March 17, 1964 Y. GUELTON 3,124,940

DEFROSTING DEVICE FOR A LIQUEFIED GAS EVAPORATOR

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Fig. 1

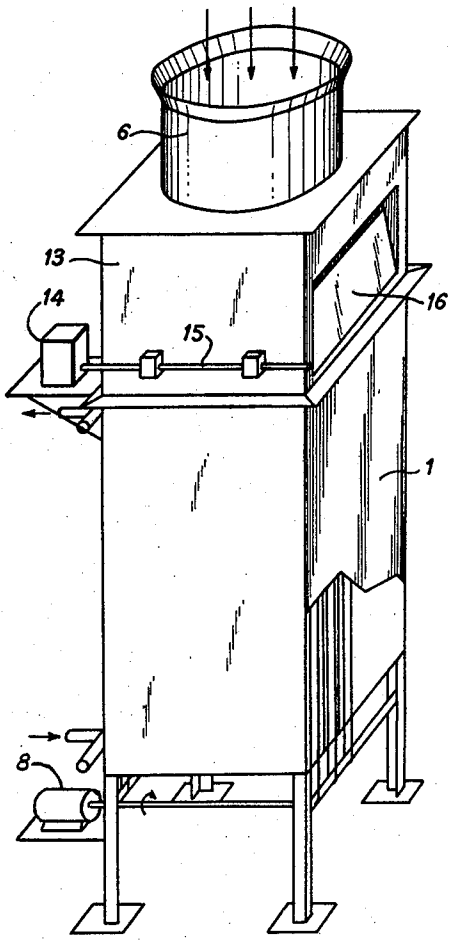

Fig. 2

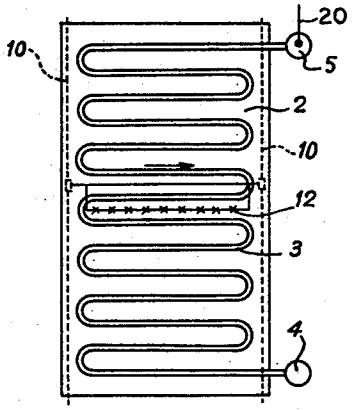

Fig. 3

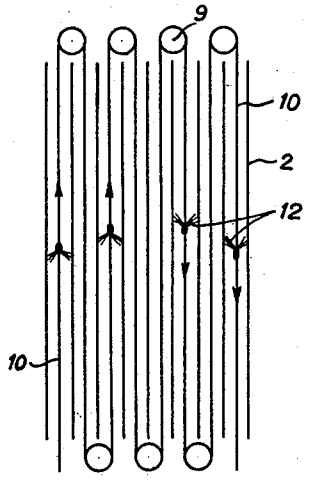

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Fig. 4

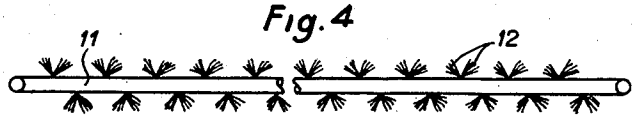


Fig. 5

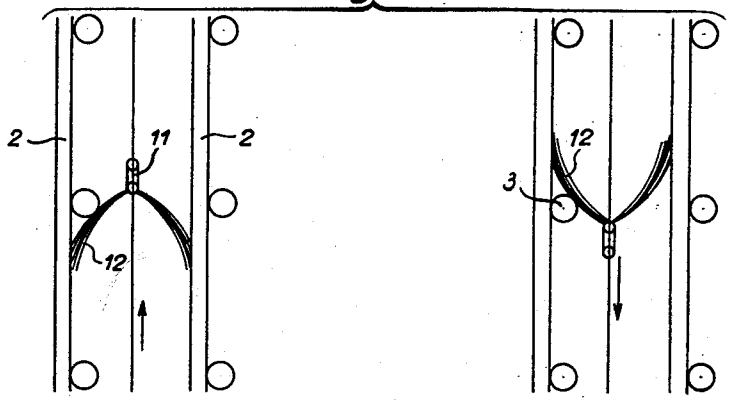
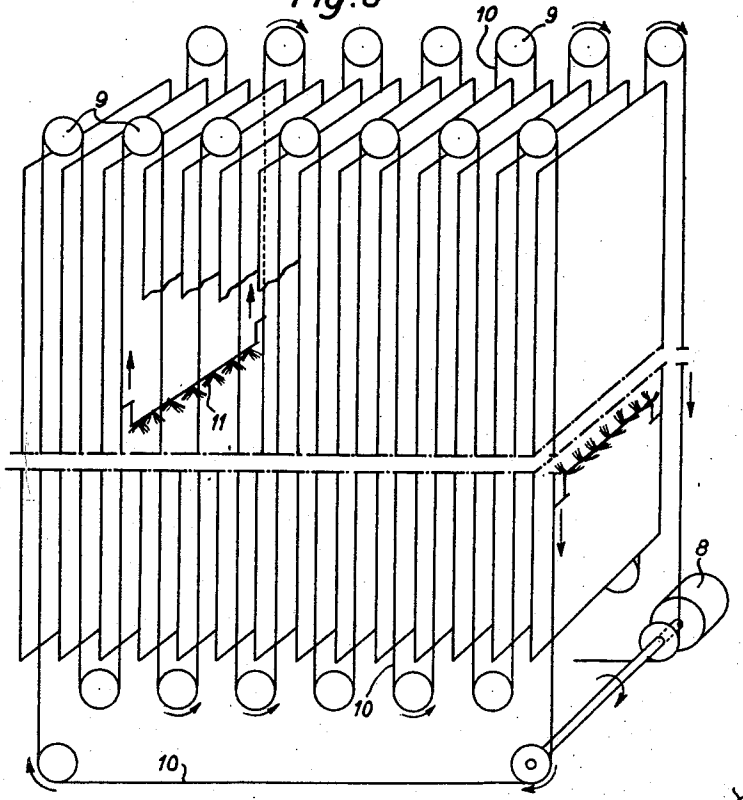


Fig. 6



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3,124,940
Patented Mar. 17, 1964

3,124,940

DEFROSTING DEVICE FOR A LIQUEFIED GAS EVAPORATOR

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Filed Sept. 28, 1961, Ser. No. 141,362
Claims priority, application France Oct. 12, 1960
1 Claim. (Cl. 62—284)

The present invention concerns an evaporator for liquefied gases and apparatus for carrying out the defrosting of the external surface of the evaporator.

Gases liquefied under pressure at low temperature, more especially liquid oxygen, are generally evaporated and heated in atmospheric evaporators capable of dealing with rates of flow of some hundreds of cubic metres per hour.

These evaporators generally consist of a number of parallel vertical plates to which are secured coils in which there flows the fluid to be evaporated.

Fans of several horse power send the ambient air on to the coil plates to effect the evaporation and heating of the liquid gas under good conditions.

