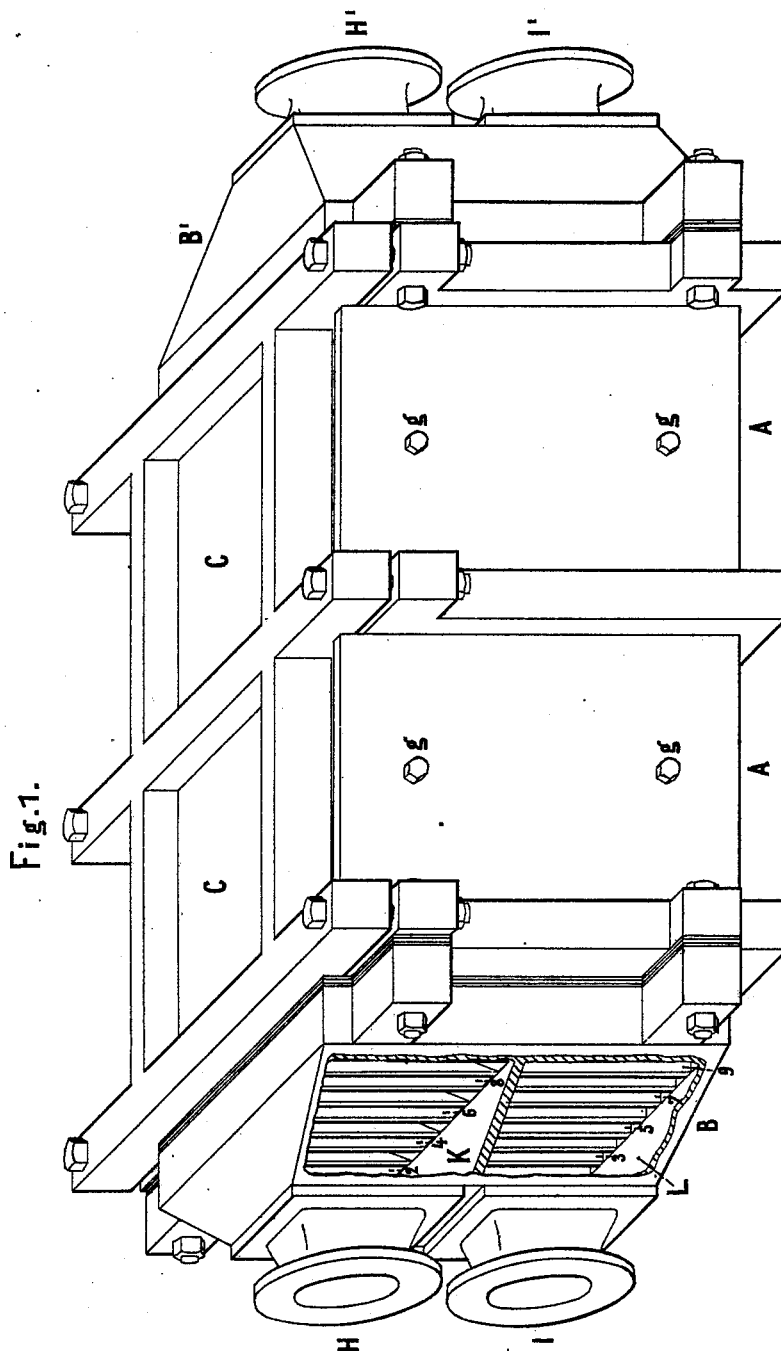


A. DRACHE.

Refrigerating Apparatus for Liquids, &c.
No. 213,635. Patented Mar. 25, 1879.



Witnesses

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Erasmus Paul.

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Fig. 3.

