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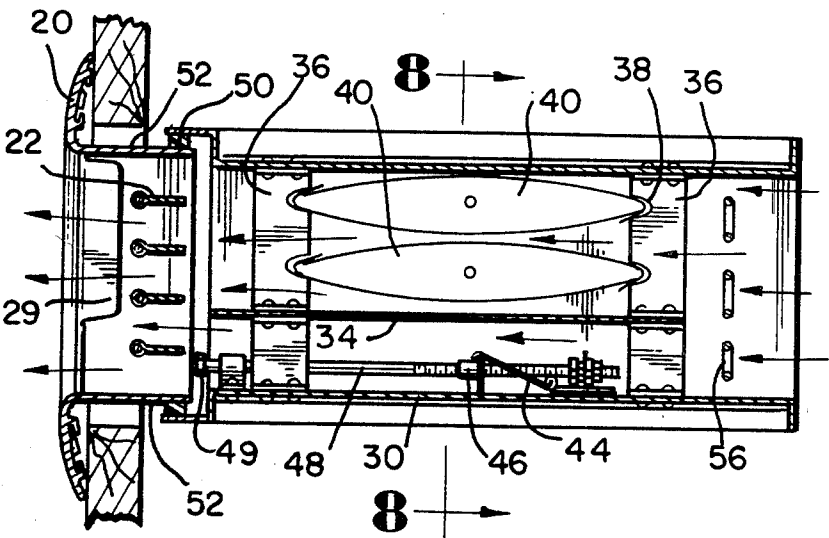
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Primary Examiner—William E. Wayner
Attorney—Kenneth E. Walden

[54] **TERMINAL OUTLET FOR AIR DISTRIBUTION SYSTEM**
2 Claims, 15 Drawing Figs.

[52] U.S. Cl..... **98/40 VM,**
137/599
[51] Int. Cl..... **F24f 13/00**
[50] Field of Search..... **236/49;**
98/40, 40 D, 40 V, 37, 116; 137/599

ABSTRACT: This disclosure is directed to a controlled volume air terminal outlet for use at a room discharge of an air distribution system for a building. The terminal outlet includes a first damper section which is thermostatically controlled for throttling air passing therethrough and a second damper section which is manually or otherwise controlled. Discharge through the terminal outlets passes through a diffuser for air pattern control. A pressure and temperature branch control is also disclosed.



