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R. S. BLAIR

HEAT INSULATION AND PROCESS OF MAKING SAME

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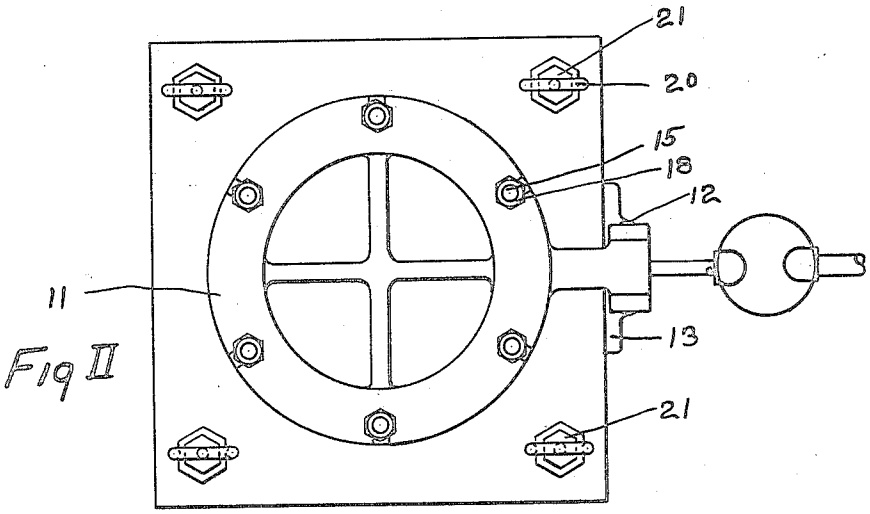


Fig II

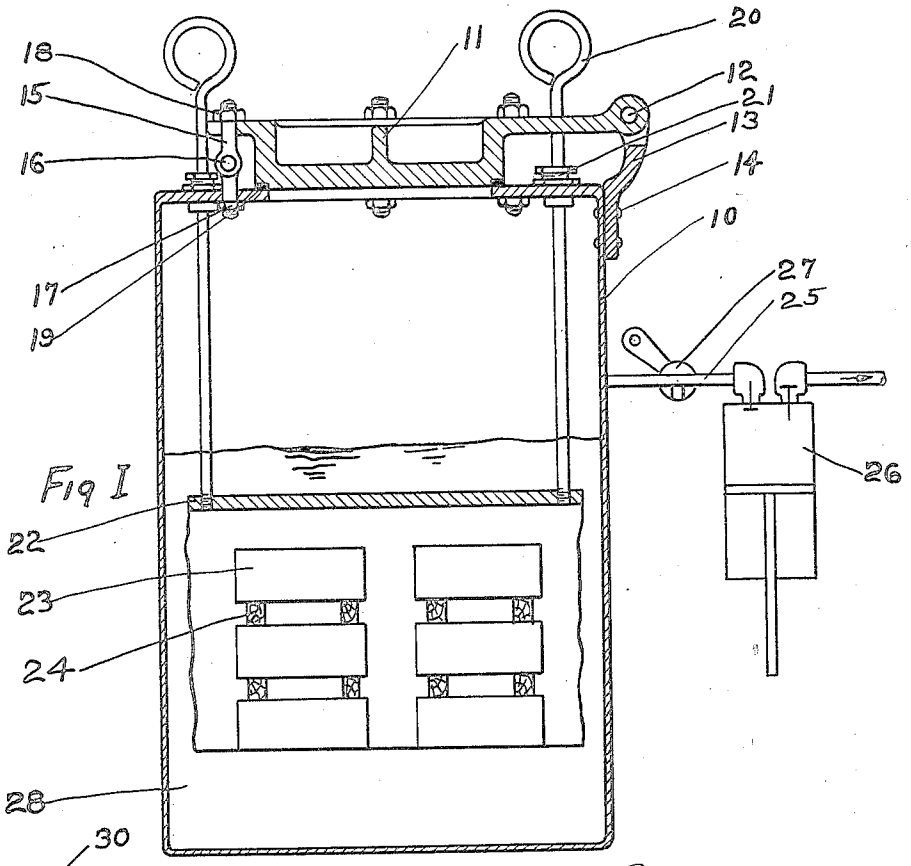


Fig I

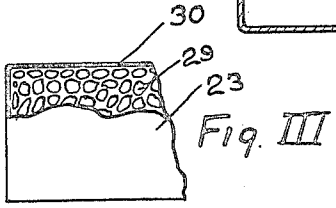


Fig. III

INVENTOR

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# UNITED STATES PATENT OFFICE.

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## HEAT INSULATION AND PROCESS OF MAKING SAME.

Application filed August 9, 1921. Serial No. 491,057.

