June 6, 1961 J. E. NORTH 2,987,258

FORCED AIR HEATING SYSTEM

Filed Oct. 9, 1957 3 Sheets-Sheet 1

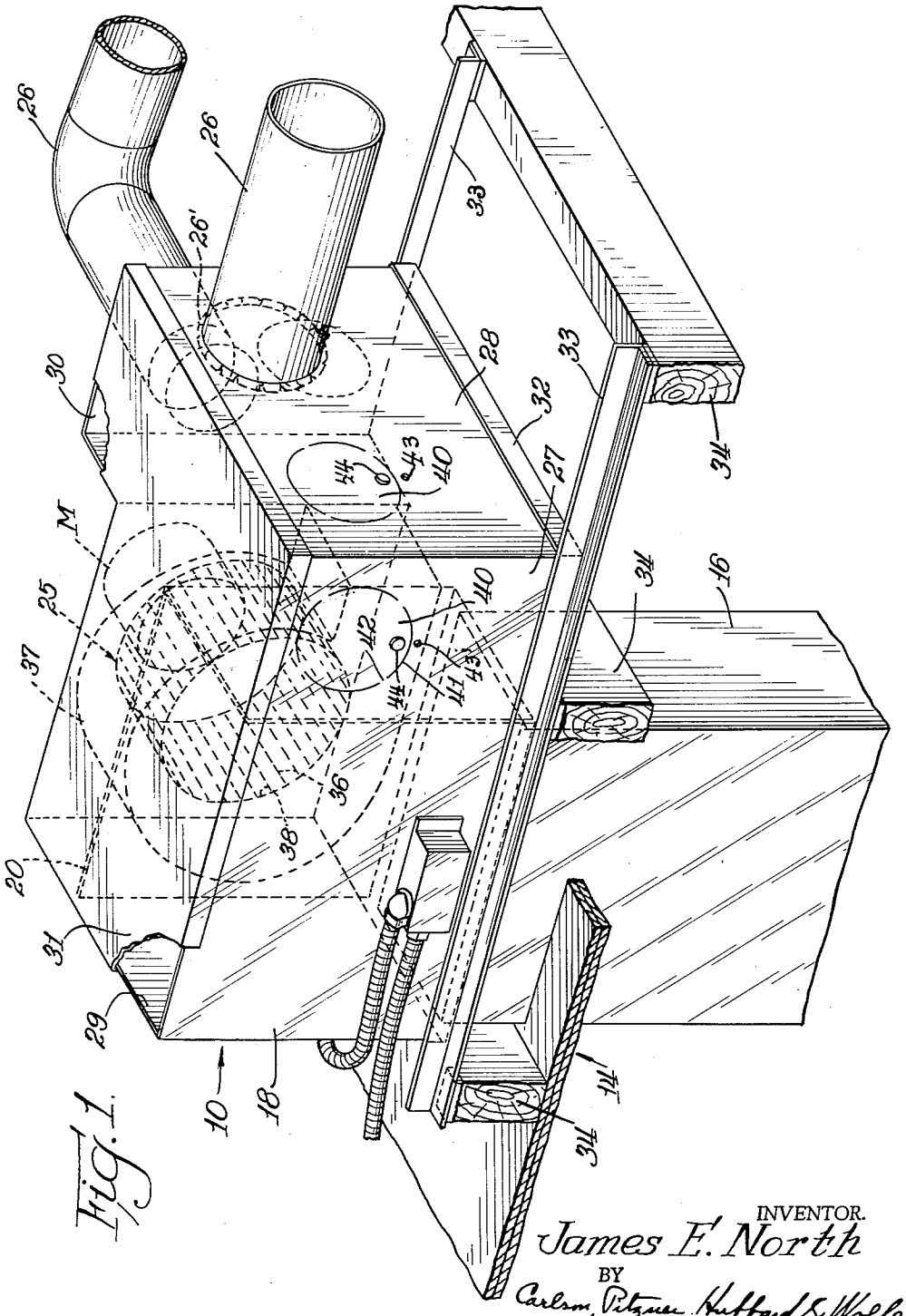


Fig. 1.

