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THERMAL INSULATION

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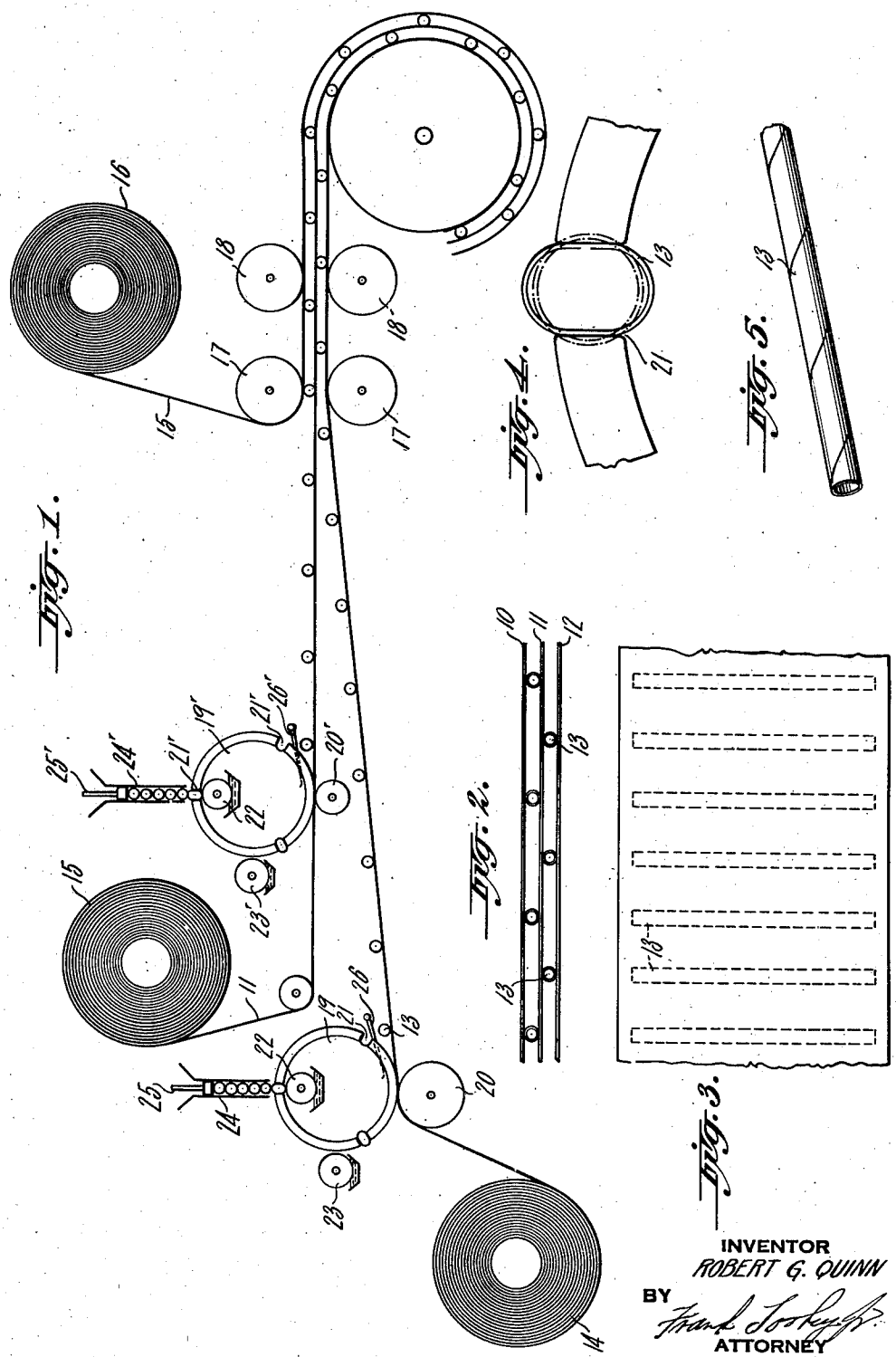


Fig. 1.

Fig. 4.

Fig. 5.

Fig. 2.

Fig. 3.