*To all whom it may concern:*

Be it known that I, ROBERT S. BLAIR, a citizen of the United States, and residing at Sound Beach, in the county of Fairfield and State of Connecticut, have invented a new and Improved Heat Insulation and Process of Making Same, of which the following specification is a full disclosure.

This invention relates to heat insulating material and more particularly to blocks of such material used as insulation for appliances which are to be kept at low temperature.

One of the objects thereof is to provide heat insulating material convenient in form, simple in construction and inexpensive to manufacture. Another object is to provide a form of heat insulating material which may be conveniently used in the construction of refrigerating appliances. Another object is to provide a type of insulating material and a method of producing the same in which the insulating properties of the material itself are combined with the highly efficient insulation which may be obtained by the use of hollow containers within which a vacuum is maintained. Other objects are in part obvious and will be in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangements of parts and the art which will be exemplified in the structure hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings in which is shown one of the various possible embodiments of this invention, Figure I is a side elevation in cross section of the vacuum tank in which the insulating material is subjected to vacuum and at the same time is coated and impregnated to a slight depth with a non-porous material. Figure II is a plan view of the vacuum tank shown in Figure I. Figure III is a greatly enlarged view of a piece of the insulating material, the section being taken along the edge thereof giving a clear representation of the air cells contained in the material and the air tight coating over the exterior surface of the piece of insulating material.

Similar reference characters refer to similar parts throughout in the several views of the drawings.

Turning now to the accompanying drawings, we have in Figure I at 10 a tank closed at the lower end and provided with a circular opening in the center of its upper end which opening can be closed by means of a cover 11 hinged at its right hand end on the pin 12 which is supported in the lug 13 riveted to the outside of the tank 10 by means of rivets such as 14, the cover 11 being tightly clamped against the upper end of the tank 10 by means of the hinged bolts 15 which are made in two pieces and are swiveled together on the pin 16. The lower end of the hinged bolts 15 are tapped into the head of the tank 10 and a check nut 17 is threaded on to the lower ends thereof where they project through the head of the tank 10, the upper end of the hinged bolts 15 pass through slots in the flange around the edge of the cover 11 and by screwing down upon the nut 18 threaded on the ends thereof the cover 11 is firmly held in position. A soft gasket 19 is interposed between the adjacent surfaces of the upper end of the tank 10 and the lower end of the cover 11 insuring an air tight joint being maintained there between when the nuts 18 on the hinged bolts 15 are firmly screwed down. Four lifting rods 20 pass through stuffing boxes 21 positioned in the corners of the upper head of the tank 10 and at their lower ends are threaded into a basket 22; the lifting rods 20 are provided with large eyes at their upper end so that a chain tackle may be hooked thereon to raise or lower the basket. Blocks such as 23 of balsa wood or pumice stone or some other similar porous material, are piled up in the basket 22; spacing pieces such as 24 of ordinary wood are interposed between the successive layers of blocks of balsa wood or pumice stone such as 23 so that when the basket 22 is lowered to the lower end of the tank 10 and thoroughly submerged in the liquid 28 contained therein all surfaces of the blocks of balsa wood or pumice stone such as 23 will be subjected to the action thereof.

Communicating with the upper end of the tank 10 by means of the pipe 25 is a vacuum pump 26, a three-way valve 27 being interposed in the pipe 25 between the tank 10 and the vacuum pump 26 so that by properly manipulating the handle thereof the vacuum pump 26 may be connected with

the tank 10 or disconnected therefrom and a port opened which will permit atmospheric air to rush into the tank 10 therethrough and break the vacuum existing therein. Turning now to Figure III we have a block of balsa wood or pumice stone or other similar porous material balsa wood being preferred, a number of which blocks were shown at 23 in Figure I. The upper corner of the block has been cut away and the structure of the material of which the block is composed has been greatly magnified so that air cells 29 which are characteristic of this material are clearly shown together with the cell walls; the outer surface of the block is covered by an air tight coating 30 of rubber, condensite or other similar material which may be had in a liquid form and upon drying will form a durable air tight film.

