THE TRANSMISSION OF HEAT THROUGH COLD-STORAGE INSULATION: FORMULAS, PRINCIPLES, AND DATA RELATING TO INSULATION OF EVERY KIND, A MANUAL FOR REFRIGERATING ENGINEERS

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THE

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FORMULAS, PRINCIPLES, AND DATA RELATING TO INSULATION OF EVERY KIND

A MANUAL FOR REFRIGERATING ENGINEERS

BY

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PREFACE.

THE laws and experiments given by the French physicist, Péclet, in his famous "Traité de la Chaleur," have been the basis of all treatises on artificial heating that have since been written.

They are equally applicable to the art of refrigeration, and it is the purpose of this book to present them in convenient form with the additional data required for modern practice.

THE TRANSMISSION OF HEAT THROUGH COLD-STORAGE INSULATION.

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1. General Principles.—Let figure 1 represent a section of a wall of a refrigerated room, and let the wall be of the same material throughout its thickness. Let this room be maintained at a constant temperature, lower than that of the external air, by the withdrawal of heat from it by any of the usual methods. Assume the room to be filled, or partially filled, by articles in storage, and suppose that the temperature of the air in the room and that of the air on the outside have remained constant long enough for the flow of heat in through the wall to have become steady; in other words, that the wall has become as cold as under these conditions it ever will become.

Consider, first, the inner surface of the wall; on account of the difficulty which heat experi-

ences in escaping from the surface of a body, this surface is appreciably warmer than the air within the room, and it gives out heat to the room in two ways, by *radiation* and by *air contact.*

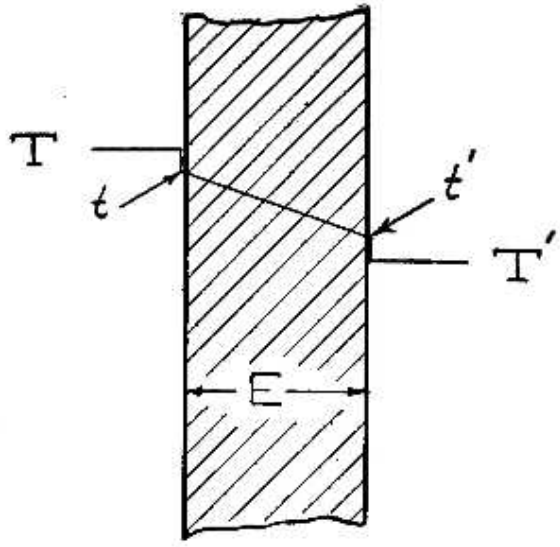

FIGURE 1.

The radiant heat travels in straight lines from the wall-surface to the objects in the room, passing through the air without much, if any, heating of it, but the heat thus imparted to the objects is given up by them to the air by air contact. The objects receiving the radiant heat will evi-

dently be at a temperature slightly higher than the air; we may neglect this in all calculations, but in measuring the air temperature of a refrigerated room by a thermometer we should always take care to protect it from radiation from the walls, and we should also prevent it from radiating heat to any cooling-surfaces such as brine pipes and so forth.

The heat given out by air contact, or convection, as it is perhaps more usually called, is emitted by the wall-surface to the air actually in contact with that surface. As this air is heated it rises, forming an ascending current along the surface, and therefore the higher the wall the less energetic is this action, although the decrease with height is less than might be expected.

The heat thus given to the air and that absorbed by it by contact with the objects heated by radiation is, of course, carried by it to the cooling-pipes; it enters these and is carried away by the cooling-liquid or gas circulating through them.

Turning to the outer wall-surface we again find a sudden difference of temperature between the air and the surface, this difference being necessary to draw the heat in through the resistance of