shall be not less than the area of the largest flue or vent connector plus 50 per cent of the areas of the additional flue or vent connectors.

3. An elliptical flue or vent may be used provided its flue gas venting capacity is equal to the capacity of the round pipe for which it is substituted.

Since Fig. 10 has been prepared for circular flues, relative capacities for rectangular and semi-elliptical flues[14] are shown in Fig. 11.

Heating appliances designed to burn gas, as well as appliances converted to gas burning, except those equipped with power type burners and ex-

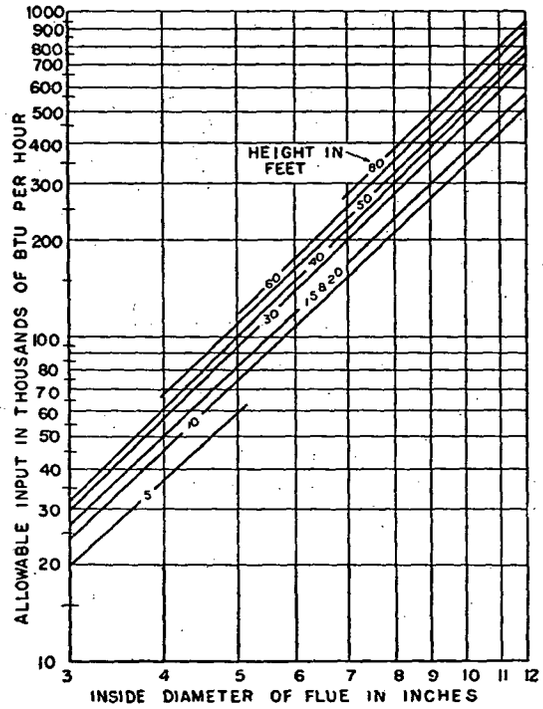

FIG. 10. CAPACITY IN BTU PER HOUR FOR GAS APPLIANCE FLUES OR VENTS

cepting conversion burner installations in excess of 400,000 Btu per hour input in large steel boilers, are always equipped with a draft hood attached to the flue outlet of the appliance. This draft hood is required if the appliance is to meet the approval requirements of the *American Gas Association* and the *American Standards Association*, and is essential for safe operation. It is designed to prevent excessive chimney draft which would lower appliance efficiency, to prevent a blocked flue or a down-draft in the chimney from impairing combustion, to provide a relief opening for the products of combustion during down-draft or blocked flue conditions, and to prevent spillage of the products of combustion to the space surrounding the appliance, if there is a chimney draft equivalent to that provided by a 3-ft chimney. As the draft hood is designed without moving parts, the

relief opening is always open, and consequently some air is drawn into the chimney. This air lowers the gas temperature in the chimney, but it also lowers the dew-point of the gases and tends to prevent condensation.

The installation of conversion burner equipment in large boilers is usually made in accordance with regulations of the local gas company. In such installations a definite chimney draft may be required for proper 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 sulfur compounds, generally between 3 and 15 grains per hundred cubic feet, gives rise to minute percentages of sulfur dioxide and sulfur trioxide. 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

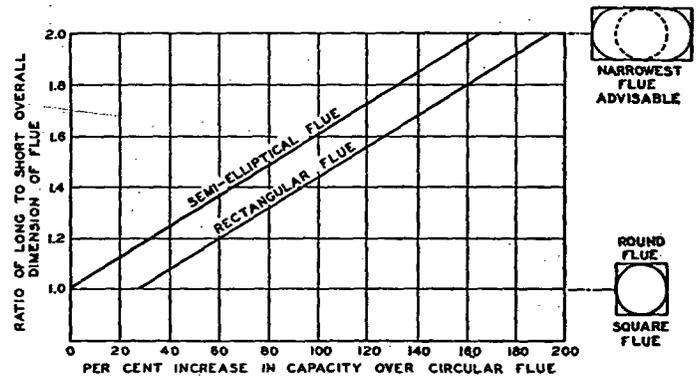

FIG. 11. CAPACITY OF A RECTANGULAR FLUE OR A SEMI-ELLIPTICAL FLUE, WITH SEMI-CIRCULAR ENDS HAVING ITS MINIMUM WIDTH EQUAL TO THE DIAMETER OF A CIRCULAR FLUE, COMPARED WITH THE CAPACITY OF THE CIRCULAR FLUE

important that the chimney be tight and resistant to corrosion, not only from moisture, but also from dilute sulfur trioxide.

Clay linings with joints which prevent retention of moisture and linings made of non-corrosive materials, are advantageous. The interior protection of unlined chimneys by applying an asphalt-chromate emulsion has been investigated by some gas companies but the material is not of current interest because insurance companies do not favor potentially combustible coatings.[15]

An investigation of damage occurring in 78,129 chimneys used for venting gas appliances in a severe climate has been made by the *Minneapolis Gas Company* with the results shown in Table 4 taken from Reference 15.

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.

RECOMMENDATIONS OF THE NATIONAL BOARD OF FIRE UNDERWRITERS

For general data on the construction of chimneys, reference should be made to the National Building Code, recommended by the *National Board*