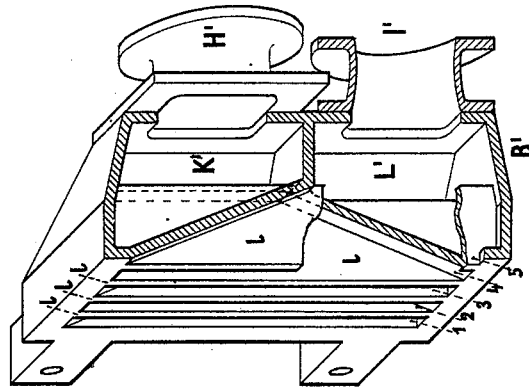
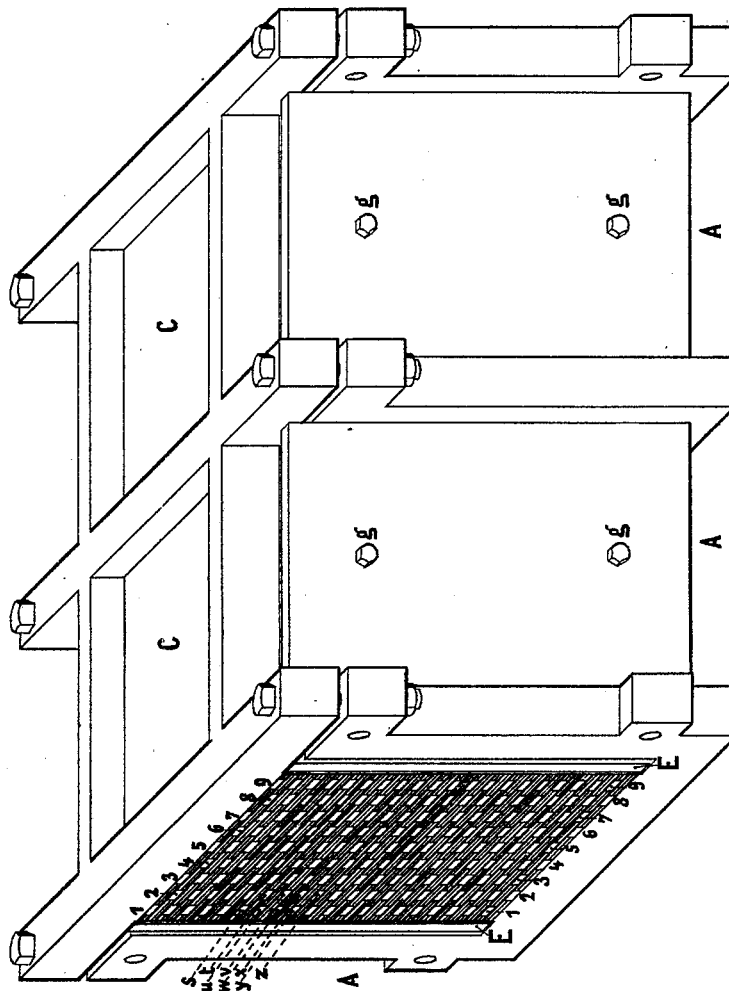


Fig. 2.



