

March 12, 1940.

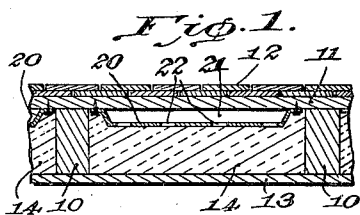
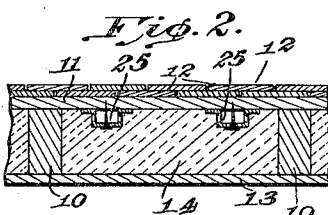
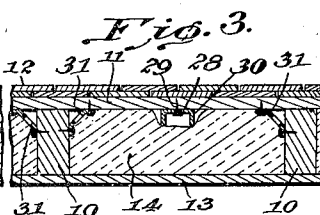
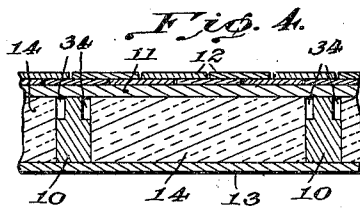
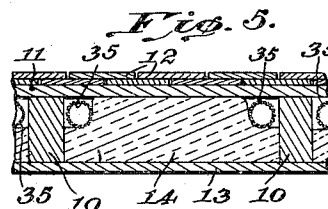
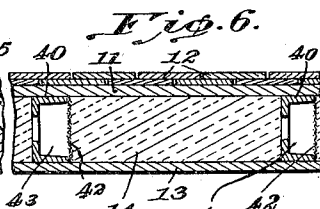
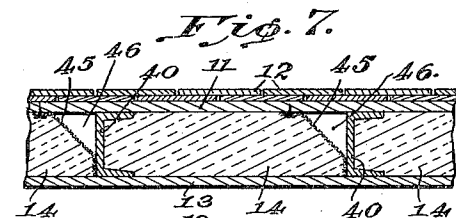
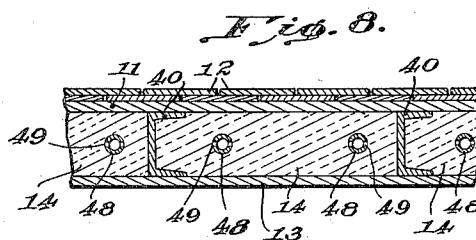
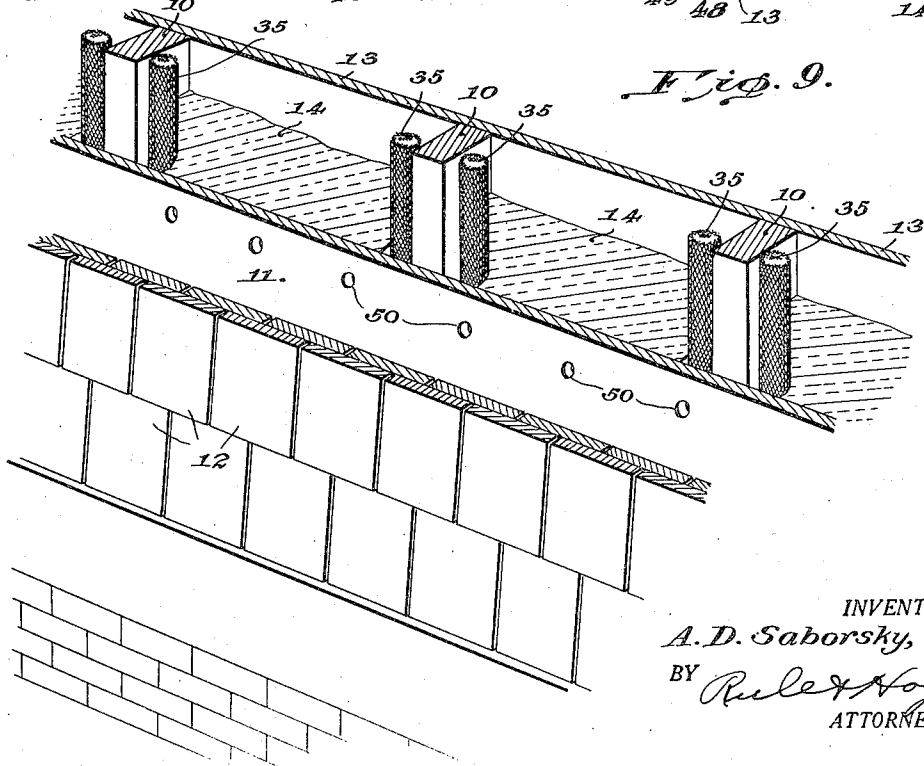
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2,192,933