INVENTOR.
James E. North
BY
Carlson, Pitzner, Hubbard & Wolfe
Attys.

June 6, 1961 J. E. NORTH 2,987,258

FORCED AIR HEATING SYSTEM

Filed Oct. 9, 1957 3 Sheets-Sheet 2

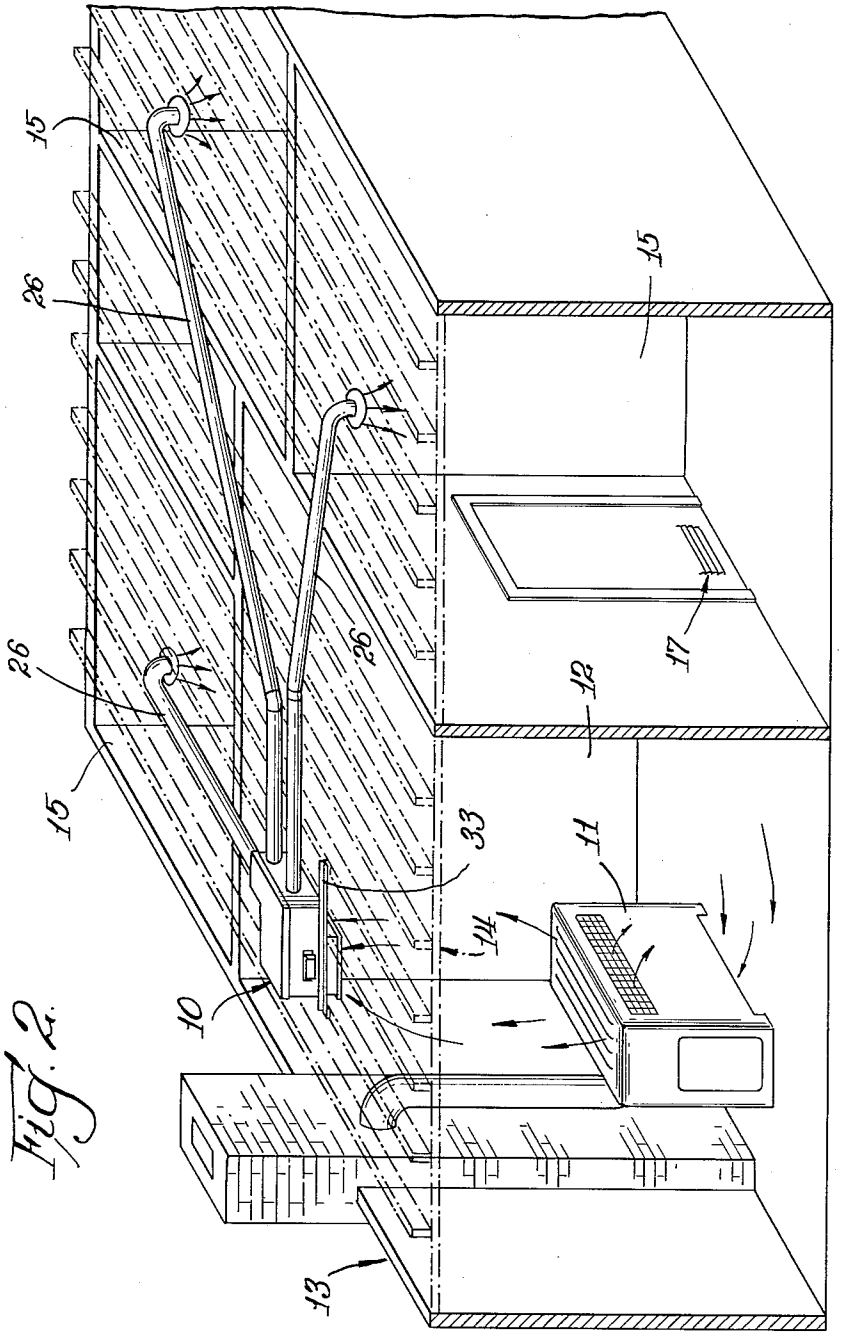


Fig. 2.

