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C. S. BARROWS

1,988,964

PANE

Filed July 15, 1932

Fig. 1

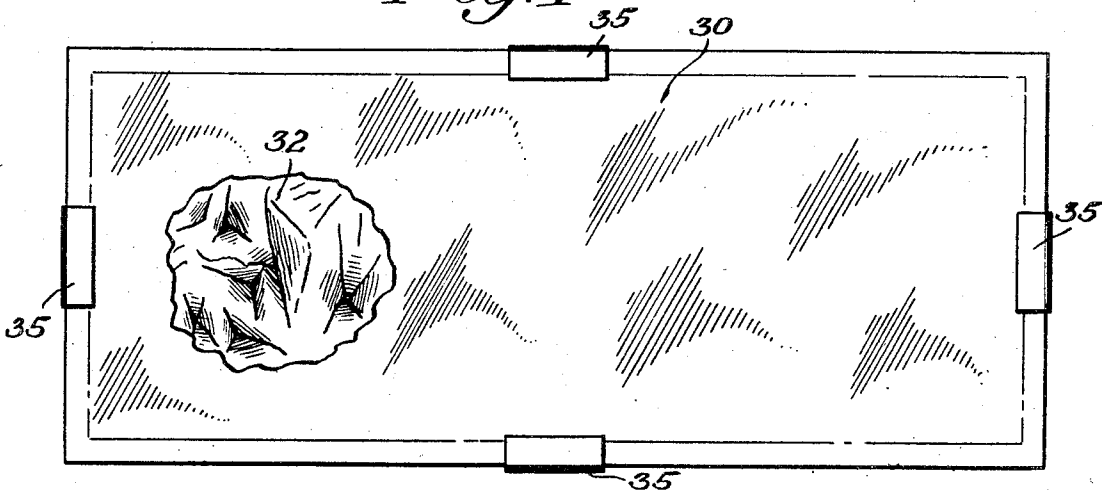


Fig. 2

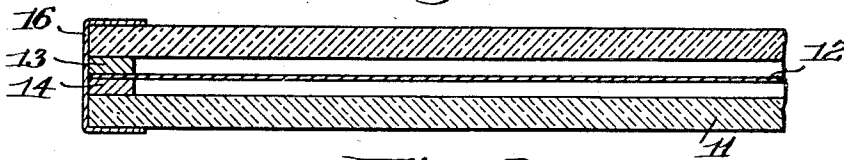


Fig. 3

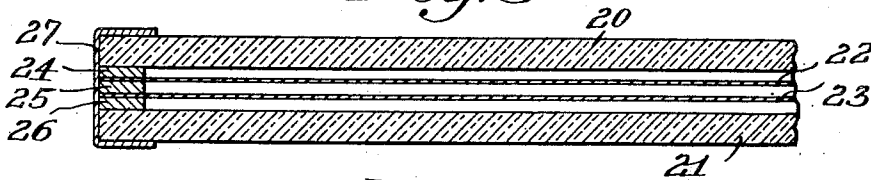


Fig. 4

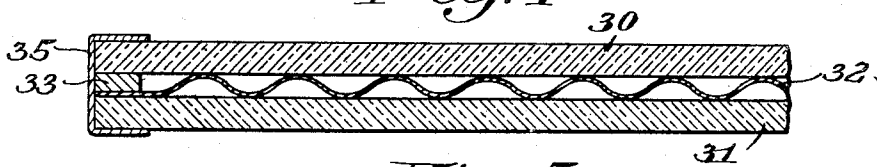


Fig. 5

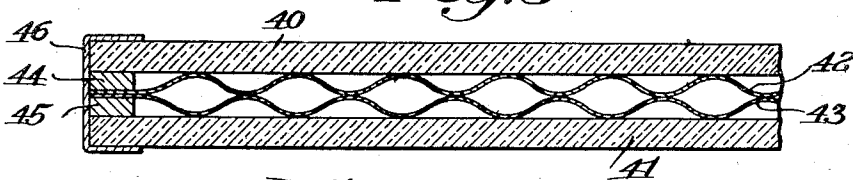
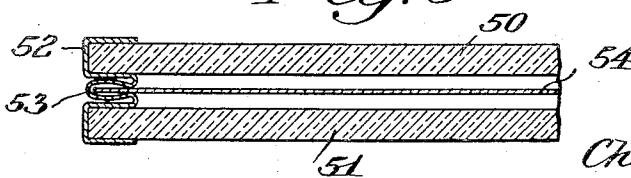