INVENTOR
ROBERT G. QUINN
BY
Frank Lockwood
ATTORNEY

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THERMAL INSULATION

Robert G. Quinn, Glens Falls, N. Y., assignor to International Paper Company, New York, N. Y., a corporation of New York

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1 Claim. (Cl. 154—45)

My present invention relates to improvements in thermal insulation construction and more particularly to a new and improved insulation construction based upon radiation principles. My present invention also contemplates the provision of a new and improved process for assembling such a composite insulation unit.

In a copending application, Ser. No. 658,371, filed February 24, 1933, I have disclosed and claimed an improved form of insulation construction wherein sheets of waterproofed corrugated paper are built up into a unit, the flutes of alternate sheets of said unit being preferably arranged at right angles to flutes of adjacent sheets, whereby a plurality of "dead air" cells are formed, thus obviating a transmission of heat by convection currents. My present invention covers, in part, further refinements and improvements of said invention.

Inasmuch as heat may be transferred by conduction, convection, and/or by radiation, an insulation construction, to be at all satisfactory, must be so designed as to avoid, as far as possible, the transfer of heat by any of these methods. It is accordingly the primary object of my present invention to provide a new and improved type of thermal insulation so designed as to avoid the transfer of heat by convection and made from those combinations of materials which reduce the transfer of heat by radiation. I have also found that by my improved construction the transfer of heat by conduction is also avoided to a great extent.

Another object of my present invention is to provide a new and improved separating or spacing means for sheets of insulating material so that dead air cells of suitable size may be formed. In practice use is made of spirally wound tubes of paper or analogous material which are not only simple to make but provide sufficient rigidity to withstand normal crushing forces.

Another object of my present invention is to provide a thermal insulation unit comprising at least three sheets of suitable material separated or spaced from each other by means of spirally wound tubes of paper or other suitable material.

Another object of my present invention is to provide a composite insulation unit made up of at least three sheets of material spaced and separated from each other by tubes of paper. The sheets used in building up the insulation unit comprise two outer sheets of ordinary paper, water-proofed paper, or other specially treated paper, and an inner or central sheet of metal foil, preferably aluminum.

Still another object of my present invention is to provide a new and improved method of constructing the aforesaid thermal insulation unit in such a manner that the process lends itself to continuous manufacture.

These and other objects of my present invention will become more apparent from a study of the following specification and by reference to the annexed drawing in which

Fig. 1 is a schematic view of the mechanism employed in constructing the insulation unit shown in Figs. 2 and 3;

Fig. 2 is a view in end elevation of my improved thermal insulation unit;

Fig. 3 is a plan view, the tubes spacing the sheets being shown in dotted outline;

Fig. 4 is a detail view of a slot formed in the feeder wheel in which the separator tubes are placed for coating and for placing them on the sheets making up the insulation; and

Fig. 5 is a perspective view of the preferred form of spacing means.

Referring now more particularly to the drawing in which like numerals indicate like parts, I have shown a thermal insulation unit comprising sheets 10, 11 and 12, separated or spaced from each other by means of tubes 13. Materials of low specific electrical resistances have the lowest emissivity coefficients. Sheet materials, such as metal foil, have emissivity coefficents approximating .04, whereas untreated papers have comparatively high factors ranging from approximately .8 to .95. Metal foils being fragile as well as costly would not be normally used as a satisfactory heat insulating medium. However, I have found that by the use of certain combinations of various sheets of materials an efficient heat insulation may be produced at a comparatively low cost.

It has been found that the emissivities of the highly polished metals are very low. Good electrical conductors are low in emissivity and conversely non-conductors have high emissivity factors. Thus polished aluminum at 73° Fahrenheit has an emissivity factor of .04; polished copper at 176° Fahrenheit has an emissivity factor of .18. Glazed porcelain, however, at 72° Fahrenheit has an emissivity factor of .945 and hard rubber at a temperature of 74° Fahrenheit has an emissivity factor of .945. The temperature at which the emissivity factor is determined is important since the emissivity factor increases appreciably as the temperature becomes greater.

Preferably, in my insulation unit the sheets 10 and 12 are made of paper, waterproofed paper,

as for example, asphalt-treated paper or untreated kraft paper, and the inner or central sheet 11 is made of aluminum foil.

