Feb. 26, 1957 J. D. GILES 2,782,914

HEAT INSULATION STRUCTURE

Filed Aug. 9, 1955

Fig. 1

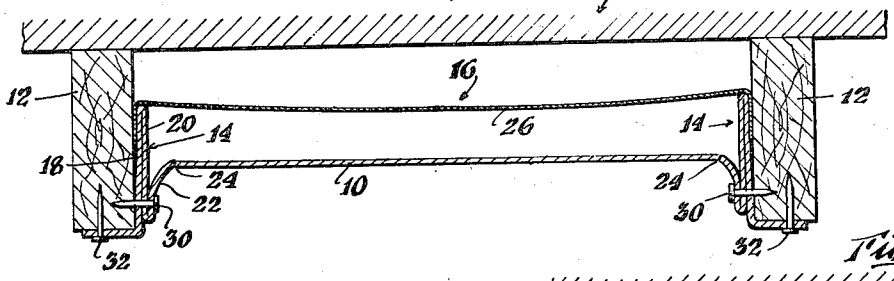


Fig. 5

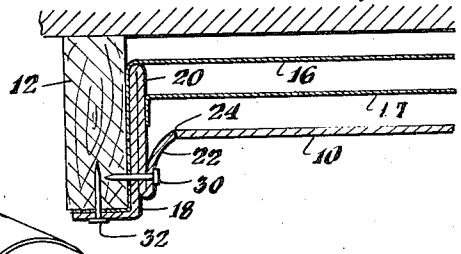


Fig. 2

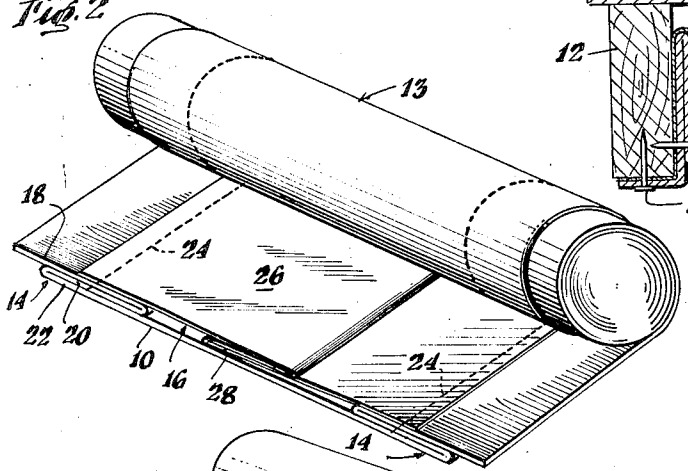


Fig. 4

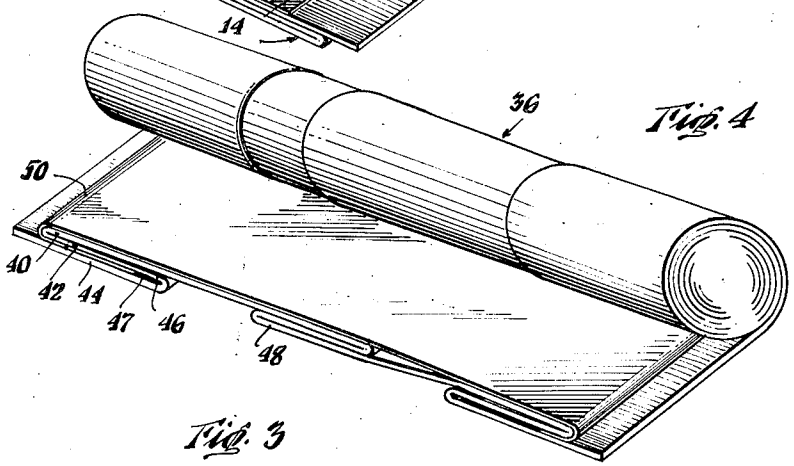
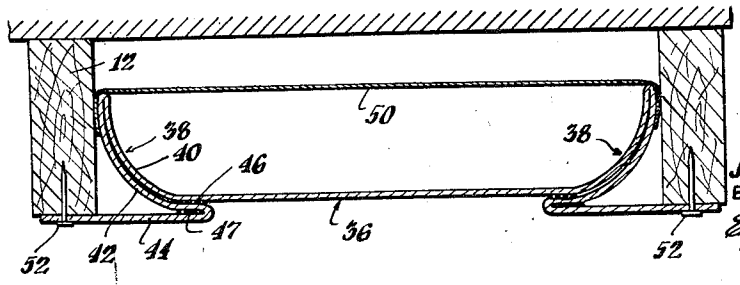


