May 14, 1935. O. SCHLICHTING 2,001,632

INSULATION AGAINST LOSSES OF HEAT AND COLD

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Fig. 1.

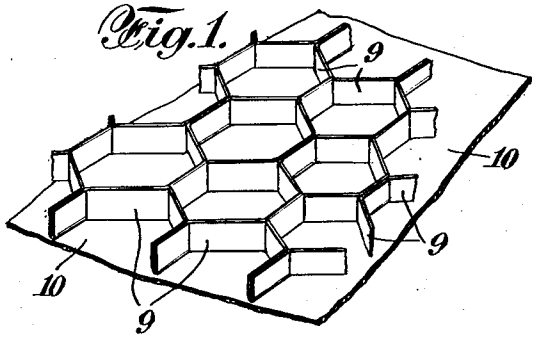


Fig. 4.

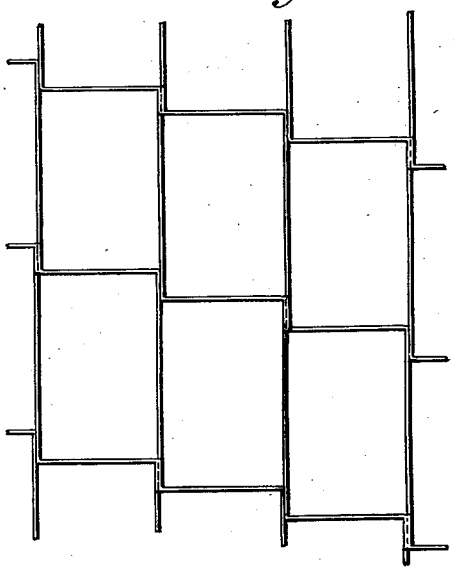
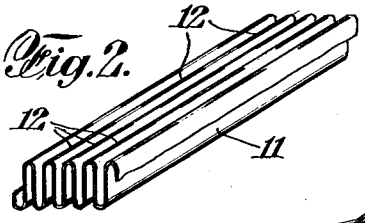


Fig. 2.



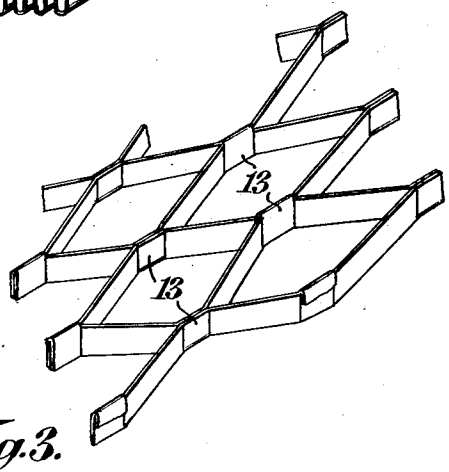


Fig. 3.

Fig. 5.

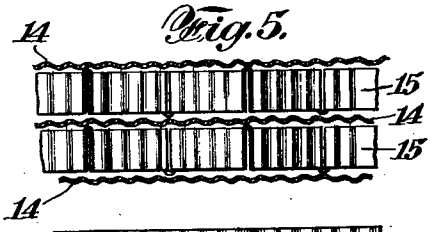


Fig. 6.

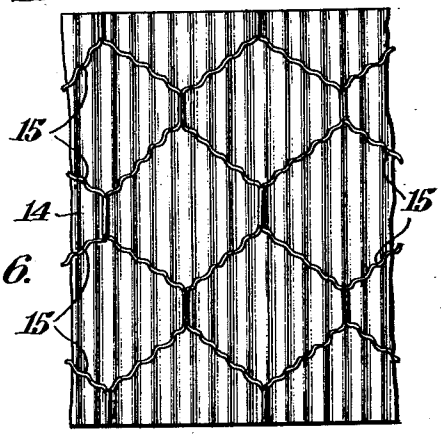


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Fig. 7.

