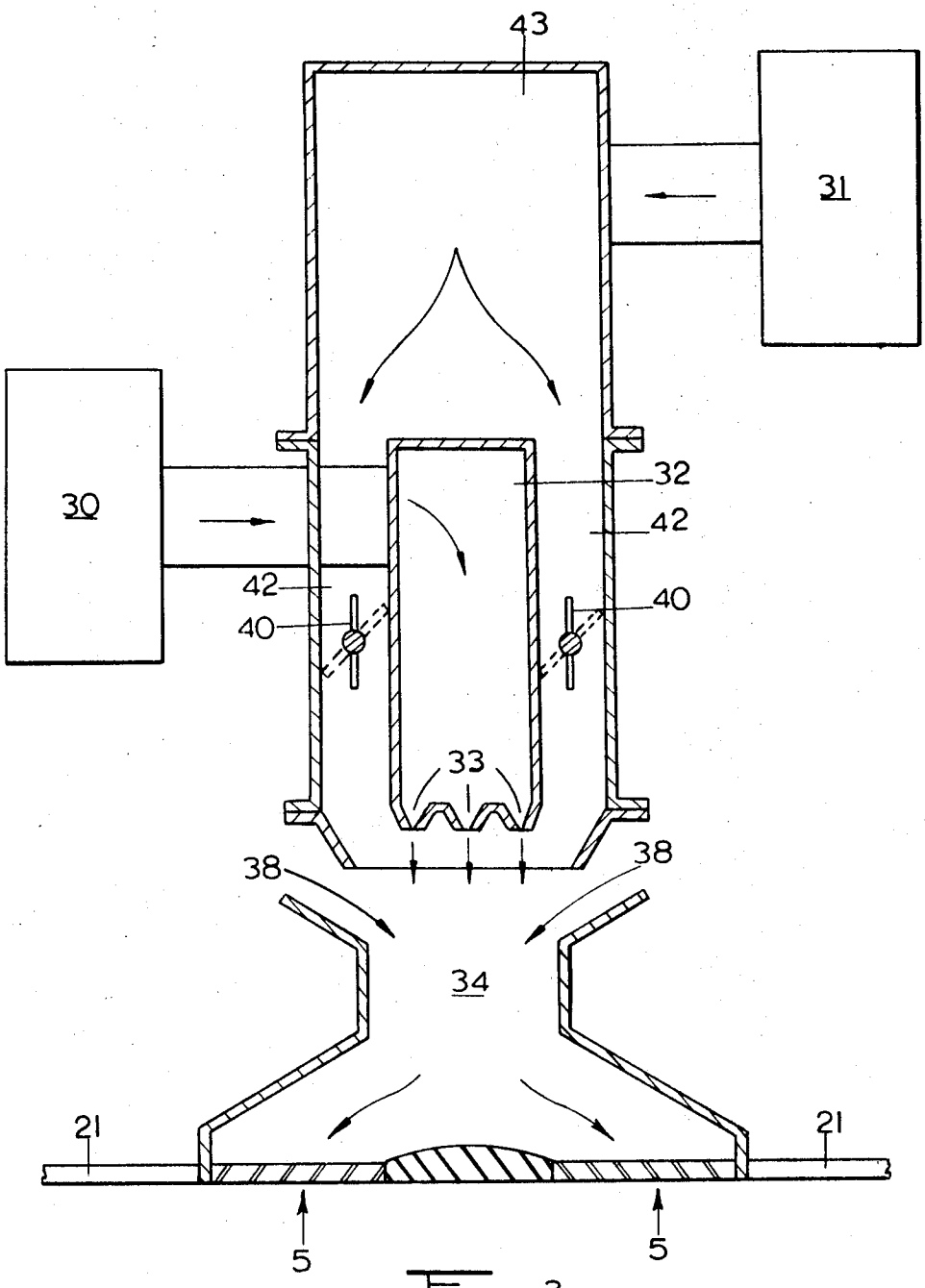


Fig. 3

HENDRIK JACOBUS SPOORMAKER
Inventor
MUNSON & FIDDLER,
Attorneys

AIR-CONDITIONING TERMINAL UNITS

This invention relates to improvements in air-conditioning terminal units and is a continuation-in-part of the present applicant's U.S. Pat. application Ser. No. 753,564 filed on the 19th of Aug. 1968 now abandoned.

In modern buildings false ceilings are commonly used, the space above the ceilings being used for containing utilities such as air-conditioning ducts. A fair amount of heated air collects, or is formed by electric lights, adjacent the ceiling of any room. It has thus occurred to air-conditioning engineers to utilize at least some of this hot air at times of low ambient temperatures.

Thus in U.S. Pat. Specification No. 3,114,505 it has been proposed to utilize the heat from light fittings to supplement the heating load on an air-conditioning system, when required. In the system there proposed, heat from light fittings is induced into an air-conditioning terminal unit. Both the induced air and the primary conditioned air are controlled by dampers which move in unison and in opposite directions so that as the primary air flow is increased, the induced air flow is reduced. While this proposal was an important development, the terminal unit is clumsy and complicated.

An object of the invention is to provide a method of air conditioning which will enable the use of a much simpler terminal unit and also to provide a unit suitable for use in the method.

Other objects and advantages will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

FIG. 1 is a section through one embodiment of a unit according to the invention,

FIG. 2 is a section through a further embodiment, and

FIG. 3 is a section through still another embodiment.

In FIG. 1 a conditioned air plenum 2 is connected to induction nozzles 3 of conventional or suitable design. The nozzles 3 discharge into a discharge chamber 4 discharging at ceiling level through a louvred aperture 5.