Fig. 3



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HEAT INSULATION STRUCTURE

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Application August 9, 1955, Serial No. 527,243

3 Claims. (Cl. 206—59)

This application relates to thermal insulation of the type which is formed by paper and foil so constructed that the insulation can be rolled into a compact bundle for shipment but which opens up for application in building structures. One form of insulation of this general category is shown in Turner et al. Patent No. 2,312,301, dated March 2, 1943. The product of this patent has great value and has gone into extensive commercial use. It does, however, have certain drawbacks and the present invention relates to an improvement on that material.

In the structure shown in the Turner et al. patent, when the paper backing is drawn out, triangles are formed which project from the face of the backing sheet and aluminum foil runs across between these triangles to supply the insulating member. This gives excellent insulation for a large part of the area to be covered but the triangles leave a gap immediately adjacent to the studs of the buildings to which the insulation is attached, and the heat flow through these gaps is enough seriously to interfere with the effectiveness of the product as a whole. Overcoming this difficulty is very simple if substantially rigid materials such as paper board could be used, for these materials could be nailed to the inside of the studs and would be stiff enough to hold the foil practically up against the face of the stud. Unfortunately, however, from a commercial angle the use of these rigid members is not feasible, for one of the most important features of an insulation structure of this type is that it should be capable of being formed into compact rolls, that is, of being rolled about a core which ordinarily is no larger than approximately four inches in diameter.

In considering this problem, it must be borne in mind that even though the foil that runs across from one stud to the other is very light, nevertheless it has some weight and tends to exert a continuing pull on the support members. The problem which we are discussing is particularly important for foil that goes into the ceilings, and of course in the ceiling the foil that runs between the studs exerts a continuing tendency to sag and thereby pulls on the supports.

I have found that it is possible to solve this problem by using kraft paper which may be either fairly heavy kraft or asphalt laminated kraft (known as duplex paper) as the backing sheet and folding this sheet in such a way that when it is installed in the building structure, two layers of the paper extend in against the face of the stud and the structure is so built that as it is attached to the studs, relative movement between the two layers of paper that extend in alongside of the stud face is prevented. It is a fact that if paper is folded over on itself and the two layers are brought together and held against relative movement, the paper thus folded has a stiffness very much greater than simply the added stiffness of two sheets not connected together. In making the structure of the present invention, I take advantage of this fact and while utilizing it I am able to obtain a member which is stiff enough to hold the foil substantially to the face of the stud and yet the two layers of paper add little in

the way of thickness to the structure to prevent it being rolled along a line parallel with the folds referred to.

This invention can readily be understood from the illustrative examples shown in the accompanying drawing in which—

Fig. 1 is a sectional view taken through two studs of a building showing the structure in place;

Fig. 2 shows the structure of Fig. 1 as it is folded in roll form;

Fig. 3 is a sectional view taken through two studs of a building showing another form of the structure of Fig. 1;

Fig. 4 shows the structure in Fig. 3 as it is folded in rolled form, and

Fig. 5 is a fragmentary view of the structure of Fig. 1 with a plurality of heat reflective sheets stretched between the support members in the sheet.

Referring to Fig. 1, the numeral 12 indicates the studs of the building and 13 may be sheathing, a roof or attic floor or the like. The insulating structure itself which embodies my invention comprises a main sheet 10 which as stated is formed of kraft paper, or preferably a laminated sheet of kraft paper and asphalt. If kraft paper alone is used, it may be, for example, of a weight between 50 pounds per ream and 90 pounds per ream. The usual laminated sheet is made of two layers of kraft paper of 30 pounds per ream and 30 pounds of asphalt per ream are included in the center. The main sheet 10 includes a pair of support members 14 with a layer of aluminum foil here indicated at 16 affixed to one or both of its faces.