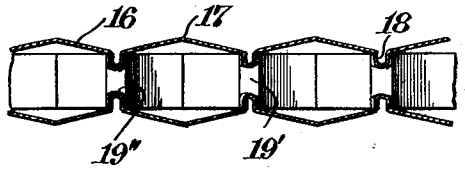


Fig. 11.

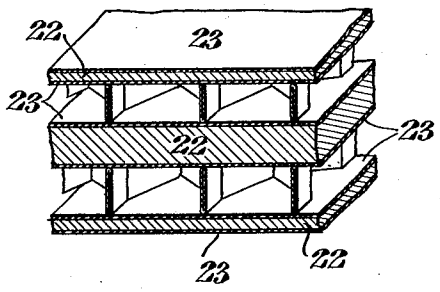


Fig. 8.

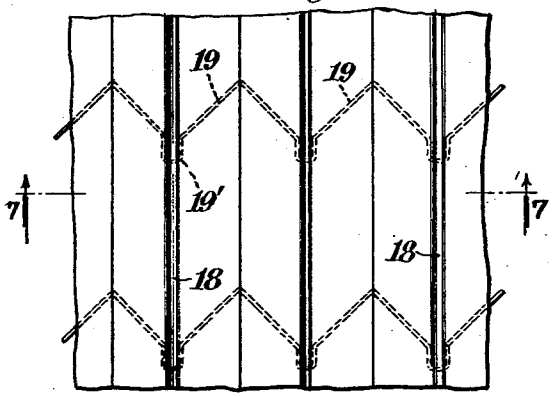


Fig. 9.

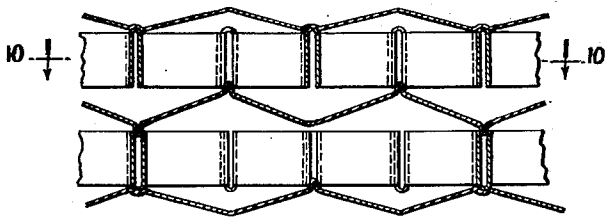
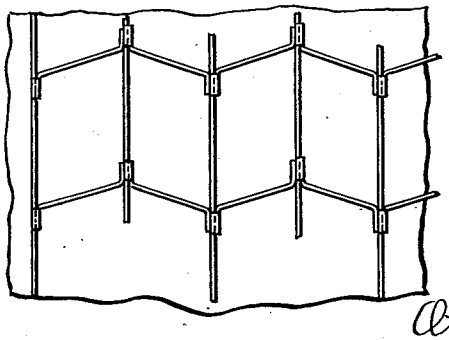


Fig. 10.



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Patented May 14, 1935 2,001,632

UNITED STATES PATENT OFFICE

2,001,632

INSULATION AGAINST LOSSES OF HEAT AND COLD

Otto Schlichting, Berlin-Steglitz, Germany

Application March 27, 1934, Serial No. 717,584
In Germany November 20, 1930

7 Claims. (Cl. 154—45)

This invention relates to an insulation against losses of heat and cold.

It is known to employ for insulating purposes layers of air which are limited by bright heat-reflecting metal foils spaced by means of asbestos cords, asbestos board, or wire constructions. It is further known to subdivide the bright reflecting surfaces by thin-walled webs having the form of bevelled plate strips.

The use of plates as spacers involves the fundamental defect of rendering the insulation relatively heavy and expensive and providing also well conducting heat bridges. These drawbacks are quite serious and become more marked the more closely the spacers have to be arranged, i. e. the thinner the air layers are.

The invention provides a new insulation means including heat-reflecting separating and limiting layers which are spaced by thin walled webs. By using this invention the defects connected with the known plate webs are avoided without introducing other drawbacks. On the contrary, the invention affords special advantages, which could not be obtained hitherto, by providing transportable insulating members that are closed on all sides, ready for installation, yieldable yet resistant to pressure, and disclose an extraordinarily uniform arrangement of the separating layers.