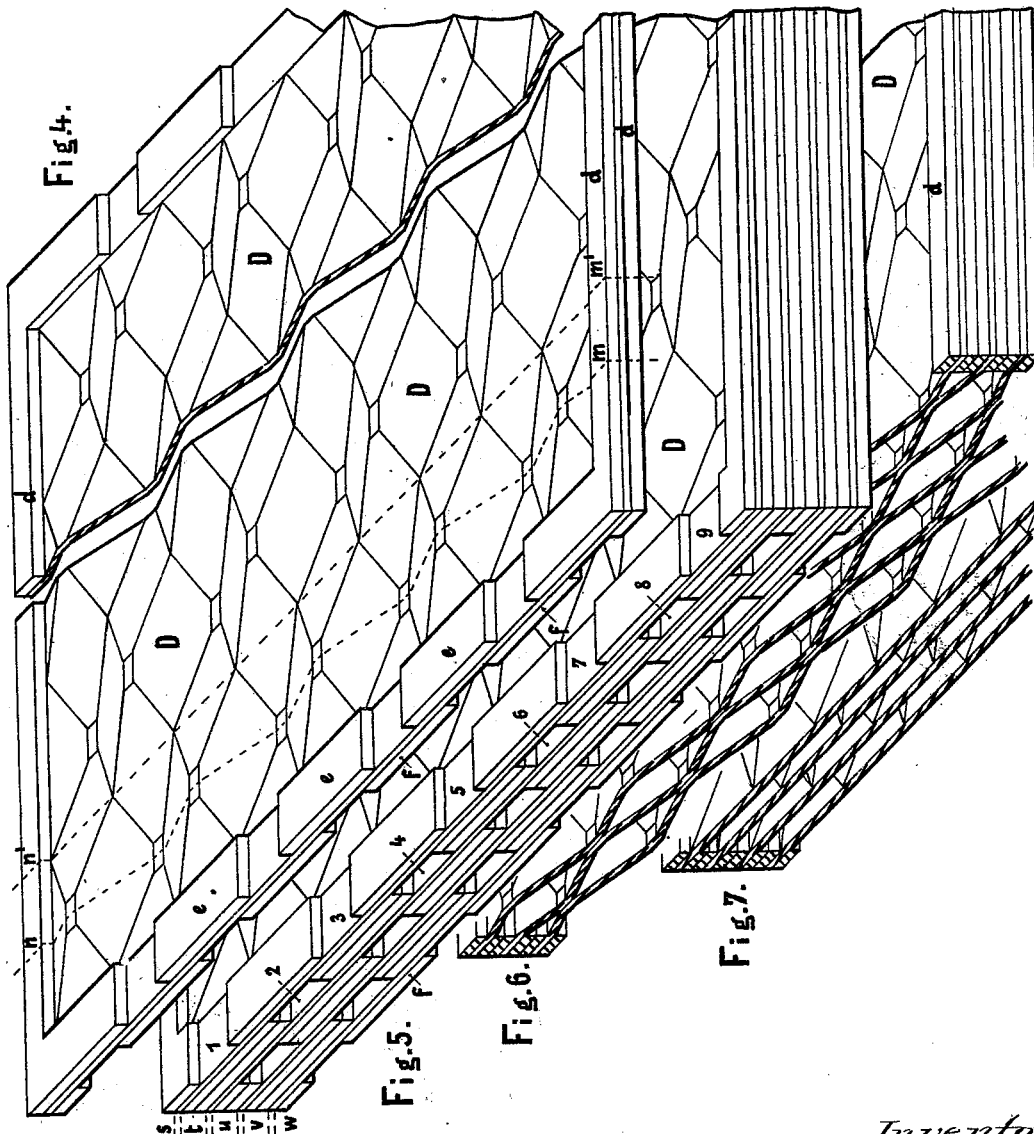
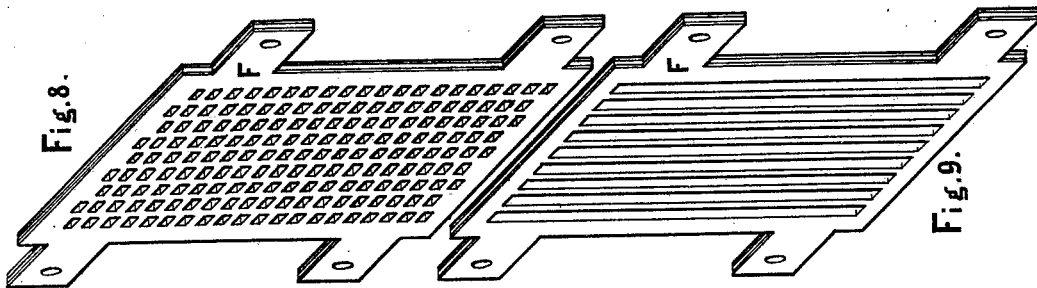
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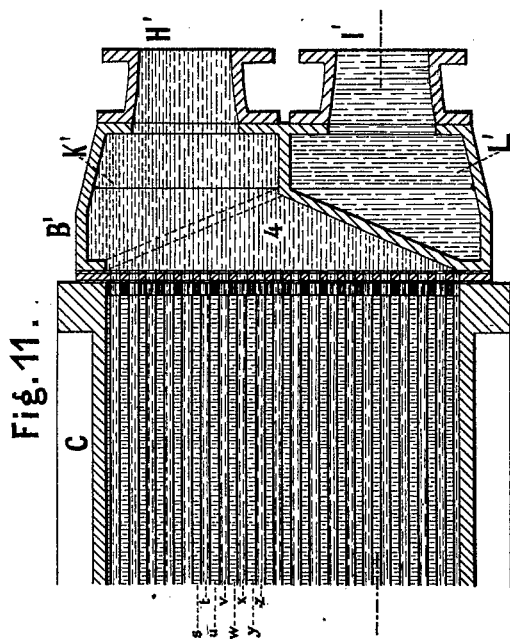


Fig. 11.

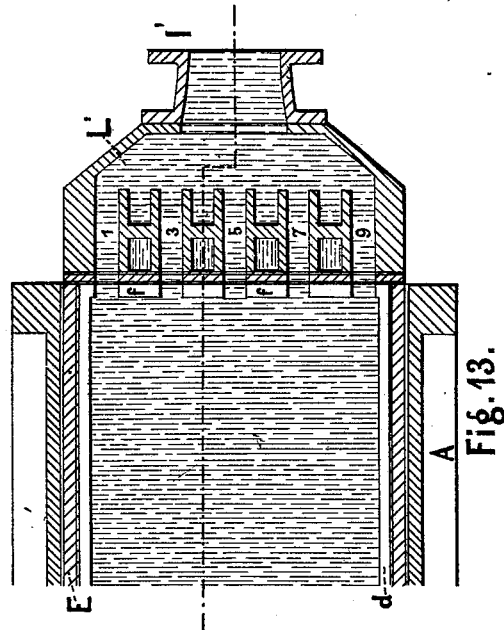


Fig. 13.