INVENTOR.
James E. North
BY
Carlson, Pitzner, Hubbard & Wolfe
Attys

June 6, 1961 J. E. NORTH 2,987,258

FORCED AIR HEATING SYSTEM

Filed Oct. 9, 1957 3 Sheets-Sheet 3

Fig. 3.

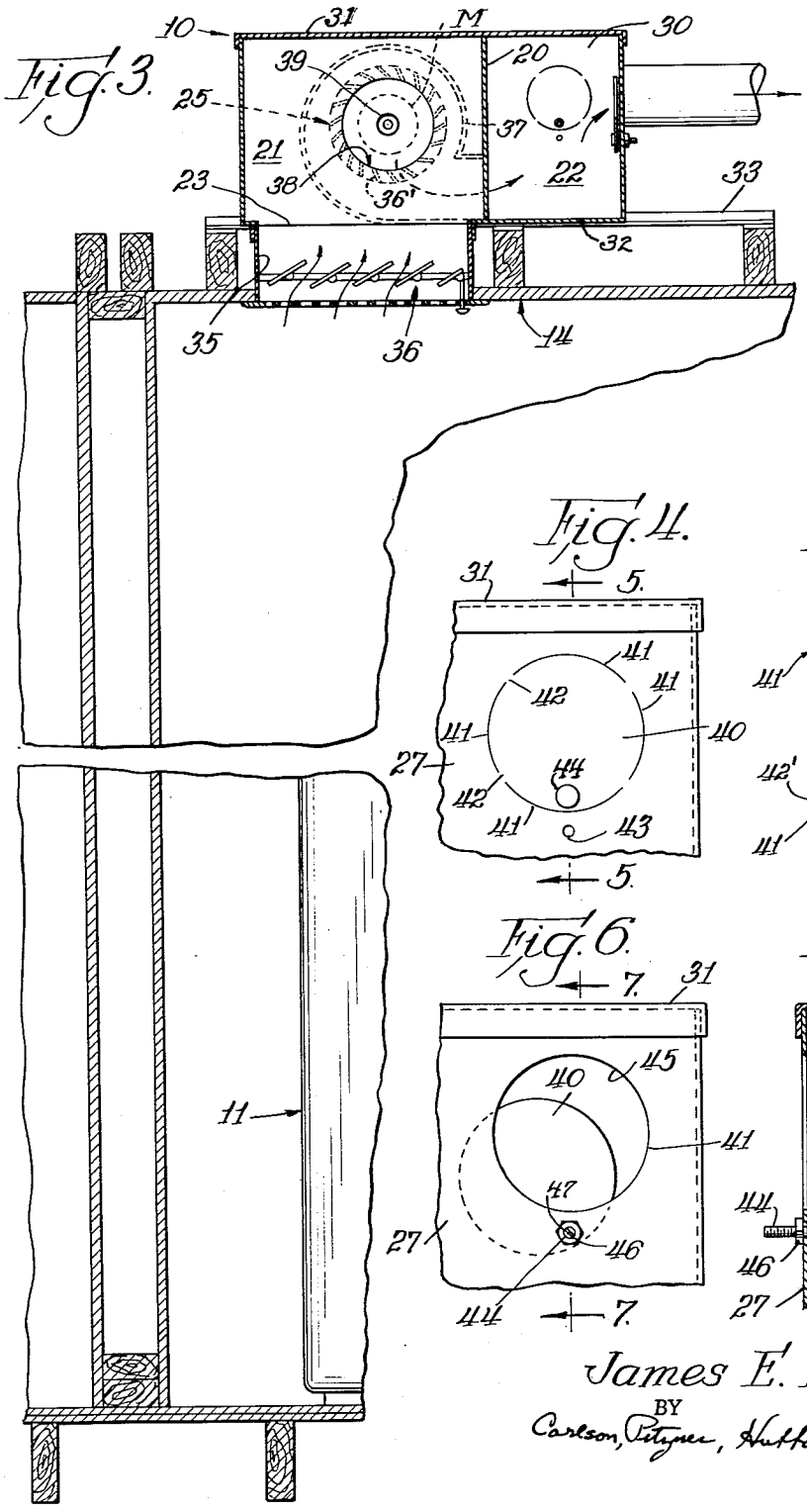


Fig. 4.

Fig. 5.

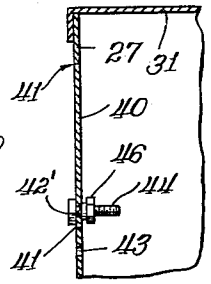
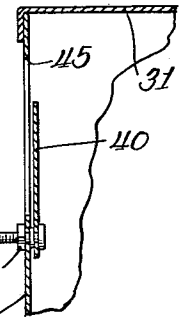


Fig. 6.

Fig. 7.



INVENTOR.
James E. North
BY
Carlson, Petzner, Hutchard & Wolfe
Att'ys.

United States Patent Office 2,987,258 Patented June 6, 1961

2,987,258

FORCED AIR HEATING SYSTEM

James E. North, Park Forest, Ill., assignor, by mesne assignments, to Heil-Quaker Corporation, a corporation of Delaware

Filed Oct. 9, 1957, Ser. No. 689,132
4 Claims. (Cl. 237—53)

The invention relates to central heating systems generally and more particularly to heating systems of the forced air type.

One object of the invention is to provide a plenum chamber and blower assembly in the form of a simple compact structural unit particularly well adapted for economical quantity production and distribution by reason of its ready adaptability on the job for use in heating systems varying widely in respect to the type of heater employed, the rooms to be heated and the number and location of the ducts required, and by reason of the flexibility afforded for expansion of the heating system after installation to supply heat to additional rooms.

Another object is to provide a plenum chamber and blower unit that may be connected directly to a suitable heater or simply installed in the ceiling of a room heated by a conventional space heater to adapt the same for heating a plurality of rooms.

Another object is to provide a sheet metal plenum chamber structure in which the walls have appropriately shaped sections partially cut through or weakened for easy removal on the job to form duct outlets when required, the wall sections and the chamber walls being formed to enable the sections to serve efficiently as dampers for the outlets which they originally closed.

