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HEAT REGENERATOR CONTAINING METAL PACKING MATERIAL COATED WITH A LUBRICANT

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8 Claims. (Cl. 257—6)

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This invention relates to an improved heat regenerator packing material which has been lubricated to reduce dusting.

It has been proposed that stone or metal pellets, within the critical size range of $\frac{3}{16}$ inch to $\frac{5}{8}$ inch in diameter, may be substituted for the Fränkl "aluminum pancakes," presently used as a low-temperature heat regenerator packing, without lowering the heat exchange efficiency of the regenerator. Because inexpensive sources of supply for such pellets are available, e. g. aluminum or iron shot or stone beach pebbles, a great saving in regenerator construction and maintenance cost may be effected.

The Fränkl low temperature regenerator or "cold accumulator" and a low temperature gas separation system in which it is used, is described in United States Patent 1,890,646 of Mathias Fränkl and the improved regenerator packing according to this invention is especially useful for such systems in which a pair of the regenerators effects heat exchange between a compressed gas mixture to be cooled and a cold separation product flowed alternately through each regenerator of the pair.

Such pellet regenerator packing while inexpensive and efficient is subject to a certain amount of "dusting" or powdering in operation. This results from the rapid and reversing fluid flow through the regenerator. Dusting is decreased somewhat by holding the pellets tightly in place with mechanical pressure on the packing material. It increases with increased and velocity of the fluid flow and hence is more troublesome in low-temperature gas separation plants with substantial pressure difference between the inflowing gas mixture and outflowing separation product. Dusting is disadvantageous not only because impurities are introduced into the product but also because in time the pellet size falls below the critical diameter range. The regenerator efficiency then drops and a replacement of the packing material may be necessary.

The object of this invention is to provide a pellet regenerator packing material of greatly reduced friability and no material reduction of packing efficiency.

The invention is based on the discovery that dusting may be substantially reduced by coating the pellets with a lubricant. In heat regenerators used in low-temperature air separation plants the lubricant must also be non-oxidizable. Graphite and molybdenum disulphide are particularly advantageous solid lubricants for this purpose, as are certain lubricants which are liquid

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at room temperature, as for example, tricresyl phosphate and the liquid polymers of dimethylsilicone and chlorotrifluoroethylene. The lubricant coating may be applied in any known manner, for example by rolling the pellets in a drum containing the lubricant. The efficiency of heat regenerator packing material is measured in terms of the fluid pressure drop through the regenerator and the mean temperature difference of the fluid flowing therethrough. Lubricating the pellet packing material causes only an immaterial increase in the pressure drop and has no effect upon the mean temperature difference. At the same time, it greatly reduces dusting and increases the life of the packing material.

The table demonstrates the reduction in dusting resulting from a lubricant coating as shown by an 85 hour milling test. It should be noted that a part of the dust in the tests on coated samples was graphite or molybdenum disulphide rather than pellet material.

TABLE

Effect of lubrication on dusting

Pellet Material	Lubricant	Percent Lubricant	Percent Dusting (uncoated)	Percent Dusting (coated)
¼ inch to ½ inch stone.	Graphite	0.05	0.185	0.0094
$\frac{3}{16}$ inch to $\frac{5}{8}$ inch aluminum.	do	[1] 1.26	0.182	0.022
Do	molybdenum disulphide.	[1] 0.45	0.182	0.016
$\frac{3}{16}$ inch to $\frac{5}{8}$ inch cast iron.	do	0.07	0.086	0.010

[1] The aluminum pellets used were in part hollow. This accounts for the excess of lubricant over that consumed in coating the stone and cast iron pellets.

While this invention has been explained with particular reference to heat regenerators for low-temperature gas separation plants, it is not intended to be so limited and is equally applicable to pellet packing material used in higher temperature heat regenerators and on pellet packing of sizes other than those previously noted as being most efficient.

We claim:

1. A heat regenerator containing packing material comprising $\frac{3}{16}$ inch to $\frac{5}{8}$ inch diameter pellets constituted of metal selected from the group consisting of aluminum shot and iron shot, such pellets having a tendency to abrade and dust when subject to repeated rapid changes of fluid flow through the regenerator, said pel-

lets being each coated with a lubricant selected from the group consisting of graphite and molybdenum disulphide.

2. A heat regenerator containing packing material comprising aluminum pellets of 3/16 inch to 5/8 inch diameter, said pellets being of a heat storing material having a tendency to abrade and dust when subject to repeated rapid changes of fluid flow through the regenerator, said pellets being each coated with graphite.

3. A heat regenerator containing packing material comprising 3/16 inch to 5/8 inch diameter pellets constituted of iron shot, such pellets having a tendency to abrade and dust when subject to repeated rapid changes of fluid flow through the regenerator, said pellets being each coated with graphite.

4. A heat regenerator containing packing material comprising 3/16 inch to 5/8 inch diameter pellets constituted of iron shot, such pellets having a tendency to abrade and dust when subject to repeated rapid changes of fluid flow through the regenerator, said pellets being each coated with molybdenum disulphide.

5. A heat regenerator containing packing material comprising aluminum pellets of 3/16 inch to 5/8 inch diameter, said pellets being of a heat storing material having a tendency to abrade and dust when subject to repeated rapid changes of fluid flow through the regenerator, said pellets being each coated with molybdenum disulphide.

6. A low-temperature heat regenerator for effecting heat exchange between a compressed gas mixture to be cooled and a cold separation product flowed alternately therethrough, said regenerator containing packing material comprising metal pellets of 3/16 inch to 5/8 inch diameter, said pellets being of a heat storing material having a tendency to abrade and dust when subject to repeated rapid changes of fluid flow through the regenerator, said pellets being each coated with a lubricant selected from the group consisting of graphite and molybdenum disulphide.

7. A low-temperature heat regenerator for effecting heat exchange between a compressed gas mixture to be cooled and a cold separation product flowed alternately therethrough, said regenerator containing packing material comprising metal pellets of 3/16 inch to 5/8 inch diameter, said pellets being of a heat storing material having a tendency to abrade and dust when subject to repeated rapid changes of fluid flow through the regenerator, said pellets being each coated with molybdenum disulphide.

8. A low-temperature heat regenerator for effecting heat exchange between a compressed gas mixture to be cooled and a cold separation product flowed alternately therethrough, said regenerator containing packing material comprising metal pellets of 3/16 inch to 5/8 inch diameter, said pellets being of a heat storing material having a tendency to abrade and dust when subject to repeated rapid changes of fluid flow through the regenerator, said pellets being each coated with molybdenum disulphide.

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