

Aug. 17, 1965

W. LEHMER ET AL

3,200,877

PACKING UNITS FOR HEAT EXCHANGERS OPERATING AT

EXTREMELY LOW TEMPERATURES

Original Filed Dec. 10, 1958

2 Sheets-Sheet 1

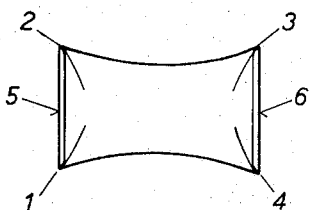


Fig. 1

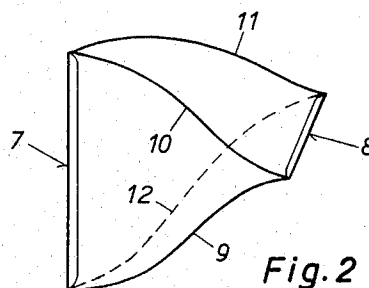


Fig. 2

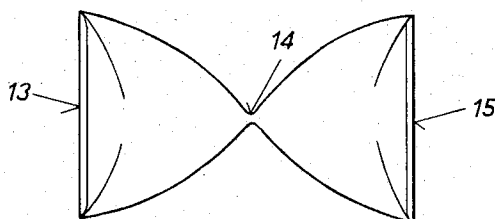


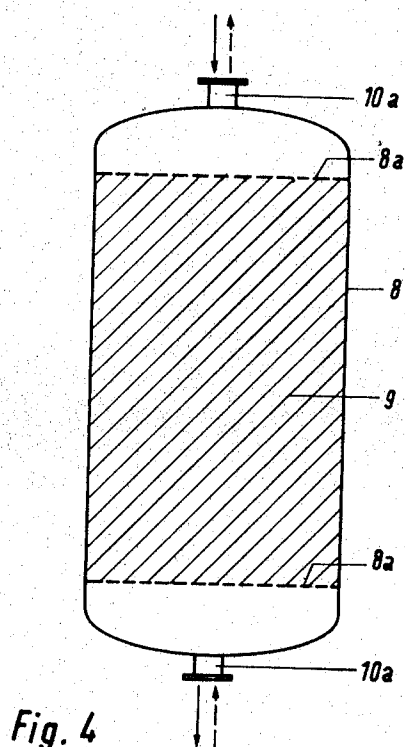
Fig. 3

Aug. 17, 1965

W. LEHMER ET AL 3,200,877
PACKING UNITS FOR HEAT EXCHANGERS OPERATING AT
EXTREMELY LOW TEMPERATURES

Original Filed Dec. 10, 1958

2 Sheets-Sheet 2



Inventors

Wilhelm Lehmer
Albert Reim
Josef Weiskaupt
By *Pierce, Scheffler & Parker*
Their Attorneys

1

3,200,877

PACKING UNITS FOR HEAT EXCHANGERS OPERATING AT EXTREMELY LOW TEMPERATURES

Wilhelm Lehmer, Munich, Albert Rein, Augsburg-Westheim, and Josef Weishaupt, Pullach, Germany, assignors to Gesellschaft für Linde's Eismaschinen Aktiengesellschaft, Holtrriegelskreuth, near Munich, Germany, a company of Germany

Continuation of application Ser. No. 779,484, Dec. 10, 1958, now Patent No. 3,159,910, dated Dec. 8, 1964. This application Aug. 2, 1963, Ser. No. 299,613

Claims priority, application Germany, Dec. 12, 1957,

G 23,553

1 Claim. (Cl. 165—4)

This application is a continuation of our application Serial No. 779,484, filed December 10, 1958, and which issued December 8, 1964 as Patent No. 3,159,910.

This invention relates to packing units or filling bodies, and is concerned with packing units of a special form for heat-exchangers, which packing units have substantially convex limiting surfaces.

The characteristic feature of the packing units of the present invention is that they occur in a tetrahedral or octahedral or pillow-like form. Each of these three forms, which deviate from the well-known spherical form, provides a larger surface area than can be secured, with uniform packing, with spherical packing units. These three forms have proved particularly successful for the fillings of regenerators in refrigerating plants, e.g., in gas separating plants, not only because of the better packing feature just noted but also because they are conducive to an optimum heat transfer.

It heretofore had been proposed to produce such packing units as hollow bodies, the same being formed from sheets or plates of aluminum.

The present development of the inventive idea concerns mainly the problem of designing packing units for heat exchangers and regenerators, respectively, to be operated at relatively low temperatures, and particularly apparatus which is to be operated at temperatures between the liquefaction-temperatures of nitrogen and hydrogen. In particular, it is intended to use the packing units for cooling (liquefying) and simultaneously for purifying hydrogen in regenerators.

According to the invention the heat-exchanger packing units of a tetrahedral, octahedral or pillow-like form, having substantially only convex surfaces but deviating from the spherical form, are designed as solid packing units of lead, or ceramic material.

Packing units, produced in the above forms, from lead have not only the above-stated advantages but also the further advantage that they are particularly easy to manufacture. In making the units a cylindrical piece—e.g., bar—of the starting material is subjected to compression cuts which squeeze (or, "pinch") off successive portions of the cylinder. When successive compression zones lie in the same plane, pillow-like pieces are squeezed off. In

2

the alternative, the compression zones may be turned toward each other alternatively by 90°, in which event the squeezed-off pieces are in tetrahedral form. If in doing so every other compression zone fails completely to sever the shaped piece, the resulting shaped pieces are octahedral or "twin-tetrahedra" in shape. The cylindrical bar of starting material, i.e., lead, is preferably between 5 mm. and 25 mm. in diameter.

The packing units are produced by squeezing the various pieces from the lead bar or from a bar of ceramic material.

The invention will now be described with reference to the accompanying drawing, in which

FIGS. 1, 2 and 3 are views of leaden packing units embodying the principles of the invention; and

FIG. 4 is a diagrammatic representation of a part of a hydrogen-liquefying plant, including heat exchangers containing fillings of the packing units of the present invention.

The packings are formed from sections of rods or columns and consist preferably of lead. The lead rods are squeezed off into short sections. During the squeezing off operation the lead will be deformed to produce the parallel edges 5 and 6 for each section squeezed off. As shown in FIG. 1 a pillow-shaped form will be produced having curved outer surfaces, four corners 1, 2, 3 and 4, and two sharp edges 5 and 6. Other packing units in accordance with the present invention may be squeezed off by suitable compression cuts turned alternately by 90°.

FIGURE 4 diagrammatically illustrates a heat-exchanger vessel (regenerator) of conventional form. A regenerator filling 9, consisting of packing units proposed by the invention, is placed between sieve plates 8a located adjacent the ends of the vessel. The upper and lower end caps of the vessel are provided with an intake nozzle 10a and an outlet nozzle 10b respectively, or vice versa, depending on the direction of flow of the heat-exchanging media.

The general procedure for making these shapes is disclosed in our U.S. Patent No. 3,159,910.

We claim:

A heat exchanger operating at low temperatures of the order of liquefaction temperature of nitrogen, said heat exchanger consisting essentially of a vessel having an inlet and an outlet and containing a filling of packing units having substantially convex surfaces, there being an even number of limiting surfaces and edges, selected from the group consisting of two and four limiting surfaces and four edges respectively, said packing units being solid bodies composed of a heat exchange material selected from the group consisting of lead and ceramic material.

References Cited by the Examiner

UNITED STATES PATENTS

2,212,932 8/40 Fairlie ----- 261—94

CHARLES SUKALO, *Primary Examiner*.