Referring again to Figs. 1 and 2, it will be seen that support members 14 are formed in the paper of main sheet 10 by positioning symmetrical zig-zag folds in the paper adjacent each side of the sheet. The zig-zag folds are formed by folding the paper inwardly over on top of the body of the sheet and then the paper is again folded outwardly over on top of the infolded portion, leaving a zig-zag fold having three layers of paper 18, 20 and 22, respectively, in the fold. The fold lines in the zig-zag may be sharply pressed and a crease line 24 is positioned in the bottom layer of paper 22 within the confines of the zig-zag fold. This may be conveniently done by scoring the paper along line 24. For best results I prefer to locate crease line 24 approximately in the center of the bottom layer of paper 22 in order to leave a substantial area of paper for nailing the structure to adjacent studs in a building as described hereinafter below. A heat-reflective sheet such as a very thin sheet of aluminum foil 16 usually between .00045 and .0020 inch thick is attached to the top layer of paper 18 in the zig-zag fold and the sheet of foil is made long enough so that it will span across between support members 14 when the structure is installed in a building, as shown in Fig. 1. With the structure in collapsed form (Fig. 2) the excess foil is folded into the form of an expansible pleat 28. If desired, a plurality of heat-reflective sheets 16 and 17 respectively may be attached to the support members as shown in Fig. 5 and as there shown the top sheet may extend over the top, down along the face of the support member adjacent the stud and out to the side edge of the sheet of paper.

As best shown in Fig. 2, the collapsed structure is a compact one, and since the zig-zag folds are symmetrically positioned in sheet 10 the collapsed structure may be readily rolled up tightly around a core as small as about 4 inches in diameter, or even less. The zig-zag folds are the only folds formed in the paper so that the thickness of the structure is maintained at a minimum and there is no added folding which may tend to weaken the paper or prevent it from serving its desired function in the building. Rolling the paper about the core tends to press and iron the paper out and the layers in the zig-

zag fold are thereby set and held against relative movement in face-to-face contact in the roll.

To install the structure in a building a length is cut from the roll and then the two top layers of paper **18** and **20** and a portion of the bottom layer between crease line **24** and the side edge of the sheet are rotated as a unit about crease line **24** to form a pair of stiffened support members that stand upright along the length of the sheet near its edges, as shown in Fig. 1. When the support members are made to stand up, pleat **28** in the sheet of foil expands and it is advisable to make the pleat big enough so that the foil will not be stretched to the extent of exerting a direct pull on the upright support members. It does no harm if the pleat does not open fully or if the sheet of foil sags somewhat. As most clearly shown in Fig. 1 I achieve best results by making the sheet of foil of such length that it sags a little between the supports when the structure is installed between adjacent studs spaced the normal distance apart. By rotating the three layers of paper of the support member as a unit about crease line **24** I maintain the face-to-face relationship of the layers of paper exactly as originally set in the roll, and as a result the support members are stiff and strong enough to press in against the face of a stud when they are nailed, stapled, or otherwise affixed to such stud. In this preferred form of my invention the support members are affixed to the inner face of the studs, as shown in Fig. 1, and the nails or staples are driven through the three layers of paper in the area below or outside the bottom of main sheet **10**, as indicated at **30**. The nailing or stapling presses the stiffened support members in against the face of the stud, and since the nails prevent relative movement between the layers of paper in the support, the two layers **18** and **20** cooperate and appear to form something of a truss structure which gives the support member strength and stiffness far beyond that of two single layers of paper. The support members tightly press the foil against the face of the studs so that it forms a continuous span of thermal insulation from the face of one stud over to the face of an adjacent stud in the building. Compared to the truss effect of the two layers of paper **18** and **20** it will be seen that where a single layer of paper **22** is employed in the support between crease line **24** and the place where the support is nailed to the stud, the paper tends to sag and fall away from the stud and the single layer is not strong enough to support the weight of paper and remain upright against the stud. If desired, the outer edge of the paper of layer **18** may be bent around the face of the stud and nailed as indicated at **32**.

Another form of the structure of my invention is shown in Figs. 3 and 4. As distinguished from the structure shown in Figs. 1 and 2 which is preferably nailed to the inner face of the studs, the structure of my invention shown in Figs. 3 and 4 is primarily intended to be nailed across the outer face of the studs so that main sheet **36** lies substantially in a plane across the outer faces of the studs.

