July 4, 1950 R. F. WALTER ET AL 2,514,170

INSULATING MATERIAL

Filed Oct. 12, 1945 2 Sheets-Sheet 1

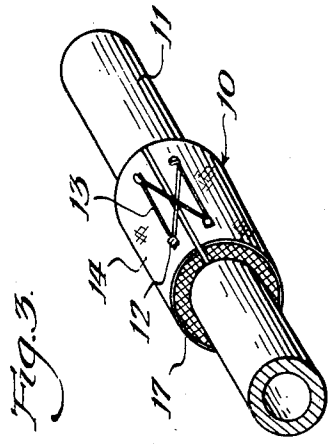


Fig. 3.

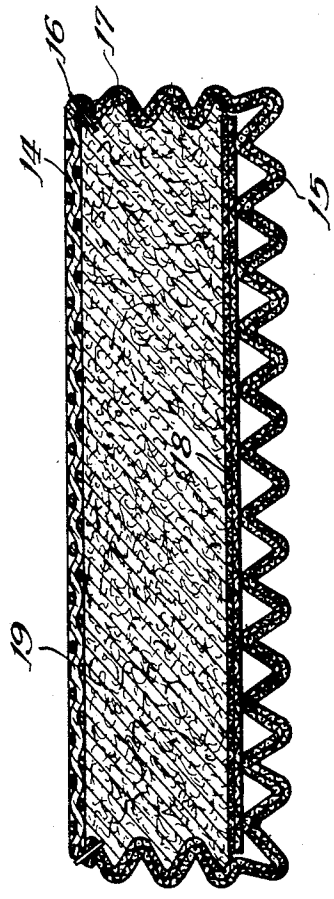


Fig. 2.

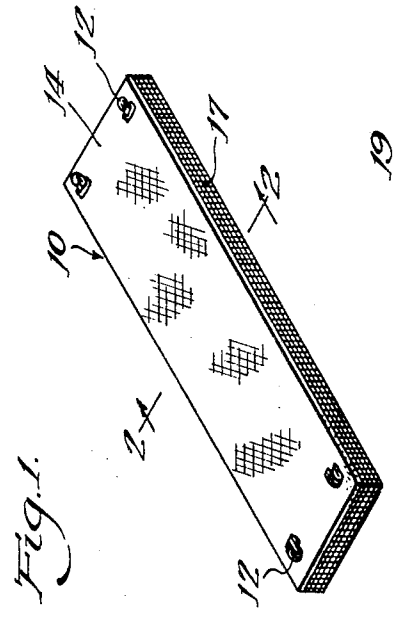


Fig. 1.

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Fig. 4.

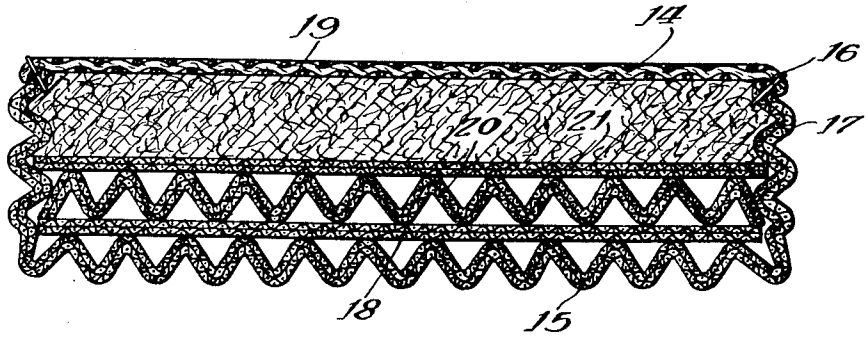
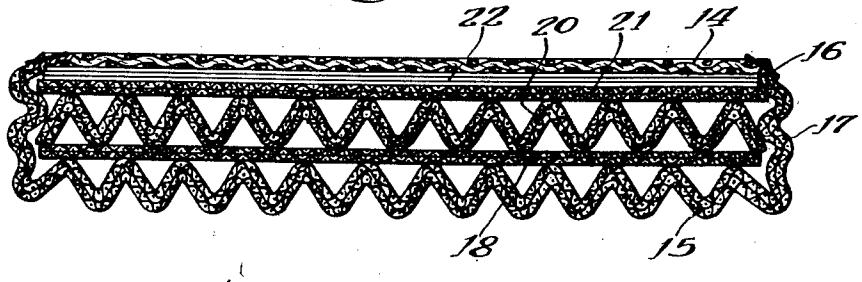


Fig. 5.