Fig. 6



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PANE

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9 Claims. (Cl. 20—56.5)

This invention relates to panes such as those used in windows and skylights for example. An object of the invention is the provision of a simple and satisfactory pane providing a high degree of insulation, both thermal and acoustical.

Another object is the provision of such a pane which may be easily and rapidly made and which is adaptable to mass production methods of manufacture.

Still another object is the provision of an insulating pane which may be either clear so as not to interfere with vision, or dispersive to a greater or less extent, or colored, as desired under any particular circumstances.

To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawing:

Fig. 1 is a face view of a pane constructed in accordance with one possible embodiment of the invention;

Fig. 2 is a diagrammatic cross section on a somewhat enlarged scale through a fragment of a pane constructed in accordance with one embodiment of the invention;

Fig. 3 is a similar view showing another embodiment of the invention;

Fig. 4 is a similar view showing a third embodiment of the invention;

Fig. 5 is a similar view showing a fourth embodiment of the invention, and

Fig. 6 is a view illustrating a special form of edge binding strip which may be used if desired.

The same reference numerals throughout the several views indicate the same parts.

As is well known, a large proportion of the heat lost through the walls of a building in winter is lost through the window panes. It follows that any insulating pane which will cut down the transmission of heat to a substantial extent and yet which is sufficiently simple and cheap to permit of wide installation, will be of tremendous economic advantage.

Various attempts have heretofore been made to provide thermal insulation of windows, but for one reason or another they have not been wholly successful. It is known, of course, to utilize storm windows or supplemental window sash placed usually on the exterior of the regular window sash during the winter months. Such storm windows have disadvantages, however, in that they need to be put up and taken down each year, and they interfere with ventilation and hamper adequate

washing of the inner window surfaces although they are not sufficiently tight to prevent access of dirt and soot to these surfaces.

As distinguished from the conventional storm windows, the present invention provides insulating panes permanently made up in units which, when once applied to the window frames, need not later be disturbed. It is intended that such window panes according to the present invention should be left in place indefinitely, providing permanent insulation not only against loss of heat during winter, but also against ingress of heat during summer.

The window panes of the present invention provide not only thermal insulation but also a high degree of acoustical insulation, so that street noises and the like are largely kept out of the room. Likewise, if these improved panes be used in glazing office partitions or the like, the noise of one room will be kept out of the adjacent room to a large extent.

According to the present invention, the improved window pane comprises two sheets of suitable strong and stiff translucent material such as glass, superimposed upon each other and spaced a slight distance from each other. The extent of the spacing may be varied as desired, but it is ordinarily preferred to have this space relatively small, say not over $\frac{1}{4}$ of an inch and sometimes as little as $\frac{1}{8}$ or $\frac{1}{16}$ of an inch.

Between these two sheets, preferably of glass, is placed one or more sheets of a translucent material other than glass, which may be a relatively weak or fragile material, preferably of a cellulosic nature. For example, the intermediate sheet or sheets may be of waxed paper or glassine paper, but it is preferred to employ the cellulosic transparent or translucent sheets widely known and commonly available on the market.