HEAT INSULATION

Filed June 30, 1937

2 Sheets-Sheet 1



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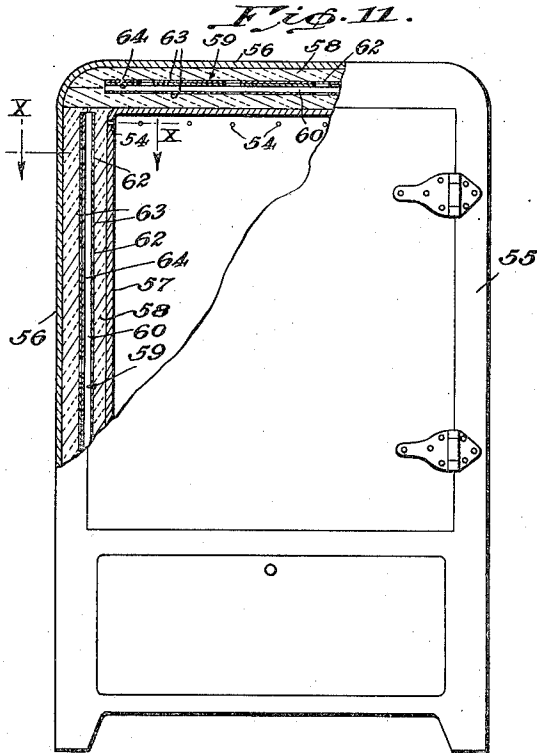
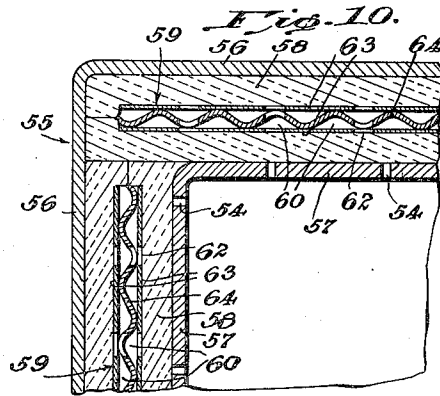
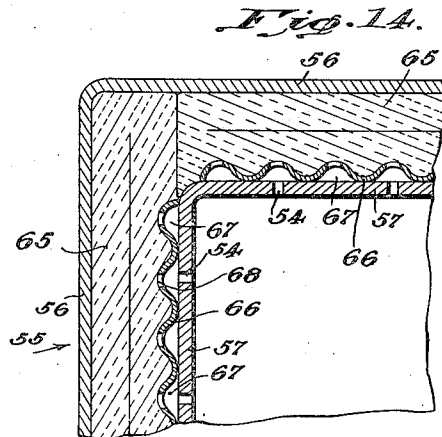
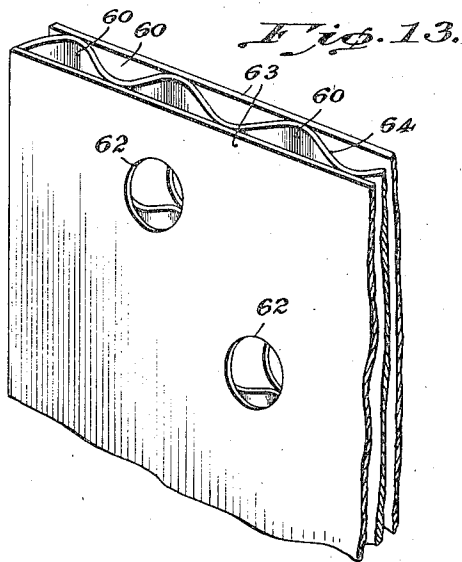
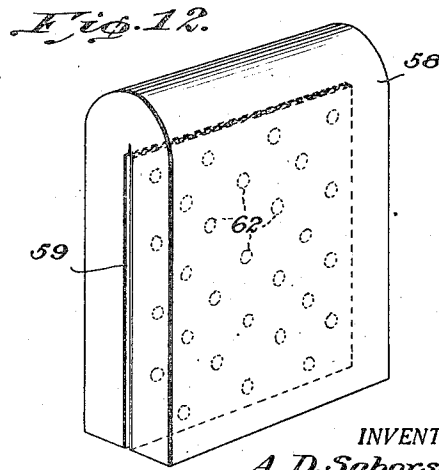
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2,192,933

