previously figured. The size leader that would be installed based on the results as figured and the actual areas of same are also given. Stacks are assumed of common commercial sizes as the plant from which the data were secured has the common commercial size stacks. These are approximately 0.7 of the leader area for the second floor, and 0.6 of the leader area for the third floor.

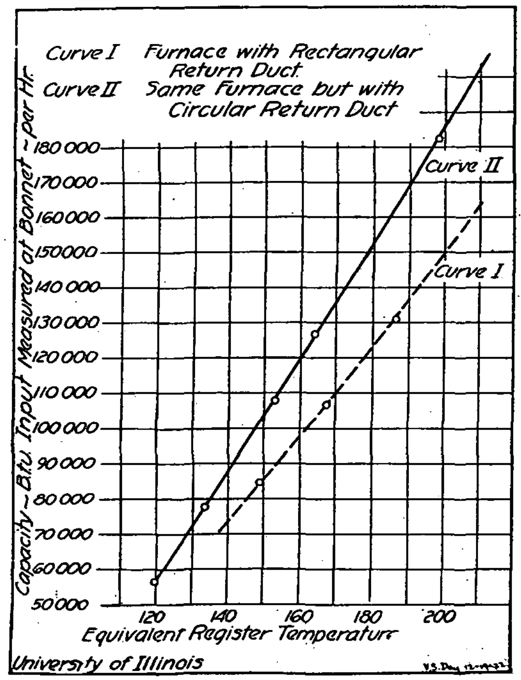

FIG. 46. CURVES SHOWING RELATION OF CAPACITY TO SHAPE OF RETURN DUCT

As test data are not yet available on stacks and registers no attempt has been made to discuss the design of this part of the system. It is also assumed that all the preceding leaders are short and straight. The effects of long runs and elbows in leaders is being investigated in tests run on the auxiliary plant.

EFFECT OF RECIRCULATING DUCT DESIGN ON FURNACE CAPACITY[2]

The following discussion is a typical illustration of the kind of information which the University of Illinois and the *National Warm Air Heating*

[2]Abstract of article by A. C. Willard, A. P. Kratz and V. S. Day in *Sheet Metal Worker*, January 19, 1923, based on tests made at University of Illinois and apply only where gravity circulation is used.

and Ventilating Association are developing in the warm air furnace research work which is being carried on jointly by these two agencies at Urbana, Illinois.

GENERAL STATEMENT

One of the most interesting series of comparative tests which has been carried on in the warm air furnace research work at the University of Illinois was the investigation of the effect of the recirculating duct on the capacity of a gravity warm air furnace. The results are of special interest to the installer and house owner, and since these ducts may materially increase or decrease the heating capacity of any given furnace the furnace manufacturer should be equally interested. When the difference in design of two common types of recirculating ducts may affect the furnace capacity by as much as 22 per cent, the details of these ducts, which account for the difference, become of vital importance to everyone connected with furnace installation.

The only change in the duct design, or in the entire plant, was to eliminate two right-angled elbows in a rectangular duct with a vertical recirculated air inlet and substitute two 45 deg. elbows with a round duct and a horizontal recirculated air inlet. In fact, the round duct with the 45 deg. elbow developed its superior air passing capacity with a register grille of only 50 per cent free area at the inlet, whereas the rectangular duct inlet was without any grille at all.

DESCRIPTION OF PLANT AND TESTS

The furnace plant Fig. 47 used in the tests was identical for both cases except for the changes necessary, Fig. 45, in the recirculating system. The tests were made as follows:

1. A group of four tests was selected from previous work, for comparison. These tests were run on the plant, Fig. 47, described under the *Main Plant* in previous reports, and on pages 18 and 19 of *Bulletin* No. 120, Engineering Experiment Station, University of Illinois. The essential features of this plant are shown in Duct *A*, Fig. 45.

2. A black iron inner casing was provided as in Group 1, extending from the recirculating duct connection to the top casing ring and spaced 1 in. from the outer casing.

A series of capacity tests were run over a wide range of operating temperature, for this condition. The essential features of this plant are shown in Duct *B*, Fig. 45.

RESULTS OF TESTS

The results of the tests are shown in the curves of Fig. 46, in which the capacities (in B.t.u. supplied to the air per hour) are plotted on a register temperature basis. A marked increase in the weight of air, and in capacity Fig. 46 was shown to exist. The round duct without the bad right-angle bends on the rectangular duct handled a much greater