These evaporators are disposed, more especially, in chains for the filling of pressure gas bottles, between the pumps which suck the liquid oxygen into its storage container and the banks of bottles into which these pumps force it under a pressure of, for example 150 kg./cm.^{2}. Investigations made under practical conditions of utilisation indicate that with the various liquefied gases these evaporators produce a gas whose delivery temperature differs by several tens of degrees from the ambient temperature, this difference varying as a function of time and also of the humidity of the ambient air. This disadvantage is troublesome under the usual operating conditions and is explained by the low output of the evaporator, which is due to the accumulation of frost on the plates, whereby the heat exchange is very rapidly reduced.

The invention is characterized in that the frost deposited on the external surface of the evaporator is eliminated as it is formed by a continuous sweeping. This is effected by means of a system of continuously moving brushes which are constantly maintained at least partly in frictional contact with the surface to be defrosted. The temperature difference between the ambient air and the gas, on the delivery side of the evaporator, is thus reduced to about 10° C.

Another advantage of the invention is that it permits of obtaining better stability of the delivery temperature of the gas in the course of the filling of one bank. This variation of the delivery temperature, which is about 22° C. in the case of oxygen when employing an evaporator operating without the sweeping, is reduced to only 7° C. in the case of the evaporator provided with sweeping means, which is a reduction in the variation of 15°.