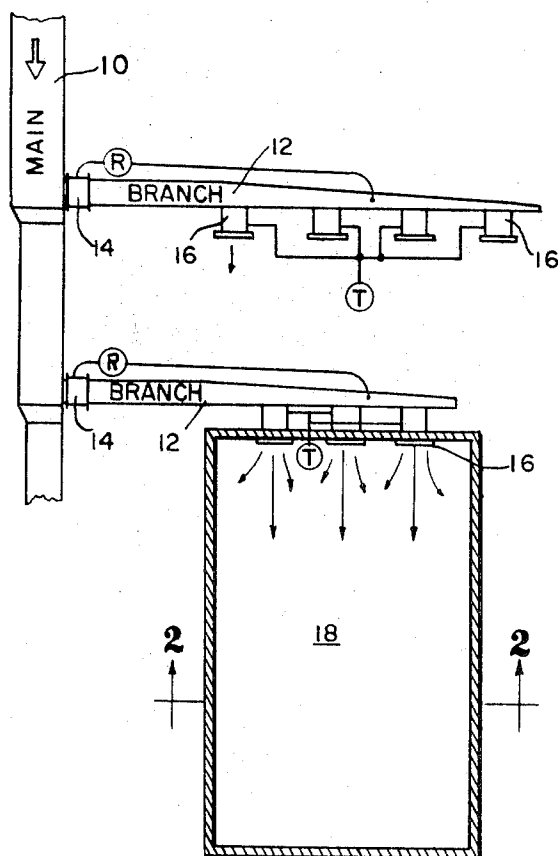


Fig. 1

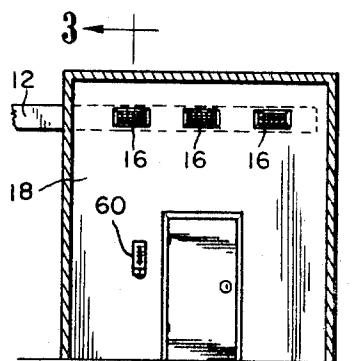


Fig. 2

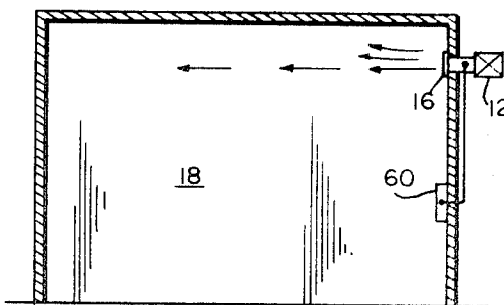


Fig. 3

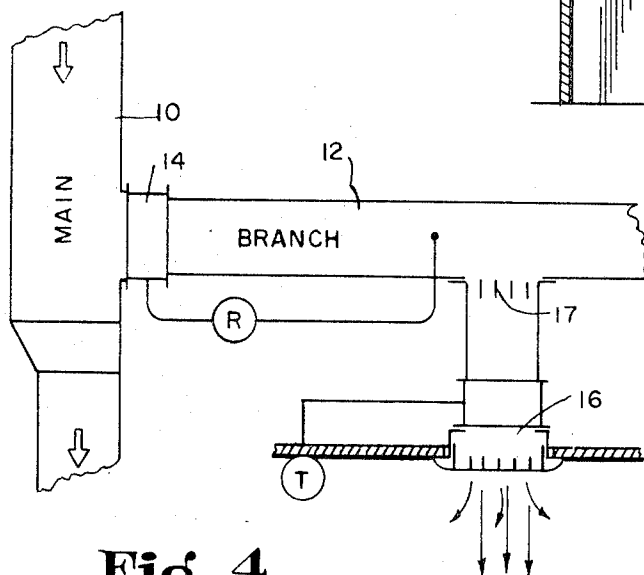


Fig. 4

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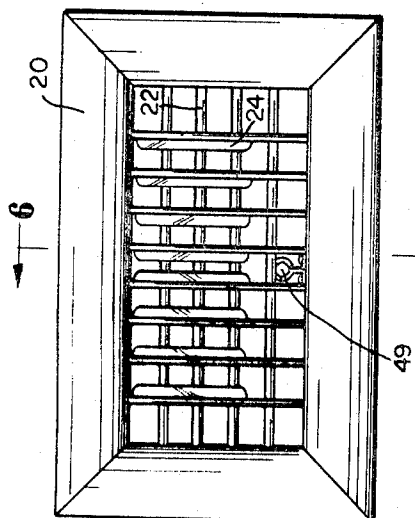


