(2) An exposure allowance of 15 per cent is also to be added to the wall and glass transmission losses and to the infiltration losses on the two adjacent sides of the building most nearly facing the prevailing wind as stated in last paragraph on page 44.

(3) It is also possible to compute the heat required to take care of infiltration on the basis of ½ of an air change per hour as given in Table 13 for a factory with minimum conditions. Volume = 50 × 120 × 20 (mean height) = 120,000 cu. ft. and heat required per hour is

$$120{,}000 \times \tfrac{1}{2} \times 0.075 \times 0.24 \times 59.4 = 64{,}200 \text{ B.t.u.}$$

Based on infiltration through one-half the total crackage in all walls, the heat to be supplied per hour is from preceding table.

$$6{,}850 + 27{,}300 + 5{,}950 + 23{,}750 = 63{,}850 \text{ B.t.u.}$$

This value based on crackage should be used, but if building is to be heated intermittently, not less than one air change per hour should be allowed.

CHAPTER II.

HEATING BY RADIATION

THE device used to transmit heat from the carrying medium to the air or surrounding space with either steam or hot water heating is called a radiator or is generally spoken of as radiation.

Radiation is divided into four general classes depending upon how it is used, namely, direct, semi-indirect, indirect and direct-indirect. If the radiator is placed within a room to be heated, and imparts its heat directly by radiation and convection to the objects and air to be heated, it is called a direct radiator. If it is placed outside of, and some distance away from the space to be heated and imparts heat to air passing over it which is then delivered to the space to be heated, it is called indirect radiation. If the radiator is placed within or immediately adjoining the room to be heated, but is hidden from view by an enclosure or otherwise, so that it only imparts heat to the air within the enclosure, which is then admitted to the room, it is called semi-indirect radiation. When air from outside flows over the heating element and then enters the room the heat is supplied by direct-indirect radiation.

Until the last few years all four types of radiation were made in a comparatively small number of fairly well standardized types and sizes and shapes. During the past few years, however, a great change has taken place in design of radiation and there are now innumerable types and sizes in use, and the number is rapidly increasing. This evolution is taking place faster than engineering data can be developed and made available for use by the engineer.

All four types of radiation may be made of pipe in which case, it is spoken of as pipe-coil. Until the past few years, most radiation was made of pipe, cast iron or pressed steel. More recently, however, an ever-increasing amount of non-ferrous metal radiation has been made, in various forms both with and without extended surface. Each of the various types has its own advantages for different forms of space heating depending upon the architectural beauty, weight, size and durability.

Direct cast iron radiators were until recently, standardized as column, window, and wall radiation for which accepted heat transmission constants are available. The so-called art or tubular type of direct cast iron radiation of more recent design which has in a large measure replaced the column type in popularity is not well standardized as regards height, width, number of tubes per section or spacing of sections, and as a result generally accepted heat-emission constants are not available. This is likewise true of the many types of semi-indirect radiation now in use.

As a result of this great diversity of design and lack of engineering data, a chaotic condition is rapidly developing which must be met by

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