combustion and consequently the foregoing reference to the use of draft hoods would not apply.

The products of complete combustion of gas are water vapor (H_2O) and carbon dioxide (CO_2). In the case of manufactured gas, the presence of organic sulphur compounds, generally between 3 and 15 grains per hundred cubic feet, gives rise to minute percentages of sulphur dioxide and sulphur tri-oxide.

The volume of water vapor in the flue products from natural or coke oven gas is about twice the volume of carbon dioxide. It is extremely important that the chimney be tight and resistant to corrosion not only of moisture, but also of dilute sulphur trioxide.

Vitreous tile linings with joints which prevent retention of moisture and linings made of non-corrosive materials are advantageous. The protection of unlined chimneys has been investigated and the results indicate that after the loose material has been removed, the spraying with a water emulsion of asphalt chromate will provide excellent protection.

Advice regarding recommended practice and materials for flue connections and chimney linings can usually be obtained from the local gas company and should be given careful consideration.

Since a gas designed appliance must be able to operate at rated input (plus 10 or 15 per cent) without chimney connection, and without producing carbon monoxide, the only function of the chimney is to remove the products of combustion from the room. The chimney provides draft to overcome the friction in the flue pipe and chimney, but does not draw air into the appliance.

Chimneys for venting appliances designed for burning gas can therefore be low in height, but must have adequate area. The height is usually established by the building height. Chimney sizes are usually selected on the basis of Btu input to the appliance. One chart[5] designed to facilitate selection is shown in Fig. 6. The assumptions made in preparing the chart as well as its limitations should be noted carefully.

Since Fig. 6 has been prepared for circular flues, relative capacities for rectangular and semi-elliptical flues[6] are shown in Fig. 7.

When a flue is connected to several appliances, the number of horizontal runs of various sizes which may be substituted for the single run having a diameter equal to that of the flue may be obtained from Table 4.

CONSTRUCTION DETAILS

For general data on the construction of chimneys reference should be made to the Building Code recommended by the *National Board of Fire Underwriters*, Article XI, Sections 1101 to 1105, in which the following are some of the important provisions listed in the 1943 edition:

(*a*) Chimneys erected within or attached to a structure shall be constructed of brick, of solid block masonry, or of reinforced concrete.

(*b*) Chimneys shall extend at least 3 ft above the highest point where they pass through the roof of the building and at least 2 ft higher than any ridge within 10 ft of such chimney.

(*c*) Every such chimney shall be properly capped with brick, terra cotta, stone, cast-iron, concrete or other approved non-combustible, weatherproof material.

(*d*) Chimneys shall be wholly supported on approved masonry or self-supporting fireproof construction.

(*e*) No such chimney shall be corbeled from a wall more than 6 in.; nor shall such chimney be corbeled from a wall which is less than 12 in. in thickness unless it projects equally on each side of the wall; provided that in the second story of two-story dwellings

corbeling of chimneys on the exterior of the enclosing walls may equal the wall thickness. In every case the corbeling shall not exceed 1 in. projection for each course of brick projected.

(*f*) No change in the size or shape of a chimney, where the chimney passes through the roof, shall be made within a distance of 6 in. above or below the roof joists or rafters.

(*g*) Smoke flues for warm air, hot water and low pressure steam heating furnaces shall have walls not less than 8 in. thick; the walls may be of solid masonry using brick, stone or concrete, or of solid moulded or solid cast chimney units of concrete, or of burned clay, or of suitably reinforced solid concrete cast in place; provided that for stone masonry other than sawed or dressed stone in courses, the thickness shall be not less

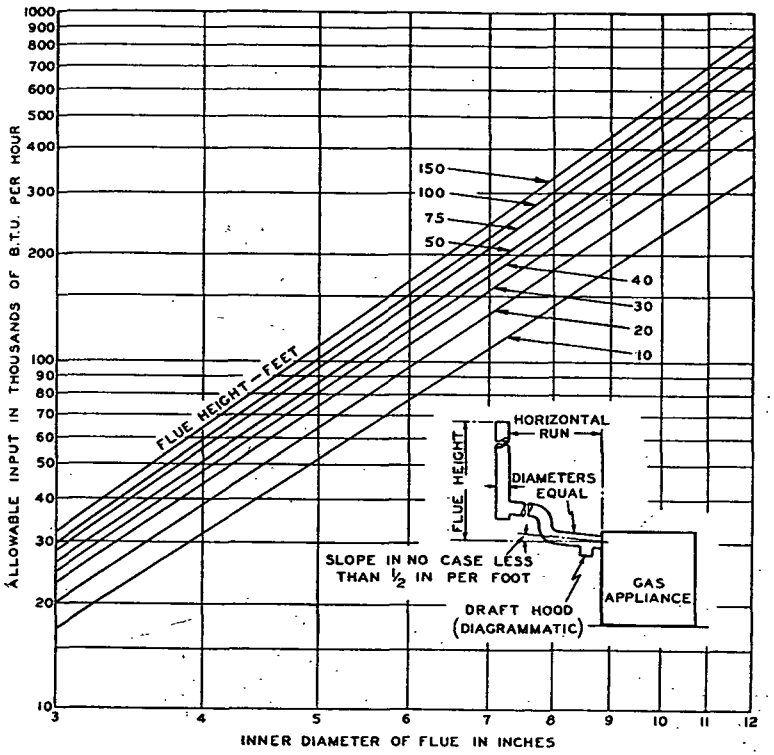

FIG. 6. ALLOWABLE BTU INPUT TO CIRCULAR FLUES FOR DOMESTIC GAS APPLIANCES WITH DRAFT HOODS

Notes:

1. Chart is based on: average flue temperature of 150 F, outside temperature of 60 F, barometric pressure of 30 in. Hg, 100 per cent excess air and 100 per cent dilution at draft hood.
2. Based on terra-cotta lined flues. With rough brick flues, capacities are 15 per cent less.
3. Based on condition that horizontal run is not greater than 20 ft except for a flue height less than 20 ft, in which case the horizontal run is not to have greater length than the height of the flue.
4. Two long radius elbows are included in the horizontal run, the diameter of which is equal to that of the flue.
5. Each additional elbow reduces the allowable horizontal run by a length in feet equal to the diameter in inches.
6. When the horizontal run has an effective length in excess of that given (or additional elbows) the next larger size of flue should be chosen. It is desirable that long horizontal runs be insulated to reduce heat loss of flue products and to conserve draft.
7. Capacities should be reduced 3.5 per cent for each 1000 ft above sea level.