Fig. 5

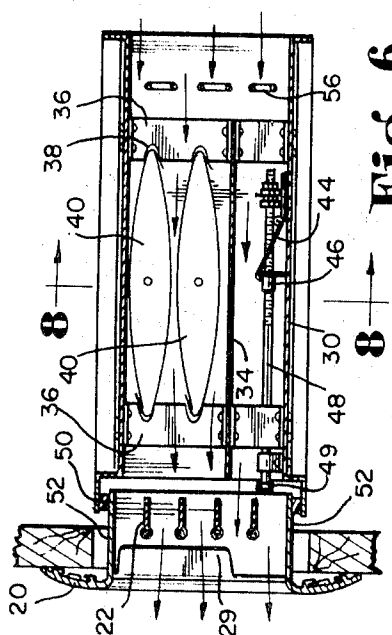


Fig. 6

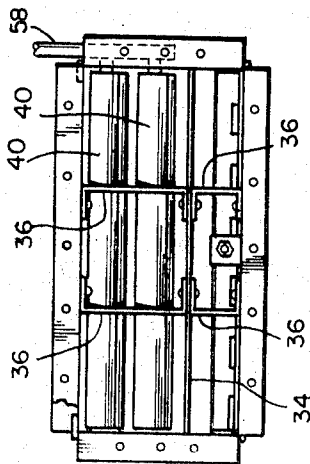


Fig. 7

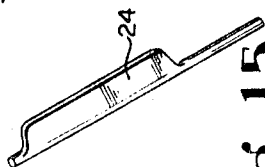


Fig. 15

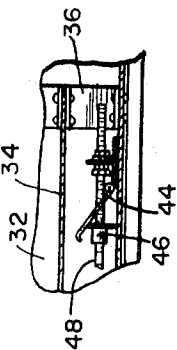


Fig. 9

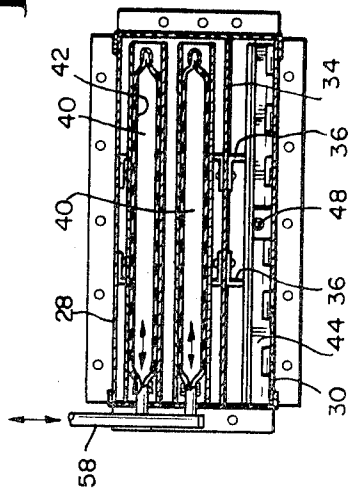


Fig. 8

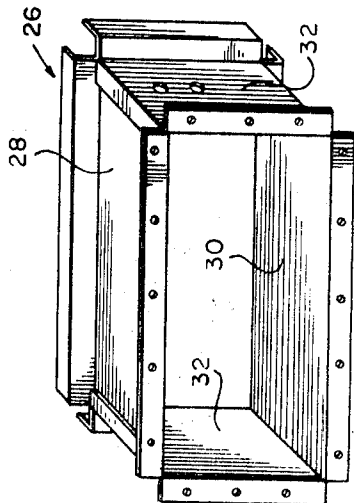


Fig. 10

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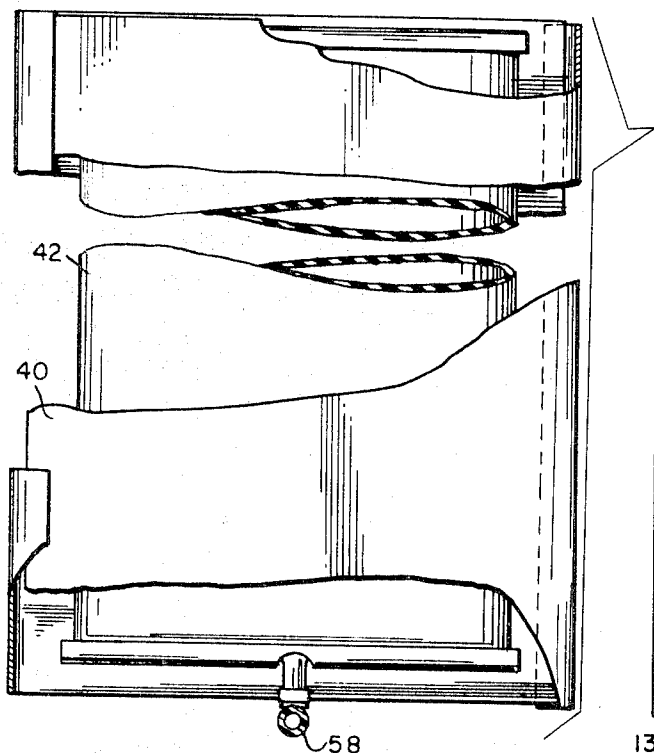