A further object is to provide a plenum chamber and blower unit in which the blower and its driving motor are mounted in a novel manner to insure adequate ventilation and adequate cooling of the motor.

Other objects and advantages of the invention will become apparent from the following detailed description of the preferred embodiment illustrated in the accompanying drawings in which:

FIGURE 1 is a perspective view of a plenum chamber and blower unit embodying the features of the invention, the unit being shown installed in a room ceiling and arranged for direct connection with a heater.

FIG. 2 is a perspective view of a complete heating system utilizing the improved unit, the heat source in this instance being a conventional space heater.

FIG. 3 is a sectional view taken in a vertical plane through the plenum chamber and the building structure in which it is mounted.

FIG. 4 is a fragmentary elevational view of the chamber structure showing the manner in which the wall is preliminarily formed to define the duct openings.

FIG. 5 is a sectional view taken in a vertical plane substantially on the line 5—5 of FIG. 4.

FIG. 6 is an elevational view similar to FIG. 4 but showing a section of the chamber wall removed to define a duct outlet, the removed section being installed to function as a damper for the outlet.

FIG. 7 is a sectional view taken in a vertical plane substantially on the line 7—7 of FIG. 6.

For purposes of illustration a preferred embodiment of the invention has been shown and will be described herein in some detail. It will be understood, however, that this is not intended to limit the invention to the particular structural details disclosed. On the contrary, the intention is to cover all modifications and adaptations falling within the spirit and scope of the invention as defined in the appended claims.