The use of the aforesaid combination of materials will result in a structure possessing the best possible insulation against the transfer of heat by radiation. Inasmuch, however, as heat is also transferred by convection currents it is necessary that some type of separating means be used to maintain the sheets out of contact with each other. I have found that paper tubes, preferably spirally wound, having a diameter of between .25 inch and .33 inch, provide a spacing between the sheets 10, 11 and 12 sufficient to obtain the minimum amount of heat transferred due to convection currents. It will be appreciated that other types of separating means may be used. For example, the separating means may be formed as an I, X, U, Y or Z. Because of simplicity in the manufacture of the tubes and the added strength obtained by the use of such tubes I have found in practice that these latter forms are not entirely suitable. In effect such spacing provides "dead air" cells between the sheets. Not only does such spacing reduce the amount of heat transferred by convection but it also reduces the amount of heat transferred by conduction since the amount of heat transferred by conduction depends to a great extent upon the density of the material. In general, the lower the density of any material the less heat is transferred by conduction. To provide the desired size of "dead air" cells I have found that the spacing between the paper tubes should not exceed six inches.

Referring now more particularly to Figs. 1 and 4, I have shown in schematic view suitable mechanism for constructing my new and improved insulation. Sheets of paper, such as waterproofed paper, are fed from rolls 14 and 16 between pairs of nip rolls 17 and 18. The paper coming from roll 14 passes between a feeder wheel 19 and a guide roll 20. As the sheet passes over the guide roll it is brought into contact with the feeder roll which places a paper tube 13 on the sheet. The feeder roll or wheel comprises a hollow cylinder, the surface of which is provided at spaced intervals with slits or slots 21 for holding the tubes. The slits or slots are slightly smaller in diameter as is shown in Fig. 4 and by this construction the tube is held against moving when it comes in contact with coating rolls 22 and 23. The coating roll 22 coats the under surface of the tube with a film of adhesive and the coating roll 23 places a similar film of adhesive on the top or exposed surface of the tube. The tubes are fed into the slots formed in the feeder roll or wheel from a magazine 24 by means of any suitable mechanically operated plunger or pushing mechanism 25. In order to release the tubes from the slots as the tubes are brought into contact with the sheet 12, I have provided a plurality of fingers 26 which are fixed to a stationary shaft 27 and which ride in slots (not shown) formed in the feeder roll or wheel. Obviously any other type of means may be employed to release the paper tubes from the slots 21.

The sheet 11 carried by roll 15 is led over a guide roll 28 and then between the feeder wheel 19' and guide roll 20'. This sheet is made of metallic foil, preferably aluminum, and in the finished product lies between the outer sheets 10 and 12, being separated therefrom by the spacing tubes 13. As will be appreciated, the feeder wheel 19' places the spacing tubes on the sheet 11, the said tubes being fed into the slots 21' of the feeder wheel from the magazine 24' by a plunger or other actuating mechanism 25'. The construction and operation of the feeder wheel 19' is identical to the construction and operation of the feeder wheel 19, the tubes being coated on their top and bottom surfaces by suitable coating rolls 22' and 23'.

The sheets 11 and 12, each carrying the spacing tubes, are then brought between nip rolls 17 and 18 where they meet sheet 10 carried by the roll 16. As will be noted from an inspection of Fig. 1, the tubes carried by the sheet 11 are staggered with respect to the tubes carried by the sheet 12, so that the tubes of one sheet are at the midpoint of the span between successive tubes of the other sheet. Hence there is no point in the composition sheet construction through which a substantially direct flow of heat can take place by conduction. The sheets, after passing between the nip rolls, are then wound on any suitable means such as a reel 28.

It is to be noted that each tube is coated on its upper and under surface with adhesive and it will be appreciated that the adhesive employed on the coating roll 22 will be slower in setting than the adhesive employed on the coating roll 23 in order to provide a film of adhesive having the necessary tackiness.

It will be obvious to those skilled in the art that the construction may comprise more than three sheets of material and that the construction may be subdivided into any desired size. In building construction the ends of the paper tubes may be sealed or squashed in order to seal the edges of the air spaces.

What I claim as new is:

In an insulation unit, a plurality of sheets of insulating material, means spaced from each other for separating said sheets comprising rows of paper tubes between adjacent sheets and having their open ends positioned in a plane at right angles to the plane of said sheets, the paper tubes of one row being located so as to be at the midpoints of the spaces between the tubes of an adjacent row, and means for securing said spacing means to said sheets.

ROBERT G. QUINN.