This intermediate sheet is relatively thin in comparison to the thickness of the space between the glass sheets, and by no means fills such space but on the contrary subdivides it into a plurality of separate compartments, greatly increasing the insulating effect. The weak or fragile nature of the intermediate sheet is not detrimental, since it is between and protected by the relatively stronger sheets of glass or the like, which give the necessary strength and rigidity to the compound structure and which keep the intermediate sheet from receiving impacts or strains. The use of material other than glass for the intermediate sheet or sheets is advantageous, since a sheet of the cellulosic material mentioned may be thinner and lighter than any glass sheet which could be con-

veniently handled during the assembling of the pane at the factory. Also, cellulosic material is believed to be a somewhat poorer conductor of heat than an equal thickness of glass, thus being somewhat more efficient as an insulator.

If a clear colorless pane is desired, both glass plates may be of clear smooth glass and in the intermediate sheet of suitable material may likewise be clear and transparent. If a colored pane is desired, it may be conveniently and inexpensively produced by using a colored intermediate layer, without going to the expense of coloring the glass sheets. If it is desired to have a pane that will disperse the light to some extent, either or both of the glass sheets may be of a suitable known dispersing kind of glass, or one or more of the intermediate sheets may be deformed, distorted, or crinkled as mentioned below to provide a dispersing effect.

The term "translucent" as used in this specification and the claims is intended in a broad generic sense as including articles which are truly transparent as well as those which are dispersive and distortive to light rays passing through them.

Referring now to the drawing, one possible embodiment of the invention is illustrated in Fig. 2, in which the two glass plates are shown at 10 and 11, with the intermediate layer 12 of material other than glass, between them.

Where only a single intermediate sheet 12 of flat or undistorted material is used, as in Fig. 2, it is preferably spaced from both of the glass plates by suitable spacers such as those shown at 13 and 14, running around preferably all four edges of the pane. Suitable holding means is also provided for holding the glass plates and intermediate sheet permanently to each other, so that they may be handled as a unit and may be conveniently shipped from the factory and put in place in the window frame. This holding means, for example, may be in the form of an adhesive. For instance, the spacing members 13 and 14 may be strips of felt paper or the like, and they may be impregnated with a tacky adhesive such for example as asphaltum, which will hold each spacing strip firmly to one side of the intermediate sheet 12 and to the adjacent glass sheet. Or, as another example, both the spacing and adhesive functions may be performed by a layer or layers of any suitable caulking compound which stays plastic, which is waterproof, and which will adhere to glass.

In some instances, the use of adhesive alone may be not sufficiently substantial, and supplemental means may then be used to hold the composite structure together. For instance, this supplemental means may be in the form of an edge binding such as shown at 16 in Fig. 2, extending across the edge and overlapping the opposite sides of the structure a short distance, as plainly indicated in the drawing. This edge binding may be placed only at intervals around the periphery of the structure, or may extend continuously around the periphery. It may consist, as preferred, of wire clips or a metal strip held on by friction or otherwise, or a paper or fabric strip held on by adhesive for example.

The glass sheets 10 and 11 are spaced so close together that they may be conveniently handled as a unit and easily glazed in the conventional manner for single sheets of glass. The space between the plates of the composite pane is so small, especially when subdivided by the intermediate sheet 12, that air currents within this space are materially impeded, and thus the con-

vection currents which would carry heat across the intervening space are largely eliminated, and a product of high thermal insulating value is provided.

In Fig. 3 of the drawing is shown a similar form of construction, differing from the construction shown in Fig. 2 in that a plurality of intermediate layers or sheets are employed. Here, the sheets of glass or the like are indicated at 20 and 21, and two intermediate layers of any available transparent sheet of cellulose or other suitable material are shown at 22 and 23, spacers 24, 25, and 26 being employed to hold the intermediate sheets not only from each other but also from the adjacent glass surfaces. It is understood that here, as in the construction shown in Fig. 2, the intermediate sheets are preferably stretched tightly across the width and length of the glass sheets so that they do not come into contact with the glass sheets at any point. Any suitable edge binding 27 may be employed if desired.

By using more than one intermediate partition sheet, the insulating efficiency of the composite structure is increased, due not only to the insulating effect of the additional partition itself, but also to the increased number of separate compartments into which the space between the glass plates is subdivided.