By way of example, the invention has been shown in

FIGS. 1–3 as incorporated in a structural unit **10** for adapting an ordinary room space heater **11** for efficiently heating a plurality of rooms. As shown in FIG. 2, the space heater is installed in one room **12** of a house **13** and operates in the usual way to heat that room by convection and radiation. The unit **10** which is preferably installed in the ceiling **14** of the room **12**, draws heated air from that room and forcibly distributes it to other rooms **15** of the house.

Under some conditions, it may be desirable to connect the unit directly with the heater. Such connection is provided by a suitable duct **16** extending upwardly from the heater to the unit as shown in FIG. 1. With either direct or indirect connection of the unit, passages **17** are provided between the rooms **15** and the room **12** for the return of cold air, thus affording continuous air circulation through the entire house and materially improving the operating efficiency of the heating system.

The structural unit **10** includes a housing **18** which may be constructed of any suitable material, although sheet metal is preferred for economical fabrication. In the preferred form shown, the housing comprises a boxlike sheet metal structure divided internally into two compartments by a partition **20**. One compartment **21** constitutes the inlet chamber while the other constitutes a distributing or plenum chamber. The chamber **21** is adapted to communicate with the space from which heated air is to be drawn, in this instance, through an opening **23** in the bottom wall of the housing. A motor driven blower **25** draws heated air through the opening into the chamber **21** and discharges it into the plenum chamber **22** from which it is distributed to the rooms **15** by way of ducts **26**. In the heating system shown in FIG. 2 the ducts are shown terminating in ceiling fixtures in the rooms **15**, although it will be understood that they may open through the walls or even through the floor of a room if desired.

In the particular embodiment shown, the housing **18** is L-shaped in horizontal section. It has one straight side wall **27**, one long end wall **28** and one short end wall **29**. The other side wall **30** is stepped, that is, it has one end portion offset from the other an amount corresponding to the difference in length of the end walls **28** and **29**. It is thus adapted to be assembled with the other wall elements to form the boxlike structure shown in FIG. 1.

A sheet metal top panel **31** extends over and covers both of the compartments in the housing **18**. This top panel may be formed with flanges adapted to fit over the upper end of the housing and is preferably secured in place in a manner which permits easy removal to provide convenient access to the interior of the housing. A similar bottom panel **32** closes the lower end of the housing, a portion of the panel being cut out to provide the opening **23** to the inlet chamber **21**.

The partition **20** which divides the housing **18** into the two compartments **21** and **22**, is L-shaped in the exemplary unit. It is assembled with the other components of the housing **18** to form a rectangular compartment at one corner of the housing, that being the intake chamber **21** in the present instance. The longer leg of the L-shaped partition is substantially the same length as the inwardly offset portion of the side wall **30** which it parallels. The other leg of the partition is substantially the same length as the offset of the portions of the wall **30** and is directed oppositely to such offset. The partition thus cooperates with the walls of the housing to define the T-shaped plenum chamber **22**.

The unit **10** may be supported in any preferred manner, as, for example, by angle bars **33** extending across a plurality of the joists **34** which support the ceiling **14**. It will be understood, of course, that the unit is positioned

with the bottom opening of the chamber **21** in alinement with a hole cut through the ceiling. When the unit is connected directly with the heater as shown in FIG. 1, the duct **16** extends through the hole in the ceiling and its upper end is suitably attached to the bottom wall **32** of the housing structure. When the unit is installed in a ceiling without direct connection to the heater, the ceiling hole may be finished off with a liner **35** carrying an adjustable shutter or damper mechanism **36** as shown in FIG. 3.