Fig. 11

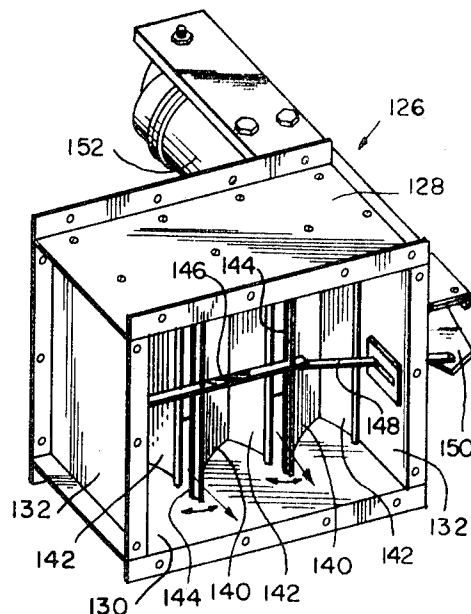


Fig. 13

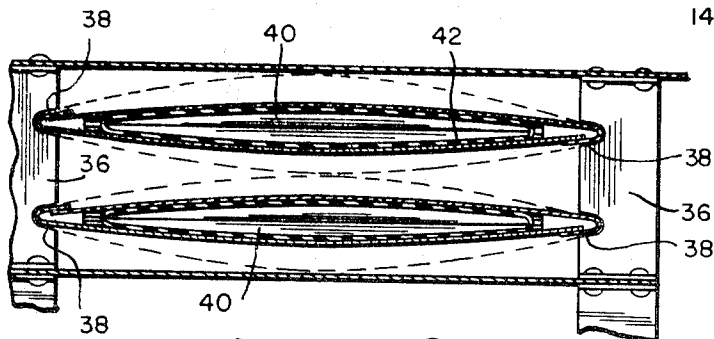


Fig. 12

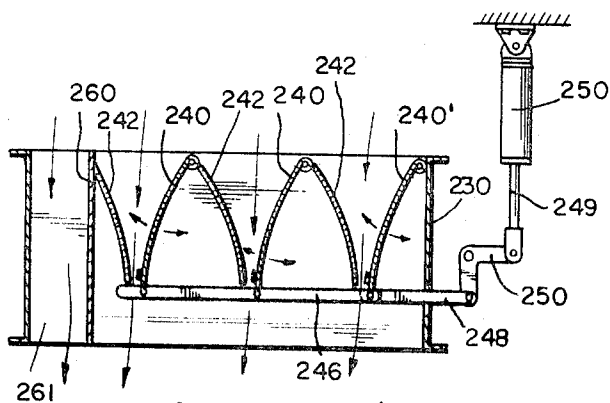


Fig. 14

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TERMINAL OUTLET FOR AIR DISTRIBUTION SYSTEM

The terminal outlet defined herein includes a housing which is adapted to be secured to an air distribution duct system at a discharge therefrom so that conditioned air passes therethrough into a room or space. The housing of the terminal outlet is provided with mechanism defining a plurality of paths. Structure is provided in the paths for controlling air volume.

To describe the terminal outlet and its operation, the specification to follow will refer to the drawings which are a part thereof. In the accompanying drawings several illustrative embodiments are shown.

In the Drawings:

FIG. 1 represents a plan view of a duct system for delivering air to a plurality of locations;

FIG. 2 is a sectional elevation view taken generally along line 2-2 of FIG. 1;

FIG. 3 is a sectional elevation view taken along line 3-3 of FIG. 2;

FIG. 4 is a representation of the invention herein in conjunction with air discharge ducting and controls therefor;

FIG. 5 is a front elevation or air discharge end of the terminal outlet;

FIG. 6 is a sectional view of the terminal outlet taken along line 6-6 of FIG. 5;

FIG. 7 is a rear elevation or air entrance end of the terminal outlet;

FIG. 8 is a sectional view of the terminal outlet taken along line 8-8 of FIG. 6;

FIG. 9 is a fragmentary view of FIG. 6 showing the bypass throttle in a near-closed position;

FIG. 10 is a perspective view only of the sheet metal housing or casings;

FIG. 11 is an enlarged plan view of the pneumatic casing cut away in part to show the bladder and air connection thereto;

FIG. 12 is an enlarged cross-sectional end view of the expansible pneumatic casings;

FIG. 13 is an alternate form of damper; and

FIG. 14 is a sectional view of the alternate damper arrangement and a bypass.