Fig. 4 shows still another embodiment of the invention, which may be used with some increase in efficiency where clear vision through the pane is not essential. Here, the glass sheets are illustrated at 30 and 31, and the intermediate sheet at 32. This intermediate sheet, however, instead of being a plain flat sheet, is distorted or crinkled so as to have a multitude of creases preferably extending heterogeneously in all directions, such as would be produced by crunching up a sheet of cellulosic material or the like into a ball and then spreading it out again. It is found by tests that such a crinkled intermediate sheet does not interfere seriously with vision through the pane, but does disperse and distort the light passing through it to some extent. It is also found that there is some increase in the insulating efficiency of a composite pane made in this way, because the intermediate space between the glass plates is further broken up into a great number of small cells or compartments, since the intermediate sheet contacts with the glass sheets at various irregular points and is free from the glass sheets at other irregular points. Hence panes constructed in this way are especially suitable for skylights where vision is not important but where heat losses are often excessive, and for factory windows where adequate light must enter but where external views need not be perfectly clear. In fact, the slight dispersive or distortive effect of the crinkled intermediate layer may be an actual advantage in some types of windows, where strong concentrated light is not desired.

The use of an intermediate layer of crinkled material has the further advantage that it reflects light (and apparently also heat) to a materially greater extent than a plain uncrinkled intermediate layer, and adds considerably to the "life" or brilliancy of the pane. For instance, when the pane is used in the window of a room, any color or design present in or on the pane is seen clearly from the outside by reflected light, as well as from the inside by transmitted light, and the color or design does not have the dull

and flat appearance so often present in ordinary colored window panes.

The undulations in Fig. 4 are largely diagrammatic, it being understood that in actual use the undulations of the crinkled sheet may be irregular and angular or may be in the form of a regular or irregular pattern.

The spacing member is illustrated at 33 in Fig. 4. Only one spacing member has been shown on one side of the intermediate sheet, because the crinkled nature of the sheet makes it immaterial whether the edges of the sheet are held midway between the two glass plates, or whether they be in contact with one of the glass plates as shown. An edge binding strip of any suitable form may be used if desired, and is indicated at 35.

Fig. 1 of the drawing is a diagrammatic face view of the embodiment shown in Fig. 4, with part of the front glass plate theoretically broken away to show the crinkled nature of the intermediate layer 32.

In Fig. 5 there is shown still another embodiment of the invention, quite similar to that of Fig. 4, but employing a plurality of intermediate layers instead of only a single layer. The glass sheets are shown at 40 and 41, and two intermediate layers of crinkled sheet material are indicated at 42 and 43, and are held between spacers 44 and 45. An edge binding 46 may be employed if desired.

The intermediate sheets 42 and 43 in this embodiment are preferably both crinkled as in the case of the intermediate sheet 32 in the previous embodiment. The efficiency of the insulating pane is thus greatly increased, since the intermediate space between the glass sheets is broken up into a very large number of cells or compartments, communicating more or less with each other, but nevertheless greatly impeding the air currents which would otherwise act to transfer heat from one glass sheet to the other. As in the case of Fig. 4, Fig. 5 is largely diagrammatic, the actual crinkled sheets being frequently crinkled irregularly and angularly, though the undulations may be regular or in the form of any desired pattern if preferred.

As stated above, any suitable form of holding means for the edges of the composite structure may be employed. Instead of using spacing strips, either with or without adhesive, it may be desirable, for example, to employ a unitary metallic molding, which not only holds the glass sheets to each other but also acts to hold the intermediate layer or layers and to space it or them from the glass sheets. For example, as shown in Fig. 6, there are two glass sheets 50 and 51 held by a metallic molding 52 having U-shaped portions to receive the edges of the glass plates and being doubled back upon itself to provide an intermediate bead 53 between the glass plates for receiving the edge of the intermediate sheet 54. If a molding of this kind is used, without other spacing means, it preferably extends continuously around the entire periphery of the composite structure, so as to exclude dust from the space between the panes. Where spacing strips, as shown in Figs. 2 to 5 inclusive are used, however, the supplemental holding means or edge binding, if any is used, need not necessarily extend continuously around the periphery, since the spacing strips themselves will tightly close the space between the glass plates and prevent dust or dirt from entering the space.

