Double-glazed windows

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SUBJECT Double-glazed Windows

In view of the interest shown in double-glazing, it is proposed herein to outline some of the fundamental considerations and possible arrangements of materials.

The need for resistance to heat flow becomes apparent when one considers the low temperatures common to the Canadian winter. When the temperature inside a building is 70° and the outside temperature -10°, the temperature of the inside surface of a single glass will be 9° F. Condensation will occur on the window when the humidity inside the house is more than 10 per cent; with double glass under the same conditions the inside surface temperature of the inner glass will be 42°F. and the corresponding humidity at which condensation begins to occur is 34 per cent. Double glass not only reduces the heat loss to 50 per cent of that through single glass, but because of the higher inside surface temperatures provided, it permits the presence of higher inside humidities in houses without condensation.

Factory-made double-glazed window units are relatively expensive, but as will be seen a perfect seal with good quality glass cannot be achieved cheaply. They are not necessarily warmer than other well-made arrangements of two glasses with an air space between. They will therefore frost on the room-side surface nearly as readily. However, when the space between the glasses is perfectly sealed by a glass-to-metal seal there can be no frosting between glasses and no entry of dust. These are the greatest difficulties encountered with double glazing in ordinary wood sash or wood frames in which it is impossible to obtain perfect sealing of the space between glasses.

Many people ask about the width of air space required between glasses. An air space 3/4-inch thick is as good insulation as one of any greater thickness. An air space 3/8-inch thick provides 90 per cent as much insulation, and one only 1/4-inch thick provides 75 per cent as much as a 3/4-inch air space. The air between glasses tends to increase in volume by 20 per cent due to expansion from change in temperature from winter to summer. There is, therefore, a very substantial breathing action due to temperature change in all units which are not perfectly sealed. The greater the air space between glasses, the greater will be the air volume change with temperature. This air

change carries in dust and moisture, and sometimes even water when rain or a water spray strikes a warm window. In perfectly sealed units the temperature change produces a pressure change of the air between glasses, since no breathing can take place, and this could break the glass if the air space were very wide. It is seen then to be desirable to keep the space between glasses as small as possible, while still retaining reasonable insulating value. It must be expected that all double-glazed units which breathe will become dirty on the glass surfaces next to the air space and will have to be cleaned sooner or later. One of the best arrangements of unsealed, or home-made units would appear to be one in which the outer glass is held in place by a light metal frame screwed to the wood sash or frame, and sealed with rubber gaskets. The outer glass can then be removed for cleaning at intervals of several years, as required.

It is impossible to achieve perfect sealing in a wood sash or frame as the wood will allow breathing of both air and water vapour. The best that can be achieved is to paint the wood well before glazing preferably with aluminum paint to provide as much of a barrier as possible to vapour which tends to enter the air space from inside the house in winter. So far as is known, the inner glass should be sealed as perfectly as possible, and the breathing allowed to take place past the outer glass. It is known that a poor seal at the bottom of an outer glass will allow water to be sucked in when rain strikes a warm window in summer. It therefore appears to be sound to arrange for the best possible sealing at the bottom and sides of the outer glass, but to arrange for breathing through a felt gasket at the top, where rain cannot enter in a double-glazed sash arrangement. The felt, if tightly installed, should act as a filter, to allow breathing but to prevent dust entering the air space. With double glass fixed in the frame, it is possible that a series of holes drilled through the top of the frame between the glasses and filled with absorbent cotton or felt would provide for the necessary breathing.

Metal window sash and metal window frames are becoming increasingly popular and are finding favour in areas where the weather is not severe in winter. The conductivity of metals is very high, and this may lead to still colder inner surfaces than are found with conventional wood sash and frames, and excessive condensation may occur in extreme winter weather. Where single windows are used, the condensation on metal sash and frames will not be appreciably greater, since the single glass is already very cold. However, when double windows or double glazing are to be used, surface condensation on the metal may become particularly troublesome. The use of two individual single metal sash in a wood frame will not create difficulty. Where any metal paths are provided through or around the air spaces between the glasses, as when metal frames are used, the inside metal surface may be much colder than the inner glass surface itself and the

condensation on sash and frames may be more severe than on conventional double windows. The glass surface in these cases will usually stay clear of frost, as the metal surface, being colder, freezes the moisture out of the air first.

Metal frame windows will give little trouble in buildings where the humidities are below 15 per cent, but this is lower than desirable in houses.