FIG. 15 is an enlarged view of a vertical louver.

A duct system as illustrated in FIG. 1 shows the distribution of conditioned air to a plurality of locations. A main air supply duct 10 distributes air to a plurality of branch or secondary ducts 12. Air is supplied in the main duct at a pressure in a range from 1 inch to 6 inches of water. Air pressure in secondary ducts 12 is maintained in a lower range from one-tenth inch to one-fourth inch of water by reason of dampers 14. One type of damper found especially acceptable for this service at 14 is the pneumatic damper disclosed in U.S. Pat. No. 3,011,518 issued Dec. 5, 1961. The pressure in secondary ducts 12 is maintained within the desired range even if fluctuation of pressure occurs in main duct 10. A regulator R, sensitive to pressure in secondary duct 12, controls the setting of damper 14 to establish the necessary volume of air flowing therethrough so as to maintain a desired constant pressure in secondary duct 12. In FIGS. 1 and 4 the regulator R is shown connected into duct 12 and communicating with the air inlet control of damper 14.

Terminal outlets 16 are shown in communication with secondary ducts 12. The outlets are shown for discharging conditioned air into room 18. These terminal outlets are operatively controlled by thermostats T which are sensitive to room temperature.

The sectional elevation of FIG. 2 shows terminal outlets leading into room 18. The sectional elevation of FIG. 3 shows the terminal outlets discharging conditioned air into a room. For reasons based on structure to be described hereinafter, air being discharged from the top of the terminal outlets is deflected laterally for short throw whereas the air being discharged from the bottom of the outlets projects straight ahead for greater throw. As will also be described later in

detail, air passing through the top and bottom may be throttled or controlled as desired. In FIG. 4, vanes 17 are shown. They may, if desired, be provided to enhance even flow of air to the terminal outlet.

FIG. 5 represents a frontal view of a terminal outlet showing a grill frame 20 in which horizontal louvers 22 and vertical louvers 24 are pivotally mounted to direct passage of air. It will be noted that vertical louvers 24 may be turned so as to provide a lateral component to the air which passes over that portion.

FIG. 6, which is a cross-sectional view, illustrates the internal arrangement of a terminal outlet. The frame, casing or housing, which carries these elements, is more clearly shown in FIG. 10 and is designated generally by the numeral 26. It is preferably formed of sheet metal having top panel 28, bottom panel 30 and side panels 32 to define a tubular section for passage of air. End flanges may be provided as shown for strength and for fastening to a duct at one end or to support a grill at the other. The tubular section as shown in FIG. 6 is divided into two portions by a partition or panel 34. Plural vertical posts 36 are provided with facing notches 38 for carrying edges of expansible casing 40. Since previously mentioned U.S. Pat. No. 3,011,518 contains a detailed description of expansible casing 40 and its supporting structure, reference is made thereto for supplementing the description herein. A pair of pneumatic expansible casing 40 are disposed in overlying and parallel relationship in one portion of the housing. These casings are in a normally collapsed position so that conditioned air passes between and around as noted by the arrows applied in FIG. 6. The FIG. 6 illustration shows casings 40 partially expanded. When air under pressure is selectively admitted into bladder 42 of the casing, then the casing expands accordingly to decrease (throttle) or completely shut off airflow through one portion of housing.

The portion of the housing located below partition 34 defines another path for flow of conditioned air as indicated by the arrows in FIG. 6. This portion defined between partition 34 and bottom panel 30 is also referred to as a bypass in relation to the passage defined between partition 34 and top panel 28.