In the structure of my invention shown in Figs. 3 and 4, the zig-zag folds for support members **38** are formed by folding the paper inwardly over against the bottom of the body of the main sheet and the paper is again folded outwardly over against the bottom of the infolded portion, leaving a zig-zag fold having three layers of paper **40**, **42** and **44**, respectively, in the fold. The two top layers of paper **40** and **42** are preferably glued together to form the stiffened support member **38** and the glue line indicated at **46** holds the two layers of paper **40** and **42** against relative movement in face-to-face contact. If desired, the entire surface of the two layers of paper in the support member may be glued together, and in the preferred form of my invention shown, I position a second glue line **47** between the two bottom layers of paper **42** and **44** in the zig-zag fold for added strength. An expansible pleat **48** is positioned in the body of main

sheet **36** between the zig-zag folds, and a sheet of foil **50** is attached to the middle layer of paper **42** of support members **38**. The structure of Figs. 3 and 4 is rolled up in the same way as the structure shown in Figs. 1 and 2, and it will be noted that in both cases the foil is positioned on top of the main sheets **10** and **36** so that the foil is rolled up inside the roll where it is protected by the main sheet which forms the exterior surface of the roll.

The structure of my invention shown in Figs. 3 and 4, is not claimed in this particular application but is claimed in my copending application, Serial No. 615,552, filed October 12, 1956, as a division of this application. In that structure it is the sheet of foil **50** that causes the support members to lift up above the level of main sheet **36**, and this is done by making the sheet of foil short enough so that it will exert a pull on the support members and lift them up away from main sheet **10** when pleat **48** is expanded by pulling outwardly on the two bottom layers of paper **44** of the zig-zag folds. After pleat **48** is expanded and the support members are in raised position the support members are pushed in between adjacent studs in the building, as shown in Fig. 3, and the structure is held in position by nailing, stapling, or otherwise affixing the bottom layer of paper **44** to the outer face of the studs, as indicated at **52** in Fig. 3. As there shown, the stiffened support members have a spring action and they tightly press the foil against the inner face of the studs. As in the form of my invention illustrated in Figs. 1 and 2, the two layers of paper **40** and **42** in support members **38** are held against relative movement in face-to-face contact so that I gain the advantage of the truss effect for stiffness, but in this case the support members are also bent and in addition to the truss effect this bending gives them a spring action for pressing the foil against the inner face of the stud. In this connection, it will be noted that the support members are bent up against the natural resiliency of the paper, and this in connection with the truss effect makes the spring action very pronounced, so that the foil is tightly pressed against the inner face of the stud. The length of the span of foil is preferably made long enough so that the foil is not actually under tension when the structure is installed in the building.

It will be understood that I intend to cover all changes and modifications of the preferred embodiment of my invention herein chosen for the purpose of illustration which do not constitute departures from the spirit and scope of my invention.

This application is a continuation-in-part of my copending application, Serial No. 373,581, filed August 11, 1953, for "Foldable Heat Insulation Material," now abandoned.

What I claim is:

1. A roll of thermal insulation adapted to be opened up to form an insulating structure comprising spaced layers of material to resist the flow of heat, which structure will be held so as to run from the inner face of one stud of a building to the inner face of an adjacent stud, such roll comprising a sheet of paper having symmetrical zig-zag folds adjacent each side in which the paper is folded inwardly over on top of the body of the sheet and then folded again outwardly over on top of the infolded portion, each of such fold lines being sharply pressed by the rolling to hold the three layers of paper in the zig-zag fold with their faces in contact, a crease line in the bottom layer of paper within the confines of the zig-zag fold, so that when the sheet is unrolled the top two layers of paper and a portion of the bottom layer of the zig-zag fold may be rotated as a unit about said crease line to form a pair of stiffened support members that stand upright along the length of the sheet near its edges, a thin sheet of aluminum foil attached near its edges to the top layer of paper of the respective zig-zag

folds, said sheet of foil having an expansible pleat which is adapted to expand and allow the support members to be rotated into upright position whereby the three layers of paper at the base of the respective upright support members may be nailed to adjacent studs of a building to hold said layers of paper of the support members in face-to-face contact against relative movement and to hold the support members and the sheet of foil carried by them pressed closely against the inner faces of such studs.

2. A structure as specified in claim 1 in which the span of the sheet of foil between the upright support members is large enough so that the foil sags somewhat when the

structure is installed between adjacent studs spaced the normal distance apart in a building.

3. A structure as specified in claim 1 which further includes a second sheet of aluminum foil running between the support members and spaced between said first mentioned sheet of foil and said sheet of paper when said support members are standing upright.

References Cited in the file of this patent

UNITED STATES PATENTS

1,726,040	Olson	Aug. 27, 1929
2,312,301	Turner et al.	Mar. 2, 1943