

In order to illustrate just how important this item of air temperature at the registers really is, the results of three tests on the piped furnace plant Fig. 47 are presented in Fig. 49 and analyzed. Absolutely no changes were made in the furnace or plant during these tests. In the right hand half of the figure each inclined line represents one test; the lowest line

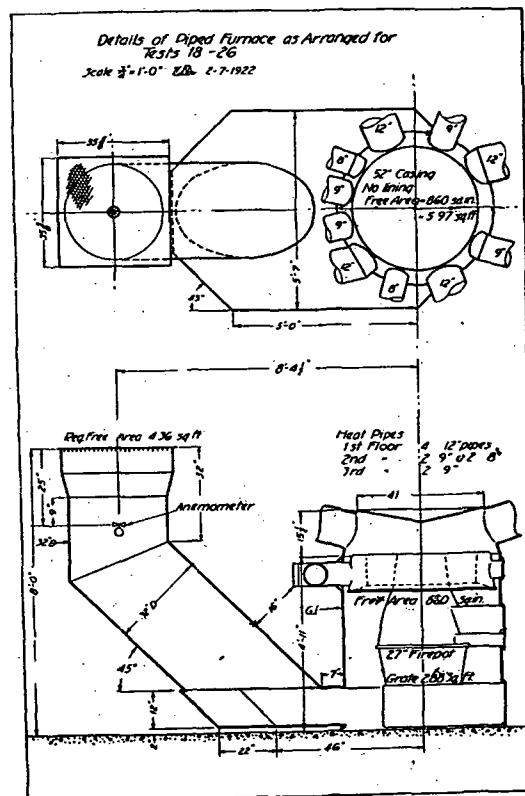


FIG. 48. AN IMPROVED RECIRCULATING DUCT WHICH INCREASED LEADER

shows the results from a test with the air temperatures at the registers for the three floors averaging 141.2 deg. fahr., the middle line is taken from a test with an average register temperature of 175.8 deg. fahr., and the upper line represents the results of a test with an average register temperature of 197.5 deg. fahr. The horizontal axis indicates the height of the register above the grate in feet, and the vertical axis gives the heating effect produced in the room per square inch of leader pipe area.

For example, during the first or low temperature test, each square inch of leader pipe to the first floor registers supplied 50 B.t.u. per hr. for useful heating effects in the rooms, each square inch of leader pipe to second floor registers supplied 89 B.t.u. per hr. for useful heating effect in the rooms, and each square inch of leader pipe to third floor registers supplied 122 B.t.u. per hr. for useful heating effect in the rooms. At this time the draft was 0.05 in. of water and the combustion rate was 3.8 lb. of coal per sq. ft. of grate.

By merely increasing the draft to 0.14 in. of water, the combustion rate in the second test increased to 5.6 lb. of coal per sq. ft. of grate and the average air temperatures at the registers became 175.8 deg. fahr. This raised the useful heat carrying capacity of each square inch of leader pipe for the first floor from 50 to 103 B.t.u. per hr., for the second floor from 89 to 153 B.t.u. per hr., and for the third floor from 122 to 204 B.t.u. per hr. A further increase of the draft to 0.16 in. of water gave a still higher combustion rate of 6.5 lb. per sq. ft. of grate and correspondingly greater heat carrying capacities for each square inch of leader as shown in the upper curve of the right-hand half of Fig. 49.

The left-hand half of Fig. 49 shows the air velocities in the leaders to each floor for each test. A glance at the curves (each curve represents one test) will show that the velocity and hence the quantity of air delivered was materially increased each time the register temperature was increased, hence an increase in register temperature not only adds more heat to each pound of air supplied at the registers, but also increases the number of pounds of the hotter air which is supplied. In all cases the leader area was the same.

It is also possible to determine exactly just what effect the changes in air temperature at the registers have had on the heating capacity of this furnace and plant. The first floor leader area is $4 \times 113 = 452$ sq. in., the second floor leader area is $2 \times 50 + 2 \times 64 = 228$ sq. in., and the third floor leader area is $2 \times 64 = 128$ sq. in., or a total of 808 sq. in. The free area of the furnace is 838.4 sq. in. Hence this furnace developed the following useful heating capacities (that is, heat supplied at registers for heating rooms to 70 deg. fahr.) in each of the three tests:

Test Number 1.

Register temperature = 141.2 deg. fahr. (Draft = 0.05 in. and combustion rate = 3.8 lb. per sq. ft. of grates.)

$$\begin{array}{rcl} 452 \times 50 & = & 22,600 \\ 228 \times 89 & = & 20,300 \\ 128 \times 122 & = & 15,600 \\ \hline & & 58,500 \text{ B.t.u. per hr.} \end{array}$$

Test Number 2.

Register temperature = 175.8 deg. fahr. (Draft = 0.14 in. and combustion rate = 5.6 lb. per sq. ft. of grate.)

$$\begin{array}{rcl} 452 \times 103 & = & 46,600 \\ 228 \times 153 & = & 34,900 \\ 128 \times 204 & = & 26,100 \\ \hline & & 107,600 \text{ B.t.u. per hr.} \end{array}$$