A damper 44, generally rectangular in shape, is disposed in the bypass portion and is adapted to be manually positioned therein to vary the passage and restrict or control the volume of air passing therethrough. The damper extends generally across the opening and is hingedly connected to bottom panel 30. A nut or equivalent 46 is threadedly received on adjusting rod 48 so as to be moved linearly back and forth to adjust the position of damper 44. The rod 48 may be provided with a nut or turning head 49 accessible from the discharge grill for adjusting the damper.

The discharge end of the housing is provided with a resilient sealing ring 50 which receives a portion 52 of grill frame 20. As mentioned before, this frame contains horizontal and vertical louvers for deflection of air passing thereover. The conditioned air being so discharged from either or both of the passages passes through these louvers.

Horizontal louvers 22 are adapted to be positioned so as to deflect conditioned air in a vertical range. They are adapted to be manually positioned for the desired deflection. Vertical louvers 24 are adapted to be manually positioned to deflect air in a horizontal range. Since they are individually adjustable, they can be arranged in any pattern desired. FIG. 15 is a perspective of one of the vertical louvers showing its formation. Its ends are adapted to be pivotally mounted in portions 52 of the grill frame. From an examination of louver 24, as shown in FIGS. 5, 6 and 15, it is evident that the lateral deflecting portion is removed at its lower portion in the path of air emitting from the bypass. Accordingly, it will be appreciated that all air emitting from the housing is traveling at a constant velocity, whether passing through the upper portion (when open) or through the lower portion or bypass (usually fully open). Thus, air passing through the grill from the bypass is permitted to move to deep throw or penetration. Air passing through the

upper portion strikes vertical louvers 24 for some lateral deflection and less penetration. By this arrangement a desired pattern of air distribution is attained—a lower stream straight ahead for deep throw or penetration at constant volume and velocity and an upper stream at constant velocity and variable volume, but at less penetration by reason of a lateral component caused by louvers 24.

FIG. 9 shows damper 44 in a more nearly closed position, obtained by turning screw rod 48, for a lower volume of air.

By the arrangements shown, volume, penetration and diffusion of emitting conditioned air is attainable to a desired degree and extent required for wide application.

An electric heating element 56 may be positioned at the entrance to the housing at the option of the installation for the purpose of heating the air passing thereover. Normally the air reaching the terminal outlet is at a predetermined temperature level which would not require additional heating. But the heating elements as shown would provide an additional option or arrangement.

Air at approximately 15 p.s.i. is selectively admitted to bladder 42 of casing 40 through pipes or tubing 58. The control for determining the amount of air admitted to casing 40 is a thermostat designated by the numeral 60 in FIGS. 2 and 3, or by the circled "T" in FIGS. 2 and 4. By way of example of operation, when a room or space is being cooled in summer with high air flow through the terminal outlet and temperature has reached a predetermined low, then thermostat 60 or "T" signals a valve (not shown) in line 58 which is energized to open. This permits air to enter casings 40 to thereby at least partially expand them so as to throttle or restrict air passage through the one portion of the housing. Since a lower volume of conditioned air then enters the room or space, temperature therein will rise. When temperature again reaches a predetermined level, thermostat 60 or "T" energizes a valve in line 58 to bleed some air from casing 40 thereby allowing more conditioned air to pass through the one portion of the housing to lower the room temperature. Regardless of the setting of casing 40, air flows at a continuous predetermined through the lower portion or bypass (also called another portion). Since air pressure upstream in branch duct 12 is maintained constant by dampers 14, constant velocity is maintained on the conditioned air entering the room or space.

An alternative form of damper is disclosed in FIG. 13. This type of damper can replace damper 40 shown in FIG. 6, as its main purpose in the terminal outlet is to provide a throttle or means for varying air passage size. Therefore, FIG. 13 is meant only to teach the damper construction and motor for adjusting it, and does not include a bypass as defined in FIG. 6. FIG. 14 shows the dampers of FIG. 13 in a similar terminal outlet. Also shown in FIG. 14 is a bypass.