The invention consists in disposing the spacing webs in the form of a grating, honeycomb or frame, or in arranging the rows of spacing webs in spaced relation to one another, so that together with the separating layers, they will form cells or regularly subdivided hollow spaces (Fig. 1). The spacing webs are connected or attached to the separating layers in any suitable manner. The arrangement in the form of a grating, honeycomb or frame ensures, as a rule, particular uniformity in the disposition of the separating layers, and thus the possibility of employing very thin webs. Furthermore, this arrangement makes it possible to produce cellularly subdivided or regularly separated air layers, reduces convection currents and exchange of air, and so limits the conduction or transmission of heat and the formation of moisture coats with all their dangerous consequences for the surface condition of the metal foil.

The gratings or webs may be produced, for instance, by slitting or stamping leaf-like bodies, such as foils, then bending or folding them, and, finally, drawing them apart or partly bevelling them. Such a method cheapens the production of metal foil gratings, since it can be applied by machinery in a very simple manner and to very thin foils. Industrial production of such gratings or webs can be simplified particularly, for example, if the leaf-like bodies are folded to and fro and provided along their folding edges with slots staggered relative to one another from edge to edge (Fig. 2). The folds are then spread apart or repeated so that the folded sides at the points of interruption of the slots form cohering webs standing on edge (Fig. 2).

By a special arrangement of the slots or by a special manner of drawing apart the folded and partly slotted foil, a grating of this type can be brought into such a form that the webs of the grating form rectangularly crossing rows and, at least in one direction, consists of rectilinearly connecting parts (Fig. 4). This lattice shape insures particular rigidity in the direction of the rectilinearly connecting webs and facilitates the drawing apart of the leaf-like body to form a grating. Furthermore, according to the invention the separating layers may be folded or grooved parallel to the course of their connecting web portions and the grating webs, in so far as they are located between the web portions connecting the separating layers, may extend in the form of folds. In this way it becomes possible to bend also coherent multi-layer insulations without trouble and to place them around curved objects, since folding imparts to the separating layers and webs the yieldability required for compressing and extending the layers (Figs. 5 and 6).

For ordinary fitting purposes it may be important to manufacture the separating layers and gratings or webs as units so as to provide a collapsible insulation and to prevent the formation of insulating members that are too bulky for convenient use and handling. For example, spacing webs arranged in spaced relation to one another and connected to the separating layers may be used. Furthermore, zigzag-like extending or folded web bands may be connected in spaced relation with folds of these separating layers, which are disposed transversely to the direction of these bands, so that the insulations may be pushed together or folded transversely to these folds (Figs. 7 and 8). The joints of the separating layers on both sides may be arranged on the same web (Fig. 7), and in multi-layer insulations the connections of the successive layers may be alternately staggered relative to one another (Fig. 9), and multi-layer insulations may thus be contracted so as to be collapsible.

The grate-like arrangement of the webs according to the invention produces a resistance to pressure which was not known till now in air layer insulations employing bright metal foils. Independently of the kind of material used for the separating layers and the thickness thereof, the gratings may be inserted as self-contained members possessing particularly thin walls and being made of a material which, compared with its thermal conductivity, possesses very high

compressive strength and which can therefore be used in such slight thicknesses that very low conduction of heat is ensured also in case of metallic substances, e. g., metal foils, such as pure aluminium foil or aluminium-plated iron foil. Metal foils have the advantage that they can be readily made into suitable webs and connected in grate-like fashion. Furthermore, they are pliant, weigh very little, and are not expensive, though paper materials or asbestos products or synthetic substances, such as artificial resins, will be satisfactory also.

According to the invention, the separating layers and the spacing webs may be corrugated or folded (Fig. 5), or consist of poor heat conductors of any thickness, plated or covered with metal foils or provided with bright coatings (Fig. 11). Such means effectively increase the rigidity of the separating layers. The corrugation may further be utilized for producing flexible layers transversely to the corrugation (Fig. 5). The folds of the separating layers may serve also for connecting the separating layers with the webs. The employment of thinnest metal foils for plating or covering poor heat conductors, such as cork or asbestos plates, affords moreover the possibility of reducing heat conduction along the separating layers and thus the supply and discharge of heat through the webs from layer to layer. Connection of the webs to form gratings and of the separating layers and webs may be effected by stitching, riveting, pasting, welding, or by diffusing metal coatings.