HEAT INSULATION

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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HEAT INSULATION

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Application June 30, 1937, Serial No. 151,100

8 Claims. (Cl. 20-4)

The present invention relates to heat insulation for any suitable application such as ice-boxes, refrigerators, bottle coolers, refrigerator cars, house insulation, warehouse and building insulation, etc., and relates more particularly to a novel method and construction for preventing or inhibiting the condensation of moisture within the insulation itself.

An object of the invention is to inhibit or prevent the condensation of moisture, particularly along the lower portions of an insulating bat or material which has been installed in an insulating panel, or portions of the insulating material or bat which lie remote from breathing communication with the atmosphere exterior to the cold side.

There are at least two factors contributing to the passage of moisture into an insulating panel from the humid warm side thereof, (1) a tendency to equalize vapor pressures between two adjacent gaseous bodies having a differential of vapor pressures therebetween, this tendency being present irrespective of the total pressures and temperatures of the said adjacent bodies. As a corollary, nature abhors dryness in air similarly as it abhors a vacuum; and (2) convection currents caused by variations in density, pressure and temperature in adjacent gaseous bodies.

At the present time, refrigerators or the like are being constructed with an impermeable outer shell, and a ventilated inner shell. The purpose of said construction is to provide a breathing into the interior of the refrigerator, that is, toward the cold side of the insulation, and thus prevent a condensation of moisture within the insulation. Breathing from the cold side tends to permit the insulation itself to remain dry owing to the lower relative humidity of the cold side as compared with the warm side. On the other hand, if the cold side were left impervious, and breathing communications were made with the warmer side, the air of relatively higher humidity on the warmer side would tend to infiltrate into the insulation, where it would be lowered in temperature, and moisture condensed therefrom.

In forming breathing vents for refrigerators, these are generally placed, if at all, along the upper edge of the refrigerator, for two general reasons, (1) so that they may be hidden from the housewife who might suspect a flaw in the icebox if she were to see holes in the inner shell of the box or food cabinet, and who would also consider such holes unsightly, and (2) to eliminate any openings along the lower edge of the box through which water or the like might leak

into the insulation when the icebox is cleaned or washed, or if any liquids or the like were spilled inside of the box. Accordingly, breathing of the insulation, if done at all, is generally accomplished through these holes along the upper part of the refrigerator. However, occasionally breathing is sometimes provided by porosity in the breaker strip around the door opening of a refrigerator. Similar reasons dictate the location of breathing holes in the upper part of the walls of cold storage rooms, although not necessarily so.

Moreover, in view of the limitations in manufacture, the outer shell or cabinet may contain some small pinholes which defy the best skill in attempting to seal the outer shell or cabinet of the box perfectly. These pinholes in the outer shell permit a small amount of air from the outside to penetrate into the insulation where the moisture carried therein may be condensed.

