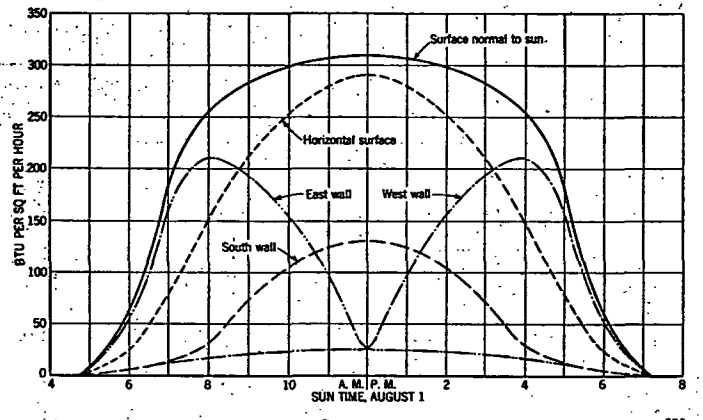

FIG. 1. SOLAR INTENSITY NORMAL TO SUN ON HORIZONTAL SURFACE AND ON WALLS FOR AUGUST 1 AT 40 DEG NORTH LATITUDE

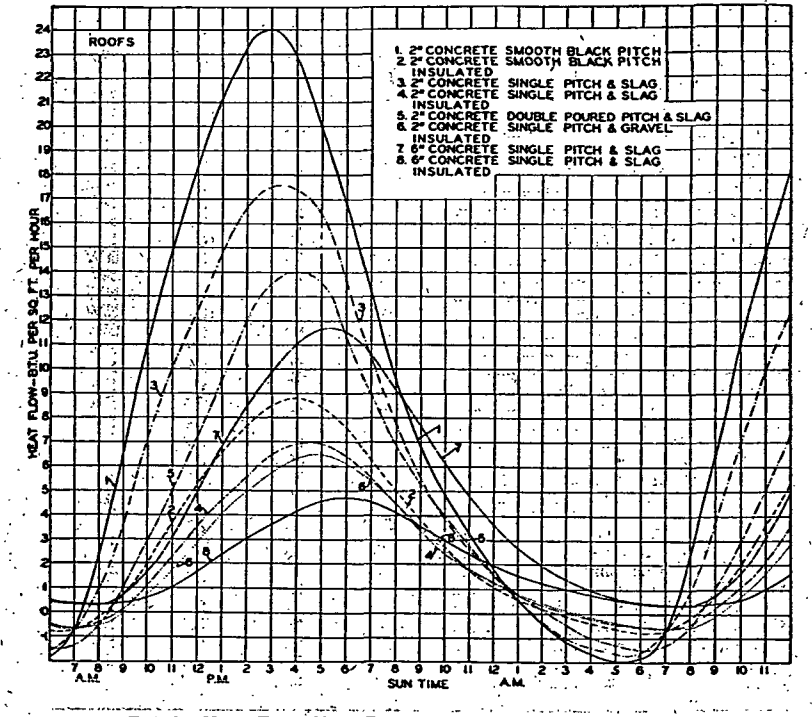

FIG. 2. HEAT FLOW-TIME RELATIONSHIP FOR HORIZONTAL ROOFS

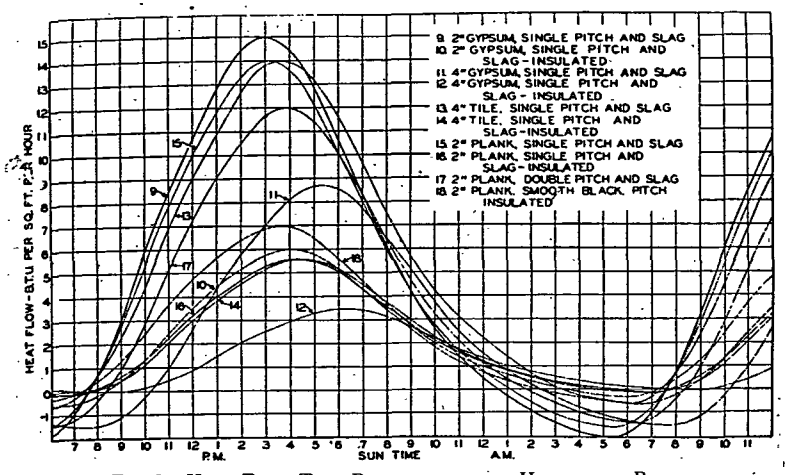

FIG. 3. HEAT FLOW-TIME RELATIONSHIP FOR HORIZONTAL ROOFS

intensity coming from all parts of the sky due to reflection and refraction. This scattered radiation intensity has been found to vary from a very low value to values as high as 20 per cent of the total radiation observed on certain days in Pittsburgh. The values shown on the curves in Fig. 1 are for combined direct solar and scattered sky radiation, and are given to represent expected design radiation intensity for August 1 for Pittsburgh. They were prepared by the A.S.H.V.E. Laboratory from data [1] obtained by pyrheliometer observations.

A study of the curves discloses the periodic relationship and wide variation in solar intensity on various surfaces. It will be observed that both the roof (horizontal surface) and south wall radiation curves are in exact phase relationship with each other, while those for the east and west walls overlap each other due to scattered sky radiation on the west wall during the forenoon and on the east wall during the afternoon. This phase relationship has an important bearing on the cooling load. Failure to consider the periodic character of heat flow resulting from diurnal movement of the sun and the lag due to heat capacity of the structure, which determine the timing and magnitude of the heat wave flowing through the wall, may result in a large error in load calculations.

The values of solar intensity appearing in Fig. 1 must not be confused with the actual heat transmission through the wall, for much of the solar radiation impinging against the outer surface fails to pass through the wall. Instead it is delivered to the outside air by reflection, radiation, and convection. A mathematical solution for the determination of solar heat transmission has been developed but the equations involved are too complex for practical application [2]. A simpler method embodying an approximate determination of the maximum contribution to the cooling load due to heat transfer from the inside surface of a wall exposed to solar radiation has been developed [3].

The heat flow in summer through various types of roofs and walls has been measured [4,5] by the A.S.H.V.E. Laboratory. The curves in Figs. 2