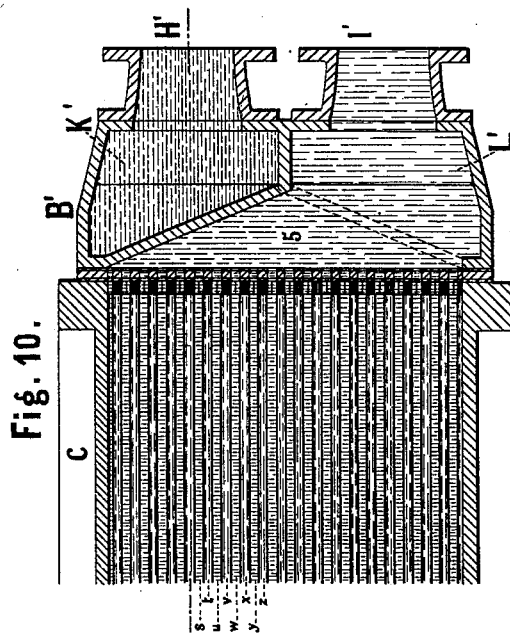


Fig. 10.

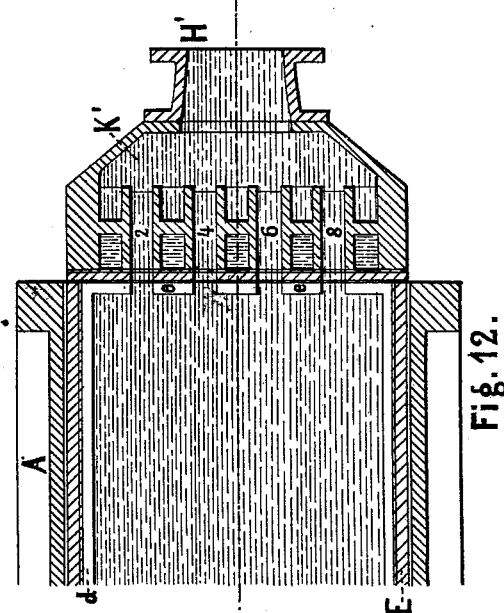


Fig. 12.

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UNITED STATES PATENT OFFICE.

ALBRECHT DRACHE, OF ERFURT, GERMANY.

IMPROVEMENT IN REFRIGERATING APPARATUS FOR LIQUIDS, &c.

Specification forming part of Letters Patent No. **213,635**, dated March 25, 1879; application filed March 1, 1878.

To all whom it may concern:

Be it known that I, Dr. ALBRECHT DRACHE, of Erfurt, in the Empire of Germany, have invented an Improved Refrigerating and Heating Apparatus, of which the following is a specification:

This invention relates to a refrigerating and heating apparatus for liquids, vapors, gases, and air in which the substance to be cooled or heated is spread out in layers and maintained separate from layers of the cooling or heating medium by plates, which may be flat or provided with series of protuberances pressed into them.

The invention consists in an improved apparatus in which a number of plates are arranged in a casing so as to provide chambers between them, said plates being provided at their ends with ledge-pieces so arranged as to form a series of conduits or passages communicating with the chambers formed by contiguous plates, the said passages being so aligned that alternate vertical series will communicate, respectively, with the induction and eduction passages of the channel parts at either end of the casing. By this construction the heating or cooling material introduced through the induction-passages at one end of the apparatus will be carried into and through the chambers between alternate plates, and be discharged through the eduction-orifice at the opposite end of the apparatus, while the material to be heated or cooled is introduced through the induction-orifice at the discharge end of the apparatus for the heating or cooling material, and is passed between plates alternating with those confining the heating or cooling material, and discharged at the opposite end of the apparatus. Thus a constant circulation of the heating or cooling material may be carried in one direction and the material acted upon be carried in the opposite direction through contiguous chambers.

The invention comprehends an improved packing-plate interposed between the channel parts and the ends of the chamber-forming plates, and also includes a construction of said plates whereby they are given protuberances, which imparts to them such stiffness and strength as to resist any unequal pressure

between the material for heating or cooling and that being operated upon.

On the annexed four sheets of drawings this apparatus is represented in different views. Figure 1 is a perspective outside view with front wall of part B broken away; Fig. 2, a view of the end or channel part B'. Figs. 4 to 9 represent details. Figs. 10 to 13 show one-half of the apparatus in two different vertical and two horizontal sections, clearly showing the internal structure.

