The Heating and Ventilating of Churches

By HAROLD L. ALT

THE ventilation problem in the modern church presents many angles for consideration, not the least of which is the fact that numerous churches are laboring under heavy debt and are, therefore, not at all anxious to spend any larger sum on the heating and ventilation end than is absolutely necessary. Added to this is the difficulty that some churches try to economize by standing cold during the week and heating up on Sunday only—a mistaken and dangerous policy.

The masonry construction of most churches, especially edifices built some time ago, is usually much heaiver than that of a corresponding theatre of equal size, and this results in extreme heat-absorbing capacity when churches once get cooled down.

Another consideration, and a most essential one, is that of noise, many churches having given up their ventilation equipment in disgust on account of not being able to use their systems during services owing to the objectionable noise.

Therefore, a heating and ventilating system, to give the utmost satisfaction possible, should combine (with all the other usual desirable qualities) a low first cost, a minimum amount of noise in operation, great capability of quick heating, and still must be simple enough to be operated by more or less non-expert janitors.

Owing to the auditorium-like arrangement there is no need of the individual duct system in the ordinary church, since the air from all sides of the building intermingles almost at once and forms a fairly equal temperature at various heights above the floor; for the same reason the double duct system need not be considered. In fact, the trunk line system seems to supply every needed function, being at the same time cheaper and simpler than either the individual or double duct system.

For the small or moderate-sized country and suburban church, the modern furnace has much to recommend it, many manufacturers paying particular attention to this sort of work. In the first place, it is absolutely quiet in operation, does not require any expert knowledge to run, cannot freeze up during the week, and supplies enough fresh air to meet moderate ventilation requirements. A recirculation connection combined with a carefully designed furnace equipment of this sort is a very practical solution of certain church requirements.

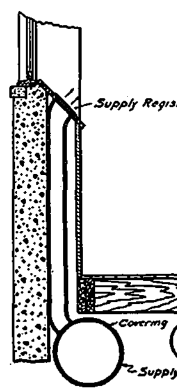

Fig. 1

In a large modern city church, which is the style of building with which this article particularly deals, the limitations of satisfactory furnace installations are exceeded, and some form of hot blast or fan system should be substituted.

Assuming the trunk line type of system has been settled upon for a large modern city church, the next point to be taken up is the location of inlets and outlets. A hot-air inlet in the aisle is objectionable on account of its being constantly walked over (thus receiving an excessive amount of dust), its poor distribution of the entering air (even when two or three such registers are used), and its unpleasant effect on the persons walking over it. Neither are hot-air inlets under the pews satisfactory, since they result in discomfort to persons sitting directly over them when the temperature is high, and must force more or less of their air through and around the clothing worn by the members of the congregation before this air rises to the breathing line.

Neither, on the other hand, do inlet registers in the ceiling and the use of downward ventilation entirely rid us of all our troubles, as the unusually high windows (present in most churches) result in very strong cold drafts downward, falling on those seated beneath such windows. All things considered, the most satisfactory location of inlet openings is in the window sills when the incoming warm air counteracts the cold down drafts, resulting in a tempered mixture of atmosphere which is thrown outward toward the centre of the congregation.

There is no objection to exhausting from outlets located beneath the pews, and this avoids the exposing to view of large exhaust registers which would otherwise appear in the walls or ceiling. In fact, when the window sill inlet is used, better results are obtained with floor exhaust outlets than with openings in the ceiling. This is apparent from the fact that the natural flow of air from the window sill inlet toward the ceiling outlet would not cross the breathing line of a single member of the congregation.

A cross section showing just such a window sill inlet and pew outlet is given in Fig. 1; both the supply and exhaust ducts in this particular case are run on the ceiling of the basement below.

Some systems only deliver supply air and let it find its way out through natural leakage. It does not seem, however, that it is reasonable to expect more than one, or at the utmost two, air changes per hour to find egress by this method. If more air (as is usually the case) is being supplied than two changes per hour, some provision should be made for taking care of the additional air furnished.

Many architects object to a radiator exposed to the view of the congregation, a much simpler expedient being the installation of a few additional rows of heaters at the fan and to warm as well as ventilate. This method involves the advantages of eliminating all the radiators, together with their steam and return piping, which would otherwise run promiscuously around the basement, and also cuts the first cost.