Ordinarily, if the temperature both inside and outside of the cabinet remains constant, the passage of moisture laden air through these pinholes may be minimized, since the uniform temperature would prevent expansion or contraction of the air both within and without the panel, and thus would prevent inhalation from occurring through the pinholes caused by convection. However, such ideal conditions do not exist, and under normal conditions there is a continual temperature variation both within and without the panel. As the temperature thus varies, the air both within and without the panel expands or contracts in accordance therewith, and thus causes a pressure differential on each side of the panel walls, thus permitting an influx of moisture laden air through the pinholes. Moreover, apart from convection, passage of moisture into the insulation by the urge of vapor pressure alone takes place to a certain extent.

When moisture laden air enters through the pinholes into the insulation which is remote from the breathing holes leading to the cold side, I have found that moisture may condense and collect in substantial quantities because it is prevented from making its way to and through the breathing holes owing to the obstruction to the passage of air caused by the mass of insulation itself.

In order to eliminate condensation within the insulation, of moisture from air which may have infiltrated therein, especially into that insulation which lies remote from breathing holes, I provide air ducts or conduit means communicating from the breathing holes in the cold

side to all parts of the insulation, however remote. These ducts or conduits automatically prevent differentials of pressure from existing between the cold side and the various regions within the insulation, and they simultaneously permit all portions of the insulation to breathe or ventilate through the vent holes into the cold side. By thus preventing differentials of pressure from existing on the inside of the insulation and facilitating a convection of moisture laden air into the cold side, I eliminate moisture laden air from all parts of the insulation and prevent its accumulation to a degree which would permit condensation.

Other objects and advantages of the present invention will become apparent from the following description taken in conjunction with the drawings, in which:

Figs. 1 to 8 are fragmentary cross-sectional plan views of house or building walls showing various sections of insulation lying between conventional studs of the wall, each of the views illustrating an embodiment of my invention as applied to this type of insulation;

Fig. 9 is a fragmentary part sectional, perspective view of a building wall embodying my invention;

Fig. 10 is a fragmentary cross-sectional plan view through a refrigerator cabinet which is insulated in a manner embodying my invention, the section being taken at the line X—X on Fig. 11;

Fig. 11 is an elevational view shown partly in section of the refrigerator cabinet illustrated in Fig. 10;

Fig. 12 is a perspective view of a fold bat provided with a core embodying the present invention;

Fig. 13 is a fragmentary enlarged perspective view of the core of the fold bat illustrated in Fig. 12; and

Fig. 14 is a fragmentary cross-sectional plan view of a refrigerator showing a modification.

Referring more particularly to Fig. 1 illustrating a conventional building wall embodying the present invention in various forms, reference character 10 designates upright studs, faced on the outside with sheathing 11 of any suitable type having on overlying layer of siding 12 of clapboard, shingle, stucco, bricks, or other suitable types. The studs 10 divide the wall into individual panel sections, each provided with its own insulation. Along the inner surface of the wall are laths and plaster or other inner wall surface 13.

Spaced between the sheathing 11 and the wall surface 13, is a body of insulation 14 of any suitable type such as glass wool, rock wool, asbestos, balsam wool, hair felt, wood pulp insulation, kapok, or the like. The insulation 14 may be in bat, mat or felt form, or it may be in modulated form which is generally used when the insulation is blown or poured into place.

In the panel section between adjacent studs, I have provided a spacer 20 serving to provide a thin, vertical air column 21 between the sheathing 11 and the insulation 14. The spacer 20 is provided with a plurality of perforations 22 communicating with the air column 21 and the insulation 14 throughout the surface thereof. The spacer 20 may be of any suitable type such as perforated sheet metal, expanded metal, a screen, perforated cardboard, asphalt, paper or the like, and may be substantially coextensive vertically

with the wall or wall section in which it is installed.

The vertical air column 21 may communicate with the outer atmosphere directly through the sheathing 11 and the siding 12, either through perforations purposely made through these members, or through the natural crevices and cracks which ordinarily and inherently form in the construction.

In Fig. 2, the same construction is used with the exception of the form of the vertical air channels. In this view the insulation 14 has been provided with vertical channels 25, which may be of thin sheet metal of inexpensive construction, and which may be perforated at intervals throughout their length, in order to provide air conduit means to the insulation throughout its vertical length. As a practical matter, however, I have found that generally there is sufficient leakage of air between the channels 25 and the insulation 14 to obviate the perforations. The panel section 25 may be nailed or otherwise affixed to the sheathing 11 as shown, or to the studs 10, or may even be embedded directly in the insulation itself.

