effect on the job. Finally somebody suggests that "the only way to make this job work is to put in a blower." *Usually that is the wrong way to go about it.*

Installing a blower for no other purpose than to overcome a defect by *force*, is an *extravagance*. Rightly applied, a blower will effect economies that cannot be duplicated in any other way, and they are not recommended for any other purpose.

Applying a blower to a furnace, should be for no other purpose than to remove the film of air in immediate contact with the heating surface more rapidly than it can be moved by gravity. As the film of air becomes heated, it carries away heat from the heating surface as it moves forward, and the more rapidly it moves, the faster the heat is removed because of a continuous film of cool air coming in contact with the hot surfaces. The capacity of a furnace which is operating under the most

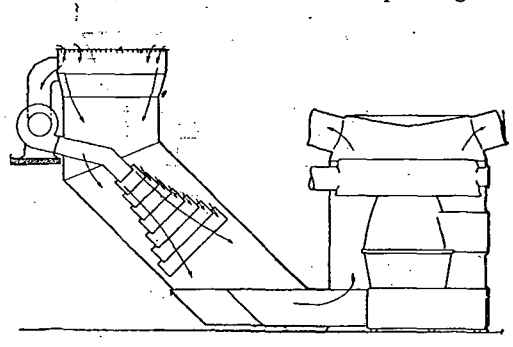

FIG. 5. DEVICE TO STIMULATE FLOW OF AIR FROM FURNACE

favorable conditions, can be increased from two to three times by using a blower. At Urbana this was demonstrated after alterations were made which had already increased the capacity by gravity circulation 1.8 times.

With a limited height of chimney and a reasonable limit to the flue gas temperature, the draft is fixed within rather narrow limits. The amount of draft fixes the rate of combustion, and the rate of combustion fixes the amount of heat obtainable from the fuel per unit of grate area. Therefore, with a fixed ratio of heating surface to grate surface, when the maximum heat transmission from a given amount of heating surface has been reached by gravity circulation, the only way to get more heat is to increase the air movement over the surface, by a blower device of some kind, or install a larger furnace with larger flues, etc.

The available pressure head is so slight in gravity work, that it needs but little resistance to stop the flow and sometimes completely reverse it. It does not require much additional pressure in many cases to set the air in motion and as soon as the ducts and flues become thoroughly heated, they will continue to operate satisfactorily.

Wherever long horizontal or crooked ducts prevail, a blower must be installed which is large enough to handle all the air that will be required to convey the maximum amount of heat into the building. Unless one is

prepared to have such a blower operate continuously when heat is required, he may be disappointed in the results, as it becomes rather costly to pay for electric current as well as coal for continuous operation.

The reason why such a blower must operate continuously and not occasionally, as a circulator can be operated, is this: Some of the leaders offer very little resistance to the flow of air, whereas some of the others offer a great deal. Therefore, dampers must be inserted in such leaders offering but little resistance, so as to make them equal the resistance of the others. If this is not done, the bulk of the air will blow through the leaders having the least resistance, with the result that little would be gained in the delivery of more air or more heat to those rooms requiring a greater amount.

By making such adjustments of the dampers to equalize the flow, it introduces so much resistance to the whole plant that the furnace is unable to heat any part of it by gravity circulation alone. That is why the blower has to run all the time, when one is installed with the expectation that all of the air required by the building will have to pass through it.

All kinds of devices have been developed to stimulate the flow of air from furnaces without having to handle all the air required to properly heat a building. Many of such devices have long since passed out of existence, and have been forgotten. During the past two years, a new crop has sprung up, one of which, Fig. 5, was recently tested at the University of Illinois and reported to the last meeting of the *National Warm Air Heating & Ventilating Association.*

This particular device is intended to make it possible to heat a building by circulating air at low temperature instead of at high temperature, thus avoiding hard firing with its inevitable waste, repairs and renewals to the furnace. Higher efficiency can be obtained under all weather and operating conditions and less attention will be demanded by the furnace to get satisfactory results.

Tests made on this device show that at a register temperature of 120 deg. it is possible to induce 60 per cent more air to flow than by gravity and at the same time get an overall efficiency 20 per cent higher. As the register temperature rises, the gain becomes gradually less; thus, at 180 deg., the amount of air induced to flow over and above what would flow by gravity is 35 per cent more and the overall efficiency is but 3 per cent more. Please bear in mind that this gain was effected after alterations had been made in the furnace so as to get the best possible results by gravity circulation. The comparative results obtainable are shown in Fig. 4.

This circulator was designed to induce the flow of several times the volume of air that the blower of itself will handle. It, therefore, consumes so little current that the cost of the fuel and the electricity combined, even if the circulator is run continuously, amounts to less than the fuel alone would amount to when similar results are produced, if such a thing could be effected.

It offers no obstruction to the flow of air in the recirculating pipe, so that the furnace can be operated without the blower running just the same as though nothing was there, and the result will in no way be different. When more heat is wanted, the circulator can be started, and