The frame-like, grating-like, net-like or honeycombed web portions can in this way be connected in an airtight manner with the limiting layers so as to produce cells which may be filled with gaseous substances of low thermal conductivity, if desired.

By way of example, the invention is illustrated in the accompanying drawings which show several embodiments thereon and in which

Figure 1 is a diagrammatic view of the honeycombed spacers **2** lying on one of the separating layers **10**.

Figures 2 and 3 show how the net-like or grating-like spaces may be produced from a leaf-like body. The body **11** is folded and provided on the folded edges with spaced slots **12**. Figure 3 shows how, simply by drawing transversely to the slots, a net-like, grating-like or honeycombed body can be obtained which coheres at the bridges **13**.

Figure 4 shows a similar arrangement in which, however, the net or grating is rectangular, the web strips extending straight in one direction and being stepped in the other.

According to Figures 5 and 6, the insulation consists of a plurality of corrugated separating layers **14** kept apart by a network of leaf-like corrugated spacers or webs **15**.

Figure 7 is a section taken on line **7—7** of Figure 8 and shows a grating-like construction of spacing webs arranged by rows and fixedly connected to the separating layers which can be readily folded so as to require little space. For this purpose, the separating layers **16** are provided with arched or annular folded ridges **17** and inwardly extending folds **18**. The webs **19** are also pre-folded and angular and are provided with projecting folds **19'** which are cut away at **19''** for receiving folds **18** and form a connection therewith.

Figure 8 is a top view of the arrangement shown in section in Figure 7.

Figure 9 is a side view of a multi-layer insulation.

Figure 10 is a section of Figure 9 on the line **10—10**.

In the construction shown in Figure 11 the separating layers consist of one of the usual insulating materials **22** provided on both sides with reflecting coatings or coverings **23**, say of aluminium foil.

The webs **24** are of net-like or honeycombed construction and are made of leaf-like or plate-like material, such as foil.

What I claim is:

1. An insulation construction adapted for use as a spacing member, comprising a flexible body formed from an integral flexible sheet comprising thin metal having bright and reflective surfaces, said flexible body being cut and folded to form a reticulated structure having branches or arms and connecting bridges, the branches or arms being of substantially the same thickness as the integral sheet and the bridges being of substantially double the thickness of the sheet.

2. An insulation construction adapted for use as a spacing member, comprising a flexible body formed from a single sheet of flexible material comprising bright metal and including branches or arms and connecting bridges, the branches or arms being of substantially the same thickness as the sheet of material and the thickness of the bridges being substantially double the thickness of the sheet of material.

3. An insulation spacing member comprising an integral sheet comprising bright metal cut and folded to form a reticulated structure having vertical side portions, said vertical side portions being provided with reflective surfaces.

4. An insulation construction comprising a flexible integral sheet comprising bright metal cut and folded to form a skeleton grating and having arms or branches of relatively thin material and connecting bridges, the connecting bridges being of greater thickness than the arms or branches, the branches or arms and bridges having bright reflective surfaces.

5. An insulating construction comprising separated layers having heat reflecting surfaces, and a spacing member therefor made from an integral sheet comprising bright metal cut and folded to form a reticulated structure having vertical side portions, said vertical side portions being provided with reflective surfaces.

6. A structure as specified in claim 5, in which said layers and spacing member are both corrugated so as to form a flexible construction which may be placed around curved objects without deforming the insulation construction.

7. An insulation construction comprising separated layers having heat reflecting surfaces, and spacing members therefor having their walls arranged substantially perpendicular to the general planes of said separated layers, the layers and spacing members being corrugated with the corrugations of the spacing members running substantially perpendicular to the general planes of the separated layers so as to form a flexible construction which may be placed around curved objects without deforming the insulation construction.

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