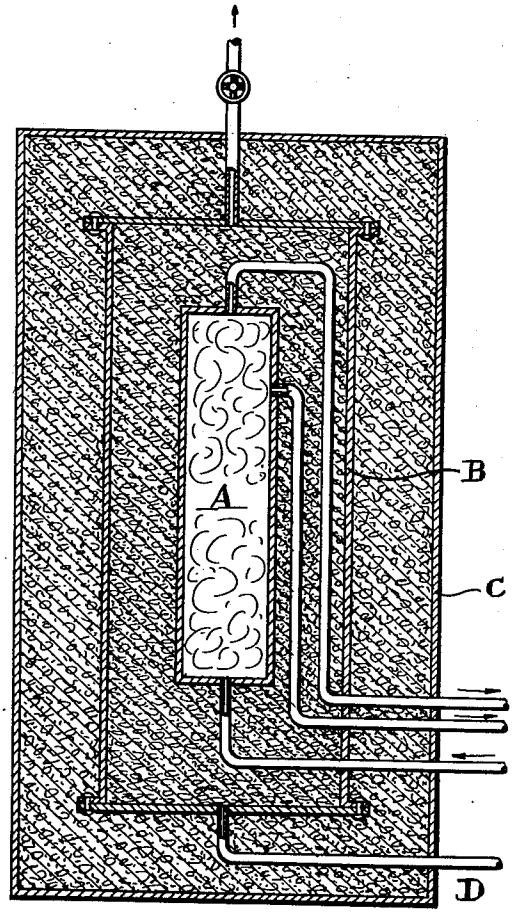
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HEAT INSULATION FOR APPARATUS WORKING AT VERY LOW TEMPERATURES

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JEAN LE ROUGE, OF BOULOGNE-SUR-SEINE, FRANCE, ASSIGNOR TO L'AIR LIQUIDE, SOCIETE ANONYME POUR L'ETUDE & L'EXPLOITATION DES PROCEDES GEORGES CLAUDE, OF PARIS, FRANCE

HEAT INSULATION FOR APPARATUS WORKING AT VERY LOW TEMPERATURES

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It is known that the non-conducting insulation of apparatus at a very low temperature is realized, in practice, by a more or less thick layer of slightly conductive porous material, such as glass-wool, magnesium carbonate, etc., the presence of which prevents, to a certain extent, the external conduction of heat by the suppression of the convection currents. This method, which is suitable in a certain number of cases, becomes absolutely insufficient when the temperature of the apparatus to be insulated is distinctly lower than the point of liquefaction of the atmospheric air filling the insulating material. The liquefaction of this air causes, in fact, an adduction of heat which may be considerable.

In order to avoid this drawback, it seems first of all that the air filling the insulating material might be replaced by a gas having a lower liquefaction point. Now, the only existing gas meeting the requirements of the case is hydrogen, and it is found that an insulating material filled with hydrogen is very slightly efficacious. This result must be attributed to the fact that, the hydrogen being of much lower density than air, the convection currents are less suppressed by the porous material and above all to the fact that hydrogen is very conductive.

The object of the present invention is to surmount this difficulty by utilizing at the same time the property possessed by hydrogen of remaining gaseous at very low temperatures, and the insulating properties of the air at fairly low temperatures.

According to the present invention, which is applicable most particularly to apparatus for the manufacture of hydrogen, the apparatus to be protected is surrounded by a first layer of non-conducting material placed in a hermetic covering, and filled with hydrogen. A second layer of non-conducting material filled with air, surrounds the first, so that the conduction of heat must take place through two successive layers, one filled with air, and the other filled with hydrogen. Experience has shown that, in spite of the poor insulating power of hydrogen, the temperature gradient through the insulating layer filled with hydrogen is sufficient to avoid any liquefaction of the air enclosed in the second insulating layer, so that a very simple satisfactory insulation is ensured by the simple superimposition of two insulating layers, the separate effects of which are insufficient, whatever thickness may be given to them.

Of course, the respective thicknesses to be given to the two superimposed layers depend upon a large number of factors, and it is experience which must determine them in each particular case. The important fact, however, is that, under a total thickness which is, relatively speaking, not very considerable, an insulator for very low temperatures may always be realized according to the device just described.

The annexed drawing illustrates diagrammatically a constructional form of the above described apparatus, in the case relating to the non-conducting insulation of a column for the separation of the constituents of coke oven gas. A designates the column, which is provided with an inlet pipe for the gas and several outlet pipes for the separated constituents, especially for hydrogen. Around the column A is fitted a gas-tight covering B, provided with a usual porous substance filled with hydrogen, approximately under the atmospheric pressure. The hydrogen is introduced by the pipe D, and the pipe E enables the sweeping of the air during the filling with hydrogen. Finally the covering B is surrounded with a covering C provided with a usual porous substance filled with air. It is evident that a similar arrangement can be used in any apparatus working at a low temperature.

What I claim is:

1. A heat insulation covering for apparatus operated at low temperatures which consists of an inner layer of porous material surrounding said apparatus and impregnated with a gas which is not liquefiable at the temperature at which said apparatus is operated, an inner gas tight covering enclosing said inner layer of porous material, a second layer of porous material surrounding said inner covering in direct contact with it and impregnated with a gaseous medium which is liquefiable at the temperature at which said

apparatus is operated and an outer gas tight covering enclosing said second layer of porous material.

2. A heat insulation covering for apparatus for separating by partial liquefaction from a gaseous mixture a component remaining in a gaseous state which consists of an inner layer of porous material surrounding said apparatus and impregnated with a gas of the same composition as the said component, an inner gas tight covering enclosing said inner layer of porous material, a second layer of porous material surrounding said inner covering in direct contact with it and impregnated with a gaseous medium which is liquefiable at the temperature at which said apparatus is operated and an outer gas tight covering enclosing said second layer of porous material.

3. A heat insulation covering for apparatus for separating by partial liquefaction from a gaseous mixture a component remaining in a gaseous state which consists of an inner layer of porous material surrounding said apparatus and impregnated with part of the gaseous component separated in said apparatus, an inner gas tight covering enclosing said inner layer of porous material, a second layer of porous material surrounding said inner covering in direct contact with it and impregnated with a gaseous medium which is liquefiable at the temperature at which said apparatus is operated and an outer gas tight covering enclosing said second layer of porous material.

4. A heat insulation covering for apparatus operated at low temperatures which consists of an inner layer of porous material impregnated with hydrogen and surrounding said apparatus, an inner gas tight covering enclosing said porous material, a second layer of porous material impregnated with air and surrounding said inner covering in direct contact with it and an outer gas tight covering enclosing said second layer of porous material.

In testimony whereof, I affix my signature.

JEAN LE ROUGE.