In a preferred embodiment of the invention, the above-described brushing device additionally comprises an original device for the automatic or manual regulation of the air delivery of the fan.

This regulation is hereinafter described, and it permits of further reducing the variation of the delivery temperature of the gas which, in the case of oxygen, then

does not exceed 2° C. In addition, it is possible with this regulation to adjust the said temperature to a predetermined value, regardless of the ambient temperature and humidity conditions.

A further advantage of the invention resides in that it is possible by means of the automatic regulation to effect this stabilisation of the delivery temperature of the oxygen in only a few minutes, independently of the delivery pressure, while with the evaporators of the prior art the temperature of the oxygen leaving the evaporator at, for example, 150 kg./cm.^{2}, is regularly reduced, whereas it can be stabilised only after a very long time when the accumulation of frost on the plates is sufficient to stop the formation of further layers.

An embodiment of the invention will now be described.

FIGURE 1 is a view in perspective of the atmospheric evaporator.

FIGURE 2 illustrates a heat exchange plate with its coil.

FIGURE 3 is a side view of the heat exchange plates of the evaporator.

FIGURE 4 illustrates the details of a construction according to the invention of a brush holder 11 with its various brushes 12.

FIGURE 5 illustrates the mode of action exerted by the brushes on the plates and on the coils of the atmospheric evaporator.

FIGURE 6 diagrammatically illustrates the principle of the sweeping of the frost formed on the coil plates.

In accordance with the construction of FIGURES 1, 2 and 5, the atmospheric evaporator is provided with a jacket 1 containing a series of parallel plates 2, to which are secured the coils 3 in which there flows the liquefied gas to be evaporated. The inlets and outlets of the various coils 3 are connected to the inlet and output collectors 4 and 5 respectively of the heater.

The atmospheric air is sent by the fan 6 between the plates 2.

A driving and reduction unit 8 shown in FIGURE 6 drives a double system of toothed pinions 9 with which there mesh the two endless chains 10. The spindles of the horizontal brush holders 11 are fixed at their ends to each of the endless chains 10. In principle, there are four brush holders, but this number may vary in accordance with the desired rate of flow of gas. The brush holders 11 thus circulate in each of the successive intervals between the plates, thus detaching and clearing the frost formed on the plates 2 of the heater and on the coils 3.

A compartment 13 illustrated in FIGURE 1, disposed between the air fan 6 and the coil plates 2, comprises the device for the automatic regulation of the delivery temperature of the gas. The said device comprises a regulator 14 which controls through a system of rods 15, in accordance with the fixed adjustment, the opening or closing of the flaps 16, whereby the useful air delivery rate of the fan 6 is appropriately adjusted. Regulator 14 is governed by a thermostat 20, the temperature-sensitive portion of which is in termal relation with the flow of evaporated gas leaving the evaporator. For example, the temperature-sensitive portion of thermostat 20 may be located inside the outlet collector 5 in the manner illustrated by FIGURE 2.

In practice, the various advantages of the invention

can be summarised by stating that an installation of evaporators equipped with the said mechanical sweeping system requires only half the number of evaporators of a system of like hourly capacity constructed in accordance with the prior art, which does not afford stability even when employed in parallel.

What I claim is:

An evaporator for gas liquefied at low temperature by heat exchange with a flow of ambient air, said evaporator comprising heat-exchange surfaces between which said ambient air flow passes and means for defrosting said heat-exchange surfaces which are swept by the ambient air flow, wherein the heat-exchange surfaces are formed by a plurality of tubes containing said liquefied gas and parallel metal plates affixed to said tubes, and wherein said defrosting means comprises brushes, means for moving said brushes continuously in a single direction along a closed path at a substantially constant speed, and means for maintaining said brushes in frictional contact with said heat-exchange surfaces at least during the major part of their travel, the brush-moving means comprising at least one endless chain, to which said brushes are affixed, disposed along said closed path, and means for driving said chain in said single direction to constrain said brushes to pass successively through the intervals between said plates.

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