While a blower of any suitable type may be utilized for drawing air into the inlet chamber **21** and discharging it into the plenum chamber **22**, the blower **25** of the exemplary unit is a centrifugal fan type blower. It includes a multi-bladed fan wheel **36'** mounted for rotation in a generally spiral casing **37**. The casing has an air inlet opening coaxial with the fan wheel and in this instance alined with an opening **38** formed in the partition **20**. The outlet for the fan is preferably located adjacent the end of the narrow leg section of the plenum chamber **22** and positioned to discharge into the transverse head portion of the chamber.

The fan wheel **36'** of the blower is rotatably driven by an electric motor M, and, in this instance, is mounted directly on the motor shaft. As a matter of convenience, the motor is supported on the outside wall of the housing structure which parallels the partition or on a suitable frame provided on or adjacent such wall. To insure cool running, the motor is preferably located externally of the housing structure with its shaft extending through a hole **39** in the wall **30**. The motor is thus out of the stream of heated air moved by the blower. As the unit is usually installed in an attic or other unheated space, overheating during the time the heating system is in operation is avoided. Additionally, forced air ventilation of the motor may be provided if desired by enlarging the hole **39** to enable the motor to draw cool outside air through the motor housing.

As indicated heretofore, heated air is distributed from the plenum chamber **22** to the rooms to be heated by the ducts **26** leading from the chamber. The number of such ducts required may vary for different installations, depending upon the number of rooms to be heated. To enable a single, standard structural unit to be used for any of the diverse installations likely to be met with, the housing structure is manufactured and supplied to each job without duct openings. Such openings are defined, however, by slits or cuts stamped or otherwise formed in the walls of the plenum chamber partially outlining sections **40** of the wall to be removed to form the duct openings. In the installation of a unit, the partially cut wall sections are simply pushed or knocked out of the wall where it is desired to connect a duct with the unit. Such connection may be made in any of the ways customary in the installation of hot air heating systems. For example, the end of the duct may be notched so that the portion extending into the chamber may be bent over as at **26'** to form a retaining flange.

The exemplary unit is shown equipped for the connection of four of the ducts **26**, although it will be appreciated that provision may be made for installation of more or less than that number of ducts. Thus, as shown in FIG. 1, knockout sections **40** are provided in each of the side walls **27** and **30** of the chamber **22** and two knockout sections **40** are provided in the end wall **28**. In the preferred form of construction shown, the removable wall sections **40** are preliminarily outlined by four arcuate slits **41** arranged to define a circle as shown in FIG. 4. The ends of the slits are spaced apart, leaving integral tongues **42** connecting the sections with the remainder of the wall and holding them in place. The tongues **42** are relatively narrow so that they can be broken off when necessary by application of pressure or a sharp blow to the outlined wall section.

In accordance with another aspect of the invention, the unit is constructed and arranged to adopt each wall section **40** for use as an adjustable damper for the duct outlet which is originally closed. For this purpose, each wall section **40** is formed with a hole **42'** and the adjacent portion of the wall is formed with a hole **43** for the reception of a bolt **44** for pivotally mounting the section **40** on the housing wall. The holes are located so that the section **40** when mounted on the pivot bolt may be swung across the opening **45** resulting from the removal of that section from the wall. In this way, the effective area of the duct opening may be adjusted as required for any installation.

To facilitate shipping and handling of the units, it is contemplated that a pivot bolt **44** will be assembled in the hole **42'** of each wall section **40** and secured in place as by welding. A nut **46** is screwed onto the bolt as shown in FIG. 5 when a unit is initially assembled. The unit may then be shipped and stored without losing any of the damper parts. When a duct is to be installed, the section **40** is pushed or knocked out and the nut removed from the bolt. The section is then remounted on the wall by engaging the pivot bolt in the hole **43** and reapplying the nut as shown in FIGS. 6 and 7. The damper thus formed may be swung about its pivot to vary the opening or effective area of the opening **40** as required. To facilitate adjustment of the damper, the end of the pivot bolt **46** is formed with a transverse slot **47** for the reception of a screw driver blade or other tool. The slot is preferably oriented with respect to the section to provide a visual indication of the damper position after a duct has been connected to the opening. One end of the notch may be distinctively shaped, as for example, beveled, to distinguish between the full open and full closed positions of the damper.