The action of the apparatus above described is substantially as follows: The nuts 18 on the hinged bolts 15 are unloosened and the upper ends of the hinged bolts 15 are swung out of the slots in the cover 11 and the vacuum existing in the tank 10 having been broken by turning the valve 27 so that the passageway therethrough lines up with the end of the pipe 25 where it connects with the tank 10 thus permitting atmospheric air to flow therethrough bringing the pressure in the tank 10 up to atmospheric permitting the cover 11 to be now lifted and swung over to the right about the pin 12 as an axis. The upper ends of the lifting rods 20 are now grasped by the operator or in the case of very large apparatus a block and tackle is hooked therein and by lifting thereon the basket 22 is brought up to the upper end of the tank 10. Blocks 23 of porous material consisting of balsa wood, pumice stone or other similar porous material are now laid in well spaced layers in the basket 22; wood spacers such as 24 being interposed between the successive layers of the blocks 23. The basket 22 having been completely filled with layers of the blocks of porous material such as 23 the lifting rods 20 are lowered so that the basket 22 connected to the lower ends thereof is lowered and submerged completely in the liquid 28 contained in the lower end of the tank 10 which consists of a solution of rubber, condensite or some other material which on drying forms a durable air tight coating. The cover 11 is now swung over to the left until it rests upon the upper end of the tank 10 and the upper ends of the hinged bolts 15 are swung over into the slots in the cover 11 and the nuts 18 securely screwed down. The air contained in the tank 10 above the liquid 28 is removed by swinging the handle of the valve 27 over so that the port connecting with the atmosphere is closed and a clear passageway is opened up through the pipe 25 to the vacuum pump 26 which being continuously in operation soon reduces the pressure in the tank 10 to considerably below atmospheric. A high degree of vacuum is maintained in the tank 10 for a sufficient length of time to permit all the air contained in the cells of the blocks of porous material 23 to be exhausted and after this has been attained the basket 22 is drawn up above the level of the liquid 28 by pulling up the lifting rods 20 and is allowed to rest in this position a sufficient length of time to allow the coating left on the exterior surfaces of the blocks of porous material 23 by the liquid 28 to solidify, the surplus draining off into the bottom of the tank 10. It may be advantageous to slightly lower the degree of vacuum while the coating of the liquid 28 on the exterior surfaces of the blocks of porous material 23 is drying as under this condition the degree of vacuum existing in the air cells contained therein would be greater than the degree of vacuum surrounding them and consequently the coating left on the exterior surfaces thereof by the liquid 28 would tend to be driven somewhat into the material and make a firmer coating thereon. Sufficient time having been allowed for the coating left by the liquid 28 on the exterior surfaces of the blocks of porous material 23 to become thoroughly set, the handle of the valve 27 is swung over breaking the connection between the tank 10 and the vacuum pump 26 and permitting atmospheric air to rush into the tank 10 breaking the vacuum therein and permitting the cover 11 then to be raised as previously described. The blocks of porous material 23 are now removed from the basket 22 and are now ready to be used as a very efficient insulating material as the air cells characteristic of this type of porous material now contain air at a very low pressure so that the insulating properties of the blocks of porous material 23 are obtained from the small vacuum cells contained therein which formerly contained inert air at atmospheric pressure. As is well known, cells containing inert air at atmospheric or higher pressure are very much less efficient as heat insulators than cells containing a greatly rarefied atmosphere.

As various possible embodiments might be made of the above invention and as various changes might be made in the embodiment and the art above set forth, it is to be understood that all material herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. The herein described art which consists in exhausting air from a porous substance and covering the substance to prevent the re-entry of the air.

2. The herein described art which consists in subjecting a porous substance to a vacuum, covering it while in the vacuum to prevent the re-entry of air after the vacuum is removed.

3. The herein described art which consists in exhausting the air from a porous substance and applying a coating to said substance to prevent the re-entry of air.

4. The herein described art which consists in exhausting the air from a substance and coating said substance with a material which enters the outer pores of the substance over its outer surface and prevents the re-entry of air.

5. The herein described art which consists in exhausting the air from a porous substance and impregnating its outer surface with a substance impervious to air.

6. The herein described art which consists in shaping a porous body into a predetermined form, exhausting the air therefrom and covering its outer surface to prevent the re-entry of air thereto.

7. As a new article of manufacture, a porous substance having the air exhausted from its pores and a covering about said substance preventing the re-entry of air.

8. As a new article of manufacture, a porous substance having the air exhausted from its pores and provided with a coating sealing its outer surface and preventing the re-entry of air.

9. As a new article of manufacture, a porous substance having the air exhausted from its pores and a flexible coating over the surface of said substance preventing the re-entry of air.

10. As a new article of manufacture, a porous substance having the air exhausted from its pores and having its outer portions over its surface impregnated with a substance impervious to air.

11. As a new article of manufacture, a non-metallic porous substance having the air exhausted from its pores and a non-metallic covering over the surface of said substance preventing the re-entry of air.

12. As a new article of manufacture, a body of balsa wood having the air exhausted from its pores and a non-metallic coating about the outer surface of said wood preventing the re-entry of air.

13. As a new article of manufacture, a body of porous material having pores of substantial size, the air being exhausted therefrom, and a non-metallic coating about the outer surface of said material preventing the re-entry of air to said pores.

In witness whereof, I hereunto subscribe my name.

ROBERT S. BLAIR.