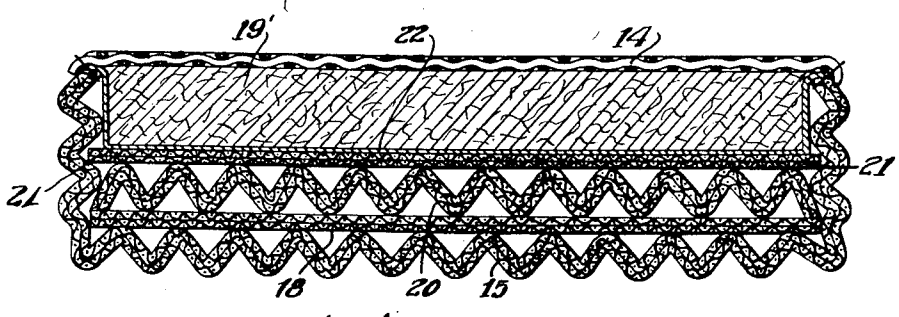


Fig. 6.

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UNITED STATES PATENT OFFICE

2,514,170

INSULATING MATERIAL

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3 Claims. (Cl. 154—44)

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This invention relates to high temperature insulating material of novel construction.

It is an object of the present invention to provide a flexible, resilient insulating composite adapted to be wrapped about the surfaces of conduits and the like tubular conductors or containers of high temperature vapors and gases, for the primary purpose of protecting personnel from being burned by contact with highly heated surfaces, rather than for the purpose of conserving heat, although not so limited.

More particularly, it is an object of the present invention to provide an insulating wrapper or envelope adapted to withstand temperatures on the order of 1000° F., or more suitable for use as a covering for high pressure steam pipes, exhaust manifolds of Diesel engines, parts of jet propulsion airplane engines, gas turbines, and other engines or machines operating at very high temperatures.

Further objects relate to the production of a high temperature insulating composite or envelope adapted to withstand long periods of use, which may quickly and conveniently be applied to the desired surface or part of an engine or machine, which may be removed without damage to itself if the engine or machine requires repairs or is to be disassembled and which may be again replaced to continue its useful functions after repair or reassembly is completed.

In general our high temperature insulating material comprises an envelope having a base or heated object contact surface or section of metallic fabric constructed and arranged to permit air currents to dissipate a portion of heat by convection (and a certain amount to be also lost by radiation) before it can do harm to the heat resistant materials just about it, while being able to withstand high temperatures and remain flexible; an upper or outer surface of woven generally conventional heat resistant fabric; and a filler or intermediate body section, preferably including loosely packed heat resistant fibres constructed and arranged so that the transfer of heat from the source of heat to the outer or top layer is reduced to a minimum.

Further objects and advantages of our insulating material, and its details of construction, modifications, and arrangement of parts will be apparent from a consideration of the following specification and drawings, wherein:

Fig. 1 is a perspective view of a high temperature heat insulating unit in accordance with our invention.

Fig. 2 is an enlarged diagrammatic section on the line 2—2 of Fig. 1.

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Fig. 3 is a perspective view illustrating the employment of the insulating unit of Fig. 1.

Fig. 4 is an enlarged diagrammatic section similar to that of Fig. 2, but illustrating a modified form of construction.

Fig. 5 is another view similar to that of Fig. 2 illustrating a further modified form of construction.

Fig. 6 is a similar view illustrating another modification of our construction.

Referring to the drawings, the reference numeral 10 generally indicates a flexible and resilient high temperature heat insulating and shielding composite blanket adapted to be used as a covering for highly heated surfaces or conduits such as, for example, the tubular conduit or exhaust pipe 11, or components of other engines or machines previously described, for the prime purpose of providing a heat shield. In order that this insulating composite or blanket may be easily applied to an engine or machine and so that it may be removed without damage to itself if the engine or machine requires repairs or is to be disassembled, the end portions of the outer surface of the composite may be provided with hooks 12 whereby the composite may be suitably and securely held against the surface to be insulated by means of laces 13, or the like fastening or securing means.