As another embodiment of the present invention, I have shown in Fig. 3 a vertical channel member 28 affixed by nails 29 in any suitable manner, also providing vertical conduits or air communicating means throughout the vertical length of the insulation. The channel 28, however, has been affixed so that the legs 30 thereof face inwardly into the insulation, holding it away from the sheathing 11 for a small distance on each side of the legs. This type of construction may be used for glass wool bats or the like which may be held apart from the sheathing 11, without permitting the fibrous material to completely close up and fill the inside of the channel between the legs.

In Fig. 3, I have also shown angle channels 31 provided in the corners formed by the stud 10 and the sheathing 11.

In Fig. 4, I have also shown recesses 34 formed in the studs 10 adapted to form vertical air channels for ventilating the insulation 14 in the same manner as the other vertical ducts or communicating means shown in Figs. 1 to 3.

Referring to Fig. 5, I have shown tubular perforated members 35 which may be in the form of cylindrical screens placed in the corners of the panel formed by the studs 10 and the sheathing 11, or embedded directly within the insulating material 14 itself.

Referring now to Fig. 6, I have illustrated another embodiment of the invention more particularly adapted to building wall insulation such as a warehouse wall formed with a plurality of upright studs 40 in the form of steel channel members. These are spaced apart at intervals to form panel sections adapted to contain insulation 14 therebetween.

In order to provide air ventilating means for the insulation 14, I have provided foraminous members 42 extending between the flanges of each channel stud 40, thus causing the spaces between the flanges of the studs to provide a vertical communicating means 43.

In Fig. 7, a further embodiment of the present invention is illustrated in which the foraminous member 45 has been arranged in the corners formed by the channel studs 40 and the sheathing 11, thus forming vertical channels 46 communicating with the insulation 14 throughout the vertical length thereof.

In Fig. 8, a still further embodiment has been disclosed in which vertical conduits or tubes 48 are shown embedded directly within the insulation 14 itself. The channels 48 may be perforated or provided with holes 49 at intervals throughout the length thereof as desired.

Fig. 9 is a perspective view, certain parts of which have been broken away for the sake of clarity, showing a building wall embodying the present invention. The particular construction of Fig. 5 has been incorporated into Fig. 9, although any of the other embodiments shown in Figs. 1 to 8 or modifications thereof, could likewise be used.

In Fig. 9, it will be noted that the sheathing 11 has been perforated by means of a series of holes 50 which permit ventilation of the insulation 14 to the outer atmosphere or cold side. The ordinary clearances and cracks found in the siding 12 are generally adequate to provide sufficient ventilation therethrough and through the holes 50 into the insulation from the outer atmosphere, although, if desired, additional ventilating means may be provided through the siding wall through to the insulation 14. The vertical perforated member 35 thus provides a more or less direct communication for the air and moisture within the insulation, throughout its entire vertical length with the holes 50 leading to the outer atmosphere, and thus inhibits an accumulation of moisture within the insulation.

Referring now more particularly to Figs. 10 to 13, I have illustrated the invention as applied to a refrigerator or cooler 55 composed of insulating panels having outer walls 56 and inner walls 57, between which is provided insulating means 58. The insulation may be and preferably is in the form of a fold bat such as the one illustrated in Fig. 12, comprising a bat of insulation which is folded over a core 59 to form a double thickness to the insulation.

The core may be of any suitable sheet material, although I have found that for ordinary purposes, a corrugated board, such as the one illustrated in Fig. 13, is admirably suited to my invention. As brought out more fully in Fig. 13, the corrugated board is constructed with surface sheets 63 having a corrugated spacer 64 therebetween forming a series of vertical tubes or channels 60, communicating throughout the length of the board or core 59, and thus providing a simple and efficient ventilating or conduit means for the insulation.