Room air is drawn in through a louvred aperture 6, passes along the cavity of a light fitting 7 and through an aperture 8 in the side of the discharge chamber 4.

The nozzles 3 are so chosen that aperture 5 delivers a substantially constant volume of air, required to maintain a satisfactory room air movement, while supplying the minimum amount of ventilation air.

A passage 9 fitted with an air volume control valve 10 leads from the plenum 2 to the discharge chamber 4. Flow of air along the passage 9 into the chamber 4 inhibits flow of air through the aperture 8. The conditions are so arranged and the aperture sizes so chosen that the inhibition is in proportion to the quantity of air flowing from the passage 9. Thus, air circulation in the room below is kept substantially constant while the supply of conditioned air may vary from the constant minimum volume to a maximum volume when the valve 10 is fully open.

As can be seen, in the embodiment of FIG. 1, hot air from a particular light fitting passes through the terminal unit, when required.

The embodiment of FIG. 2 is designed to draw hot air from above the ceiling space regardless of the source of the heat. Thus the ceiling will have apertures, preferably associated with light fittings, to allow room air to pass into the ceiling space.

In this embodiment there is a plenum 12 leading to induction nozzles 13. The nozzles 13 discharge into a discharge chamber 14 discharging at the level of a ceiling 21 through a louvred aperture 15.

Air from above the ceiling 21 is drawn through an aperture 18 in the side of chamber 14.

Again the nozzles 13 are so chosen that the aperture 15 delivers a substantially constant volume of air while supplying a minimum amount of ventilation.

An aperture 22 fitted with a damper 20 leads from the plenum 12 to a passage 19 into the chamber 14. When the damper 20 is open, flow from the passage 19 inhibits flow of air through the aperture 18. Once more apertures are so chosen and conditions so arranged that inhibition is in proportion to the quantity of air flowing from the passage 19.

Thus the operation of one control 10 or 20 allows for full control for the conditions under which the terminal units of the invention are designed to operate.

In the embodiment of FIG. 3 there are two conditioned air ducts 30 and 31. The duct 30 delivers conditioned air to a box 32 which through induction nozzles 33 flows via a space 34 through louvred apertures 5 to the room to be conditioned. The duct 31 delivers to a plenum 43 from which there leads two passages 42 controlled by dampers 40. The dampers 40 act in unison. Finally apertures 38 in the sides of the chamber 34 allow air from above the ceiling 21 to enter the chamber 34.

In use air conveyed by the ducts 30 and 31 will be conditioned to different extents. Thus the air in the duct 31 may be colder than the air in the duct 30. In this case also the nozzles 33 are so chosen that the apertures 5 deliver a constant volume of air while supplying the minimum amount of ventilation. The apertures 38 are so chosen and conditions so arranged that when the dampers 40 are open, flow through the passages 42 inhibits flow of air through the apertures 38. The degree of inhibition is again proportional to the quantity of air flowing from the plenum 43.

I claim:

1. An air-conditioning terminal unit adapted to be mounted above a ceiling in an overhead space, which the ceiling separates from the living space of a room, comprising:

a. a discharge chamber defined by a base, sides and a top,

b. a first opening in the base of the chamber adapted to be disposed adjacent an opening in the ceiling for delivering air directly into the living space,

c. a constantly open second opening in one side of the discharge chamber above the first opening for receiving air from the overhead space,

d. conduit means connected to a source of conditioned air,

e. discharge means connected to said conduit means and including nozzle means for increasing the velocity of said conditioned air, said nozzle means being located in the top of the chamber adjacent the second opening for projecting a stream of the conditioned air through said chamber and contiguous with the second opening towards the first opening so as to induce and entrain air through the second opening from the overhead space into the stream of conditioned air for delivery of the combined air from the nozzle means and from the second opening through the first opening into the living space,

f. air passage means connected to said conduit means and including a discharge opening located adjacent said nozzle means and on the opposite side thereof from said second opening, and a throttle valve in the air passage means for controlling the passage of air through the discharge opening,

g. the relative flow capacities of said discharge means, air passage means and second opening being arranged such with adjustment of said throttle valve the increase or decrease in the volume of air passing through said air passage means and discharge opening is substantially equal to the decrease or increase, respectively, in the combined volume of air passing through said discharge means including nozzle means and said second opening, whereby the flow of air through said first opening into the living space may be maintained substantially constant.

2. The terminal unit claimed in claim 1 in which the second opening communicates with a light fixture defining a heat-retaining chamber through which air is drawn.

3. The terminal unit claimed in claim 2 in which the light fixture includes a downwardly facing transparent cover forming part of the heat-retaining chamber and through which light is transmitted to the living space.

4. An air-conditioning terminal unit adapted to be mounted above a ceiling in an overhead space, which the ceiling separates from the living space of a room, comprising:

a housing;

a discharge chamber defined by the housing and having a base, sides and a top;

a first opening in the base of the chamber adapted to be disposed adjacent an opening in the ceiling for delivering air directly into the living space;

constantly open second opening means in sidewalls of the chamber for receiving air from the overhead space; an upper portion of the housing adapted for receiving secondary air from one source at a predetermined temperature for delivery downwardly toward the first opening;

a box between the upper portion of the housing and the chamber;

means for connecting the box to another source of conditioned air, being a source of primary air;

downwardly directed discharge means to the box for delivering primary air toward the first opening past the second opening means to draw air through the latter from the overhead space for delivery to the living space;

passageways bypassing the box between the upper portion of the housing and the chamber to deliver secondary air towards the first opening between the flow of primary air in the plenum chamber and the second opening means in at least partial opposition to air entry from the second opening means;

and means for controlling the flow of secondary air into the discharge chamber.