Practical trial, however, has developed several severe and radical failings in a purely hot blast system used without direct radiators. One of these is the well-known fact that while a hot blast system is at best rather slow in warming up a cold building (even with recirculation), the heavy walls of a church absorb so much of the first heat delivered to the room that a hot blast system otherwise perfectly adequate will have to begin operation Saturday afternoon to bring a cold building up to 70 degrees by 10 a.m. Sunday morning. This causes a jump in the electric power bill during cold weather that is nothing less than startling.

Another disadvantage is the inability to warm any room during the week without starting up the whole system and running the large fan. To some extent this may be overcome by a more or less complicated system of dampers, but can never compare in economy with the use of direct radiators for heat alone, and the blast system solely for ventilation effect.

The drawings shown in Figs. 2 and 3 are the basement and first floor plans of a church built a few years ago, in which the hot blast system is used in general without radiators.

This system was carefully designed in the extreme, flues being run to supply each class room individually, so that the doors of the class rooms could be shut, if desired, and ventilation still carried on.

The air was vented through the roof by means of two ventilators, one over the Sunday-school room and the other over the church. In the societies' room S, where the air supplied amounted to more than would be lost through natural leakage, a vent X was cut through into the church to allow a relief of the back pressure which might otherwise be created in the confined room. This hot blast system was most carefully figured and installed by engineers co-operating with the architect, and everything to make the system a success, which could be done, was done. In spite of this, as might be expected, the objections previously mentioned were found to exist in this installation. While a recirculation connection R (Fig. 3) was provided in the cold air downtake from the roof so that the outside cold air could be shut off and that in the church revolved over and over again, and ventilators V provided, it was found impossible to let the building get cooled down during the week and then heat it up on Sunday morning.

By starting Saturday afternoon and recirculating the air, the original 40-degree temperature (to which the interior of the church often fell during the week) could be raised up to about 60 degrees before shutting down for the night. During the night the temperature would drop back to somewhere around 52 degrees, and by starting up at 6 a.m. Sunday morning, it was possible to get as high as 65 degrees by 10.30 a.m. Continued operation during the day, even in extreme weather, shoved the thermometer up to above 70 degrees before evening, showing that the apparatus was amply able to maintain a proper temperature as soon as the walls ceased absorbing large quantities of heat.

To those who might say the apparatus should be increased, I would answer that this increase must amount to at least 100 per cent. over that already installed, since it would be necessary to accomplish the same heating effect (minus the drop during the night, of course) in about one-half of the time at present required.

To those claiming the building should be kept warm during the week, I would answer that this would entail a total of more hours of fan operation per week, as well as additional coal, thereby increasing not only the coal expense, but the power bill as well.

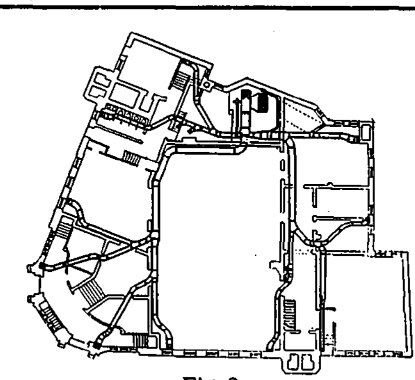
Fig. 2

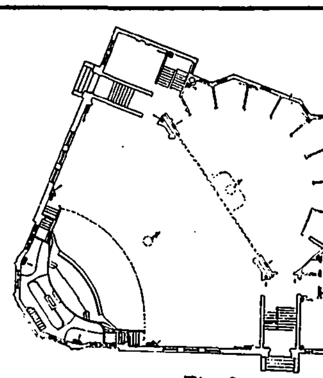
Fig. 3

Let us turn away from the combined hot blast heating and ventilating system, and see what results are attained when the warm air is used solely for ventilation effect and the heating accomplished by direct radiators.

In the first place, this means that steam supply and return pipes must be run practically all over the basement, as well as the galvanized iron pipes used for the ventilating system, and that these pipes must be arranged so as not to interfere with each other. It also means a slightly higher first cost, this not being as much of an increase as might be expected, owing to the fact that the fan heater can be reduced to about 50 per cent. of the capacity otherwise required, besides which it is also unnecessary to provide a recirculation connection.

The advantage of heating positively all rooms regardless of direction of the wind or their isolated location, is obtained only with this system. By the simple expedient of valving each riser, and, possibly, two or three points in the mains, this heating can be accomplished without warming up the whole system and without the expenditure of any electric power whatsoever.

Moreover, no power need be used to operate the fresh air