

a gas steam boiler, giving an evaporation of 465 lb. of water (from and at 212 deg. Fahr.) with a consumption of 1,000 cu. ft. of gas:

$$\text{Efficiency} = \frac{\text{B.t.u. in steam}}{\text{B.t.u. in gas}} = \frac{\text{lb. water} \times 970.4}{\text{cu. ft.} \times \text{B.t.u. per cu. ft.}}$$

$$\text{With gross value} : \frac{451,236}{550,000} = 82.04 \text{ per cent}$$

$$\text{With net value} : \frac{451,236}{500,000} = 90.25 \text{ per cent}$$

Furthermore, it will be seen that the maximum efficiency possible, based upon the *gross* heat value of the above gas (without condensing the water vapor in the flue gas), would be $\frac{500}{550}$, or 90.90 per cent.

Efficiencies of 80 per cent based on the *gross* heat value of gas fuel, are obtainable in properly designed vented appliances. It should be remembered that the efficiency of a gas appliance in actual operation closely approaches that determined in laboratory tests.

WASTE FROM USING GAS IN COAL BURNING APPARATUS

In coal stoves or coal furnaces the path traveled by the flame is short and the radiating surface is relatively small. For this reason, the use of gas in such stoves is always wasteful and will require about three times as much gas for the same heating service as would be required if the gas were used in a properly built natural-gas furnace. Even with perfect combustion in the fire pot of a coal stove or coal furnace the waste will usually be about 75 per cent. Properly built natural-gas furnaces have a longer fire travel and much more radiating surface than coal furnaces, and are, therefore much more efficient.¹

Hot air furnaces, designed for use either with manufactured or natural gas, are available in sizes ranging from 5,000 cu. ft. to 20,000 cu. ft. rated capacity.

House heating boilers, of the cast-iron sectional type, designed especially for gas fuel, are available in single units ranging from 200 sq. ft. to 7,500 sq. ft. rated capacity (steam). Typical gas warm-air furnace and boiler are pictured in Figs. 48 and 49, respectively.

RATINGS

Gas appliance manufacturers have followed the custom established by coal appliance manufacturers in rating their product in terms of cu. ft. (warm air) and sq. ft. of radiation (water and steam). Gas appliance ratings in these terms are generally empirical, however; they are selected

¹"Waste and Correct Use of Natural Gas in the Home"; Sec. 29, Technical Paper 257, Department of the Interior, Bureau of Mines; by Samuel S. Wyer.

to conform in size with a coal appliance of equivalent power under ordinary operating conditions.

The capacity of a gas furnace or boiler is subject to much smaller fluctuations than a boiler employing solid fuel; the element of length of firing period does not enter into consideration; heating surfaces remain clean for longer period of time. Although most coal boilers are rated on an 8-hr. firing period (with anthracite coal and clean heating surfaces) for catalog purposes, the architect or heating engineer makes allowances for less favorable conditions when deciding upon appropriate equipment. Gas appliance manufacturers give to their product a rating comparable

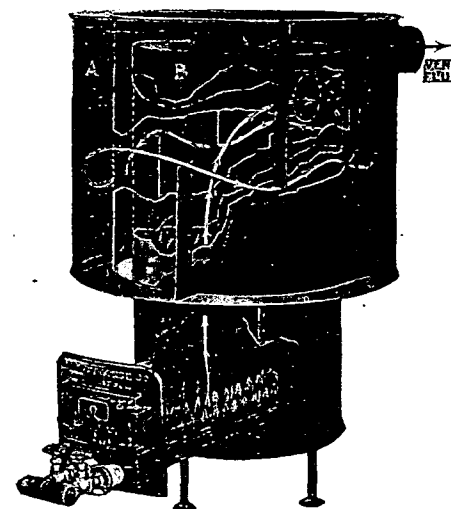


FIG. 48. VIEW OF GAS FIRED WARM AIR FURNACE

to that of a coal boiler on the 8-hr. basis. In other words, where a 2,400 sq. ft. coal boiler would be chosen, a 2,400 sq. ft. gas boiler would generally be appropriate.

It is a common practice for gas boiler manufacturers also to give their boilers a rating in terms of "Available B.t.u." (B.t.u. per hour available in the steam or water at the boiler outlets).

A gas furnace or boiler will show essentially the same capacity or efficiency with any gas fuel, provided steps are taken to furnish proper burner equipment and air regulation for each type of fuel. Most manufactured gases, although of lower heating value than natural gases, if burned in sufficient volume, will produce equivalent results. The heating value of a mixture of gas and air (air just sufficient to completely burn the gas) is almost the same for any typical commercial gas, as is shown in Table 50.