Referring more particularly to Fig. 2, this form of our insulating composite comprises an envelope formed of an outer covering layer 14 of woven heat resistant fibrous material such as a cloth of woven fibrous asbestos, woven fibrous glass, woven composites of glass and asbestos fibers, or the like, and a base layer 15 of very open mesh flexible metallic fabric. The outer covering layer 14 is of lesser area than the base layer 15 and the two are joined together, as by stitching at their defining edges as at 16, so as to form an envelope. More particularly, the flexible metallic fabric layer 15 is provided with upturned edges as at 17 to form side walls, the edges of these side walls being joined to the edges of the cloth covering layer 14, as previously indicated, at 16.

The base layer 15 is preferably composed of one or more plies of knitted wire, and suitably a two-ply layer may be employed resulting from the collapsing of conventionally produced tubular knitted metallic mesh fabric. The knitted wire used may be made from different metals or metallic alloys and is preferably made of finely drawn, tough wires knitted with relatively coarse loops having relatively large openings. For example, this material may be made from ordinary steel wire for use where corrosion is not a factor

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or from alloys which are non-corrosive, or from lighter metals and alloys where weight control is essential.

As indicated, this layer of flexible metallic fabric is of a very open mesh and is further formed with crimps or corrugations. The crimping pattern used for distorting the material of layer 15 may be any one of a large number of patterns, but preferably a corrugated formation is employed which will produce a layer having greatest resistance to flattening after crimping with the minimum amount of contact with the heat source. The crimps are formed to provide a number of uniformly wide and deep furrows across the entire base of the composite, and preferably also extending along the sides 17, the crimps or corrugations being, for example, of ¼ inch depth.

Immediately above and in direct contact with the crimped base layer 15, there is placed one or more thicknesses of relatively flat open mesh flexible metallic fabric 18 having relatively smaller meshes. By the addition of this relatively closer knitted metallic or wire cloth 18, the number of effective furrows of the base layer 15 is doubled and the tendency of any fluffy fibrous filler material 19, to fall through and fill the furrows made by corrugation of the base layer 15 is reduced to a minimum.

The envelope or pocket is filled with loosely packed heat resistant fibrous material, such as asbestos, glass wool, mineral wool, slag wool, "fiberglas," or the like non-combustible fibrous material.

The employment of a metallic base fabric enables the formation of a blanket which remains flexible under all conditions of temperature and one which can withstand high temperatures. The crimped formation of the metallic base provides furrows through which air currents may circulate and dissipate some of the heat by convection before it can damage the fluffy insulating material 19, and removes the filler material from too close proximity with the heat source. The crimps or corrugations also offer more heat protection to the fibrous filling 19 from radiated heat by locating the fibrous stock further away from the heat source. In addition, the corrugations provide point contact between the insulation and the heat source instead of surface contact thus reducing the transfer of heat by conduction. The layer of flexible metallic fabric 18 placed over the base layer 15 doubles the number of furrows in the base layer thus increasing the circulation of air currents between the heat source and the insulation filler 19, and also acts as a protecting medium to prevent the fluffy filler material 19 from falling out of the envelope or through the very open meshes of fabric 15.

The fluffy, fibrous, heat resistant filling material 19 provides a flexible highly porous layer between the inner and outer layers, or top and bottom of the blanket, so that the transfer of heat from the source of heat to the outer or top layer 14 is reduced to a minimum.

The outer layer 14 of woven heat resistant fibrous cloth provides a heat and fire resistant covering and remains flexible and strong during a long period of use.

Operating tests conducted on a heat insulating composite made in accordance with the form of Fig. 2, and having a thickness of one inch, showed that it was able to withstand a temperature of 1000° F., for a period of 600 hours. During such use the temperature on the outside averaged about 200° F. During this 600 hour period of use, the temperature on the hot side rose at intervals to 1400° F. At the end of this test period, the insulating composite was still in excellent condition and as far as could be observed, could be replaced and continued in service indefinitely.

Thus, in general, it will be seen that by employing a construction such as hereinbefore described and illustrated, including fibrous insulating materials, which would ordinarily be destroyed by direct contact with the high heat of the hot elements to be insulated and shielded, the fibrous material is protected and its life prolonged by being positioned and removed out of contact with the direct heat source, by interposition of a metallic base fabric of crimped or corrugated form providing air spaces between the hot body and the fibrous insulating material. Although this construction takes full advantage of the fact that the air spaces resulting from the employment of the corrugated base fabric 15, do act as an insulation aid, their formation is incidental to and the result of the maintaining of the less heat resisting insulation filler materials 19 as far away from the source of heat as possible, so as to prevent their destruction by direct contact with the hot elements, and thus prolonging the life of usefulness of the composite, and the prevention of rapid transfer of heat from the heat source to the outer surface of the covering fabric 14.