In order to enhance the accessibility of the moisture and air within the insulation 58 to the upper portions of the refrigerator, and more particularly to the ventholes 54, which may be as shown in the drawings or other communication openings between the insulation and the inner cold chamber, as, for example, openings through the breaker strip in the door opening of the refrigerator. I preferably provide a series of openings 62 through the board or core 59, thus causing the tubes 60 to communicate with the insulation, throughout substantially its entire volume.

In Fig. 14, I have illustrated a modification of the present invention in which the refrigerator walls are provided with insulation 65, and a spacer element 66, placed along the inner wall 57, providing vertical conduit means 67. The spacer 66 is preferably corrugated, and perforated with the perforations 68 so that the insulation may readily breathe through the holes 68, the conduits or vertical tubes 67, and through the holes 54

or other openings into the low temperature zone within the refrigerator cabinet.

In the operation of my invention, I have discovered that the vertical or horizontal conduit means as embodied in the various forms of the present invention, facilitate ventilation and breathing of all parts of the insulation through to the cold side, and also inhibit air from entering the insulation from the warm outside, thus also inhibiting the passage of air through pinholes or cracks which may exist in the outer wall surfaces 56.

Modifications and variations may be resorted to without departing from the spirit and scope of the present invention as defined in the appended claims.

I claim:

1. A heat insulating panel having side walls spaced apart, fibrous heat insulation between said side walls, and air conduits in said insulation adapted to provide ventilation throughout said insulation through to the cold side of said panel.

2. An insulating panel comprising side walls spaced apart, one of said side walls being on the cold side and having perforations along certain portions thereof, fibrous heat insulation means between said walls, and air conduit means embedded in said insulation communicating with said perforations adapted to equalize pressures between the atmosphere lying on the cold side and the pressures within said insulation, and adapted to ventilate the insulation through to the cold side.

3. In an insulating panel, side walls spaced apart, subdivided insulating material replete with air filled interstices filling the space between said side walls, and perforated hollow tubes embedded in said insulating material providing air communicating means throughout the vertical length thereof.

4. Means for insulating a heated house wall having studs spaced apart, sheathing overlying the studs on the outer surface thereof, and an inner wall surface secured to said studs and spaced apart from said sheathing, said means comprising heat insulating material filling said walls between said inner wall surface and said sheathing, and vertical air channels embedded in said insulating material permitting air ventilation throughout said insulation to the upper portions of said sheathing.

5. Means for insulating a heated house wall having studs spaced apart, sheathing overlying the studs on the outer surface thereof, and an inner wall surface secured to said studs and spaced apart from said sheathing, said sheathing being provided with perforations along the upper portions thereof adapted to permit breathing therethrough from the outer atmosphere, said means comprising heat insulating material filling said walls between said inner wall surface and said sheathing, and vertical air channels embedded in said insulating material permitting air ventilation throughout said insulation to the upper portions of said sheathing.

6. An outside insulated wall structure for heated buildings comprising upright studs spaced apart, an inner wall surface on the inner side of the wall defined by said studs, porous sheathing on the outer side of the wall defined by said studs, heat insulation material in the spaces between the studs and between said sheathing and inner wall surface, and perforate vertical air channels embedded in said insulation between said studs and between said sheathing and inner

wall surface, adapted to permit ventilation within said heat insulating material throughout the vertical length thereof, through said porous sheathing to the outside of said building.

- 5 7. A wall structure comprising an inner wall surface having perforations along the upper portions thereof, and an outer wall surface spaced from said inner wall surface, heat insulating material filling the space between said inner and
10 outer wall surfaces, and vertical air conduit means in combination with said insulation adapted to permit ventilation of all portions of said insulation through said perforations.

8. A wall structure which comprises an inner wall surface having perforations along the upper portions thereof, an impervious outer wall surface spaced from said inner wall surface, fibrous
5 insulating material filling the space between said wall surfaces, and a core embedded in said insulation providing air communicating means throughout said insulation to the upper portions
10 of said insulation adjacent to said holes in said inner wall surface.

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