The above features also increase the utility of the unit by affording a high degree of flexibility for expansion after installations. Thus, a system installed for initially heating one or two rooms **15** in addition to its room **12** may be quickly and easily expanded to heat an additional room or plurality of rooms. All that is required is to knock out a wall section **40** for each additional duct **26** required and to install a standard duct or sheet metal pipe. The removed section and its pivot bolt and nut are right at hand for installation as the damper. Thus, even though the expansion may be made years after the initial installation, instant availability of the required parts is insured.

It will be apparent from the foregoing that the invention provides a structural unit of novel and advantageous character by which a conventional room space heater may be quickly and easily adapted for heating an entire house. The improved unit may be connected directly to a heater or it may be installed so as to draw air from a room heated by an ordinary space heater. The heated air, however supplied, is forcibly distributed to the other rooms to be heated.

The improved structural unit is simple and inexpensive to manufacture. In particular, the provision of removable sections in the plenum chamber walls to define the duct outlets permits the use of a single standard unit for wide variety of installations. In other words, a standard unit can distribute the heat to any number of rooms within the capacity of the heating system. Units can therefore be manufactured in quantity and kept in stock by contractors or others in the heating system field with the usual economies accruing from quantity production and distribution.

The invention also provides for the mounting of the blower motor in an advantageous manner to insure cool operation at all times. More particularly, the motor is mounted out of the path of the heated air moved by the blower and the latter may also function to circulate cold outside air through the motor housing.

I claim as my invention:

1. A structural unit for a heating system comprising, in combination, a boxlike structure having side and end walls, a partition dividing said structure into intake and plenum chamber, the outside walls of said plenum chamber having sections partially cut through for on the job removal to define outlet openings, and means permanently secured to the chamber walls for adjustably securing the removed wall sections to the walls in overlying relation to the openings to determine the effective areas of the openings.

2. A structural unit for a heating system comprising, in combination, a boxlike structure having side and end walls, a partition dividing said structure into intake and plenum chamber, the outside walls of said plenum chamber having sections partially cut through for on the job removal to define outlet openings, each of said sections and the adjacent portion of the wall being apertured for the reception of a bolt for pivotally mounting the section in position to swing across the opening resulting from the removal of the section, and a pivot bolt and nut for mounting each section, said bolt being mounted through the hole in the associated section and secured thereto as by welding, said nut being screwed on the bolt in the initial assembly of the unit.

3. A structural unit for a heating system comprising a boxlike structure having at least one flat sheet metal wall, said wall being partially cut through to define circular knockout sections, each of said sections having an aperture adjacent one edge, a pivot bolt assembled in each aperture and welded to the section for bolting the section to the wall after its separation therefrom, said wall having apertures for receiving said bolts positioned to locate the sections for swinging across and controlling the effective areas of the openings formed by their separation and removal from the wall, and a tool receiving slot in the end of said bolt by which the position of a section can be adjusted, said slot being oriented relative to the section to provide a visual indication of the position of the section.

4. A structural unit for distributing air heated by a space heater to a plurality of rooms, said unit comprising, in combination, a boxlike sheet metal structure adapted to be mounted in the ceiling of a room containing a space heater, a partition dividing said structure into intake and plenum chambers, said intake chamber having a bottom opening in communication with the room containing the heater, a motor driven blower mounted on said unit in position to draw air from said inlet chamber and discharge it into said plenum chamber, the walls of said plenum chamber having a series of integral sections partially cut out for ready removal on the job to provide duct outlets from the plenum chamber, and means carried by said sections for pivotally mounting them on the wall to swing over the duct openings resulting from their removal.

References Cited in the file of this patent

UNITED STATES PATENTS

2,332,969	Higley	Oct. 26, 1943
2,338,356	Powers	Jan. 4, 1944
2,516,368	Coleman	July 25, 1950