From the foregoing description, it is seen that

the invention provides a highly efficient composite pane which can be easily manufactured, readily shipped, and easily glazed in substantially the same way that the conventional single panes of glass are glazed. It may stay permanently in place since dust and dirt are excluded from the inside surfaces of the glass, and these surfaces will remain clean indefinitely. High thermal and acoustical insulation is provided by these panes, the thermal insulation feature resulting in great economic savings especially in cold climates where heating is an expensive item.

It is also seen that in each of the embodiments of the invention heretofore described, the intermediate layer or layers may be said to be freely spaced at least in part from one or both of the glass plates. When the intermediate layers are of crinkled form as in Figs. 4 and 5, they contact with the glass plates or with other intermediate layers at various points, but between these contacting points they are spaced from the glass plates or other intermediate layers. By the term "freely spaced" as used here and in the accompanying claims, it is meant that there is at least some free space between the parts thus described; that is, that the space between them is not solidly filled up with other solid material.

While certain embodiments of the invention have been disclosed, it is to be understood that the inventive idea may be carried out in a number of ways. This application is therefore not to be limited to the precise details described, but is intended to cover all variations and modifications thereof falling within the spirit of the invention or the scope of the appended claims.

I claim:

1. A composite pane comprising two spaced sheets of glass permanently secured to each other and a sheet of material other than glass between said glass sheets and spaced at a multiplicity of intervals from one of said glass sheets and extending toward said one of said glass sheets at a multiplicity of intervals between said spaced intervals.

2. A composite unitary ready-to-apply insulating pane comprising two sheets of glass spaced from and permanently secured to each other, and a crinkled sheet of translucent material between said glass sheets and contacting with them substantially only at spaced points.

3. A composite unitary ready-to-apply insulating pane comprising two sheets of glass spaced from and permanently secured to each other, and a sheet of readily flexible cellulosic material between said glass plates and freely spaced at intervals from both of them and in contact with one of them at other points.

4. A composite unitary ready-to-apply insulating pane comprising two sheets of glass spaced from and permanently secured to each other, and a plurality of crinkled sheets of translucent material other than glass interposed between said glass sheets.

5. A composite unitary ready-to-apply insulating pane comprising two sheets of glass spaced from and permanently secured to each other, and a plurality of crinkled sheets of translucent material interposed between said glass sheets and each covering substantially the entire area of said glass sheets.

6. A composite insulating pane comprising two sheets of relatively strong and stiff translucent material spaced from each other, and a sheet of relatively weaker and more flexible translucent cellulosic material substantially thinner than

the thickness of the space between the stiff sheets, interposed between said sheets to tend to diminish air currents in said space.

7. A composite insulating pane comprising two
5 sheets of glass superimposed on one another, a crinkled sheet of translucent material other than glass interposed between said glass sheets, a spacing member between said interposed sheet and
10 at least one of said glass sheets adjacent the edges thereof, and means for holding said glass sheets and interposed sheet together.

8. A construction comprising two sheets of glass spaced from and permanently secured to each other, and a sheet of relatively thin flexible self-

supporting translucent cellulosic material interposed between said glass sheets and unconnected to them throughout the major area of said cellulosic sheet.

9. A construction comprising two sheets of relatively thick inflexible transparent material spaced
5 from and secured to each other, and a sheet of relatively thin flexible self-supporting translucent cellulosic material interposed between said inflexible sheets and deformed out of a plane so
10 that different portions of said relatively thin sheet lie at different distances from one of said inflexible sheets.

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