The construction of modified form of Figs. 4 and 5 are particularly well adapted for use on gas turbines and jet propulsion engines where even higher temperatures, such as from 1300° F., to 1700° F., are encountered.

As shown in Fig. 4 the insulating composite may be constructed with multiple layers of corrugated metallic mesh fabric instead of the single layer of Fig. 2, and the several layers of metallic mesh fabric employed may be made from different metals or metallic alloys. These materials may be laid in layers, each one of which is made from the same material, or they may be laid in such a way that the layer next to the source of heat shall have the highest heat resistance with the subsequent layers having less and less heat resistance, and the materials from which the metallic fabric is made may be entirely different in each layer. One or more of the layers may be composed of "semi-metallic" fabric, such as a composite of metallic and asbestos strands or filaments.

Thus in the construction of Fig. 4, the composite is essentially that of Fig. 2 with the addition of a second layer of corrugated open mesh metallic fabric 20 over the flat layer 18, and another layer of flat metallic mesh fabric 21 may be positioned upon the corrugated layer 20. It will be understood that if desired additional and alternating layers of corrugated and flat metallic mesh fabric may also be employed.

With this multiple corrugated metallic mesh fabric layer construction, it is possible to reduce the thickness of fibrous heat resistant filler material 19 required to complete the insulation, and to remove the filler 19 still further from the heat source. In this form of construction, the uppermost layer of uncrimped or flat metallic mesh fabric 21 may or may not be employed.

Fig. 5 shows another modified construction in which a metal heat reflecting foil 22, having a thickness of about .002 to about .004 inch, is interposed between the woven cloth cover 14 and the metallic mesh fabric arrangement of Fig. 4, and in place of the filler material 19 thereof.

With this form of construction the foil 22 may be used in conjunction with a layer of heat resistant fibrous filling material, 19' as shown best in Fig. 6, and such composite construction is preferred.

It will be further understood that in installations of our insulating blanket, where the absorption of oil or water by the cloth cover 14 and/or by the fibrous filling material 19 may be considered objectionable, such objections may be corrected by coating the cover cloth 14 with suitable synthetic resins or synthetic rubber compounds which are unaffected by oil and water, and the fibrous filling material may likewise be treated with a material which will render it impervious to oil or water.

We claim as our invention:

1. A flexible and resilient high temperature heat shielding composite blanket comprising an outer covering layer of woven heat resistant fibrous material, an outer base layer of open mesh corrugated flexible metallic fabric the corrugations of which are self-supported, an intermediate layer of loose heat resistant fibrous material, and an interposed layer of open mesh flexible metallic fabric being of smaller mesh than said corrugated fabric and supporting said loose fibrous material above the ridges of said corrugated base layer, said base fabric having upturned edge portions forming side walls extending substantially the thickness of the blanket joined edgewise to said outer covering layer and forming an envelope therewith.

2. A flexible and resilient high temperature heat shielding composite blanket comprising an outer covering layer of woven heat resistant fibrous material, an outer base layer of open mesh corrugated flexible metallic fabric the corrugations of which are self-supported, an intermediate layer of loose heat resistant fibrous material, and an interposed layer of open mesh flexible metallic fabric being of smaller mesh than said corrugated fabric and supporting said loose fibrous material above the ridges of said corrugated base layer.

3. A flexible and resilient high temperature heat shielding composite blanket comprising an outer covering layer of woven heat resistant fibrous material, an outer base layer of open mesh corrugated flexible metallic fabric the corrugations of which are self-supported, an intermediate layer of loose heat resistant fibrous material, an interposed layer of open mesh flexible metallic fabric being of smaller mesh than said corrugated fabric and supporting said loose fibrous material above the ridges of said corrugated base layer, and means comprising edge portions forming side walls extending substantially the thickness of the blanket joined edgewise to said outer covering layer and forming an envelope therewith.

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WILLIAM J. JOYCE, JR.

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