days for the season in question and the average degree-days as shown in Table 3.

TABLE 3. DURATION OF HEATING SEASON

City	Degree—Days for Heating Season
Atlanta	2880
Boston	6055
Buffalo	6750
Cincinnati	5302
Cleveland	6096
Chicago	6007
Dallas	2455
Denver	5880
Detroit	6202
Jacksonville	1080
Kansas City	5302
Minneapolis	7953
New York	5303
Oklahoma City	3827
Pittsburgh	5327
San Francisco	3450
St. Louis	4583
Philadelphia	4950
Seattle	5156
Washington	4562

PROPORTIONING RADIATION

The charts of Figs. 1 and 2 graphically represent the number of cubic feet of gas per square foot of radiation for the heating season in any climate, the climate being expressed in degree-days, and are applicable to any heating condition in the United States. These charts give very close estimates when the radiation is proportioned to maintain a maximum inside temperature of 70 deg. and when that temperature is maintained.

It seems hardly possible to formulate a general rule to cover the estimating of fuel consumption when temperatures other than 70 deg. are to be maintained; at least to formulate a rule based upon the ones just given. For example, the maintenance of a temperature other than 70; let us say 55 deg.; would amount to cutting a much different proportion off the heating season in San Francisco than would be the case in some other locality, for example, New York. It would seem, therefore, that in the absence of sufficient data on which to base rules for estimating fuel consumptions in those cases where temperatures other than 70 are to be maintained with the building to be heated, it would be safest to handle each case individually, strictly according to its own peculiarities. A suggested procedure would be to examine the weather reports for the locality in question, determine the difference between the average outdoor temperature and the temperature to be maintained in the heated spaces for each week during the heating season, and then calculate the actual heat loss for each of the weekly periods taken. The total loss for the heating season; which would of course differ in length from the usual heating season, which is based on the maintenance of an indoor temperature of 70 deg.; divided by an assumed year-around efficiency for the entire heating plant, which could safely be taken as 75 per cent; would

give a very fair estimate of the annual fuel requirement expressed in B.t.u. to be supplied to the gas-burning appliance.

CROSS-CONNECTING COAL AND GAS BOILERS

Quite frequently, when a customer already has a coal boiler in his home, it is sometimes expedient to leave the coal boiler in place, and to cross-connect the gas boiler with it. Where gas heating is new to the community, it produces a more secure feeling in the customer's mind when putting in gas-fired house-heating equipment, if he knows that he can burn coal at any time he has occasion to.

In hot-water heating systems, it is necessary to valve off the return pipes on the coal boiler, which prevents circulation through the latter when the gas boiler is in use. Since the gas boiler holds comparatively little water and is almost always insulated, no valves are needed on the return pipes to the gas boiler. Hence, by opening the valves on the coal boiler, it may be operated independently or in conjunction with the gas boiler.

For steam or vapor installations, it is necessary to valve off all the returns and flows on each boiler unless the gas boiler is set so that the water line in both boilers is at the same level, in which case it is necessary to valve off only the coal boiler to prevent the heating of the water in the coal boiler when it is not in use.

The gas boiler should be set as close to the coal boiler as practicable, and the flows and returns should cut into the flows and returns of the coal boiler as near to the latter as possible.

LARGE BUILDING HEATING COSTS

The foregoing material on the estimating of heating costs when gas is used as the fuel is somewhat more applicable to residences than it is to large buildings or to buildings that are used for other than residential purposes. The use of specially designed gas boilers for large installations, such as office buildings, department stores, and other buildings of a similar nature, is increasing so rapidly that it is possible to give fairly accurate data covering several phases of these installations. In comparing the true cost of heating a large building of a commercial nature with gas, as opposed to other fuels, there are a number of items that should be considered in addition to the bare fuel costs. Rental value of the floor space occupied by the boiler installation and of the space required for fuel and ash storage, may have a strong bearing on the true cost of heating. When gas is burned the added feature of cleanliness resulting from the elimination of coal delivery and ash removal may add materially to the attractiveness of the building. It is difficult to evaluate the reduced necessity for redecoration when gas is used, because the frequent changes in tenancy encountered in this class of building always necessitate redecoration. There are many cases however, where this factor has a tangible value.

The supervision of a gas-heated plant is reduced to a minimum. The methods of control produce a uniform temperature at all times, with the minimum requirement of making sure that the pilots are operating and that the temperature controls are set at the proper joint. It is often