In FIG. 13, the housing is designated generally by the numeral 126 and includes a top wall 128, bottom wall 130 and sidewalls 132. Movable dampers 140 are hingedly connected to fixed vanes 142. Each damper 140 is provided with a resilient seal 144 on its surface facing damper 140 in order to insure complete air control. A bar 146 links the front edge of movable dampers 140. Another bar 148 extends through sidewall 132 and connects bar 146 with a bellcrank 150. The bellcrank is operated by axial extension of a rod (not shown) from air motor 152.

In FIG. 14, dampers 240 are hingedly connected to stationary vanes or parts 242. One damper 240' shown hingedly connected to wall 230. The movable dampers 240 are connected to bar 246. A second bar 248 connects bar 246 to bellcrank 250. Linear motion of bar 246 so as to position dampers 240. Air flows through the damper space as shown by the arrows. A portion 261 for bypass flow of air therethrough, as indicated by the arrows, is shown in FIG. 14. This portion bypasses air from the damper portion. Bypass 261 may be provided with mechanism to restrict the opening thereof, as for example the plate damper described and shown in FIGS. 6 and 9. Other

construction may be provided in bypass 261 if desired, or omitted altogether.

Applicants have hereby disclosed a variable volume damper with bypass in a housing for delivering air through a discharge grill into a room or space. The room thermostat controls the amount of conditioned air (to meet the room demand) that must flow from a relatively low pressure supply or branch duct 12 which is maintained at constant static pressure of from one-tenth to one-fourth inch of water. When delivering maximum air flow, all dampers 40, 140 or 240 are wide open. The thermostat can modulate this opening for correct air flow required.

Heretofore a maximum variation of air flow into a room or space caused problems in maintaining good air distribution. Too much throw at maximum volume furnished drafty conditions or too much drop. Too little throw at minimum air flow is expected in most variable volume systems. Herein, deflecting vanes in front of the part of the terminal outlet served by the modulating dampers spread the stream and thereby shorten the throw during maximum flow conditions. There are no diverging vanes in front of the lower portion or bypass so that air emitting therefrom is straight and hence is in a straight pattern for long throw at all times. The discharge velocity is constant at either condition because the supply duct is maintained at constant static pressure. The transition from large opening (large volume) with divergent air pattern for short throw to small opening (small volume) with straight air pattern for long throw is a gradual one and automatic, merely dependent upon the setting of dampers 40, 140 or 240.

We have disclosed several embodiments of the invention. It is obvious that further variations may be made thereto without departing from the spirit of the invention. We define our invention by the allowable claims herein.

We claim:

1. A terminal outlet for use at a discharge location from a building air distribution duct system for delivering conditioned air into a room comprising:

a unitary housing having elongate air passage therethrough and terminating at its rear in an outwardly turned annular flange for securing the housing to the side of an air duct surrounding an opening for air communication therethrough,

pneumatic expansible oval casing means transversely disposed in one portion of the housing air passage for expansion and contraction in thermostatic response to the temperature of the room to which conditioned air is being delivered so as to control the volume of conditioned air delivered through said one portion to the room,

manually adjustable damper means disposed in another portion of said housing for independently controlling the volume of air passing through said another portion for straight ahead projection into the room irrespective to thermostatic conditions in the room,

said damper means being manually adjustable by screw means accessible at the air discharge end of said another portion,

plural banks of air turning vanes at the discharge side of said housing,

one bank horizontally mounted within the housing and manually positionable for giving a vertical component on air movement independently selectively in front of either of said housing portions,

another bank vertically mounted within the housing and manually positionable for giving a lateral component on air movement from only said one portion after having passed through said first mentioned one bank.

2. The claimed subject matter of claim 1 wherein the manually adjustable throttle means comprises a plate hingedly mounted to one side of the housing and disposed within said another portion and being adjustable therein by nut means thereon moving in response to a turnable elongate screw.