Within a casing, A, the plates D (shown in detail in Figs. 4 to 7) are arranged above each other. These plates are provided at the two lateral edges, on the upper and also on the under side, with ledges *d d*, and at the ends with a number of short ledge-pieces, *e* and *f*. The latter are arranged in the manner shown in Figs. 4 and 5, so that a ledge-piece, *e*, on the top of any plate D is opposite to a space between two ledge-pieces, *f*, on the under side, and that the ends of the upper ledge-pieces overlap those of the lower ones. A number of such plates being placed one upon the other, the spaces *s t u v*, &c., Figs. 2, 5, 10, and 11, are formed between them, each space being closed at the sides, while it has a number of openings at either end, which alternate in any two contiguous spaces, so that the openings of the vertical rows 1 3 5 7, &c., Figs. 2 and 5, communicate with the spaces *s u w*, &c., while those of the rows 2 4 6 8, &c., communicate with the intermediate spaces, *t v x*, &c.

The liquid or gas, &c., to be heated or cooled (represented in the figures on Sheet 4 by a vertical shading) is introduced by the tube I, Fig. 1, and is discharged by tube I'. The heating or cooling medium (shown on Sheet 4 by horizontal shading) enters by the tube H' at the opposite end, and flows off at H. The currents of the liquids, or either of them, may, however, be reversed, or the liquid, &c., to be heated or cooled may pass into and out of the apparatus by the tubes H and H', and the said medium by the tubes I' and I.

The tube I leads into a chamber, L, Fig. 1, in the channel part B, which corresponds to chamber L' in B', Figs. 3, 10, 11, and 13. Either of these chambers communicates with a number of vertical channels, 1 3 5 7, &c.,

one of which is shown in vertical section in Fig. 10. In a similar manner either of the chambers K and K', Figs. 1, 3, 10, 11, 12, communicates with the channels 2 4 6 8, &c., lying between the former, and having the shape as specially shown by Fig. 11. The edge surfaces of the partition-walls *l* between the said channels correspond with the reciprocally overlapping parts of all the ledge-pieces *e* and *f*, so that when the part B is screwed to the part A the channels 1 3 5 7, &c., communicate by the openings of the rows 1 3 5 7, &c., with the spaces *s u w*, &c., and the channels 2 4 6 8, &c., by the openings of the rows 2 4 6 8, &c., with the spaces *t v x*, &c., which are intermediate to the former. The two liquids, gases, &c., entering into the apparatus will thus be distributed in alternate layers, being kept separated by the intervening plates. The whole tier of plates D is pressed together by a strong covering-plate, U, bolted to the casing A.

For the purpose of making tight joints between the ledge-pieces *e* and *f*, and also between these and the corresponding surfaces of the parts B and B', sheets of india-rubber suitably perforated may be applied. It is, however, more convenient to use a packing-plate, F, Figs. 8 and 9, composed of a sheet of metal lined on both sides with india-rubber. The metal and the lining fixed to one side must be perforated, so as to correspond to the openings between the plates D, (see Fig. 8,) while the lining on the other side may be provided with slits corresponding to the channels in the parts B and B'. (See Fig. 9.)

For closing the joints between the lateral ledges *d* of the plates D, a solid sheet of india-rubber is introduced on either side between the tier of plates D and a plate, E; or the india-rubber may be permanently fixed to this plate, which can be pressed against the plates D by the screws *g*.

If the pressures of the two liquids, gases, &c., within the apparatus are equal or nearly so, the plates D may be flat; but if there is a material difference between these pressures, the plates must be stiffened by corrugations or otherwise, or they must reciprocally support each other. For this purpose it is preferable to press or emboss into them series of pyramidal or otherwise shaped protuberances, which, bearing with their apexes on the protuberances of the contiguous plates, prevent the plates from bending or collapsing. Plates of this design are shown by Figs. 4 and 5 in perspective view, and in Figs. 6 and 7 in sections, according to the lines *m n* and *m' n'*, respectively. This arrangement of the plates tends also to improve the circulation of the two liquids, &c., and to promote the transmission of heat from the one to the other.

For the purpose of properly adjusting the plates D in the casing A, and of making their ends flush with each other, straight plates or bars serving as templets or guides are screwed to the casing, and the plates E having been drawn back, the plates D are regularly piled upon each other, and thereupon pressed together by bolting down the covering-plate C. The end parts, B and B', are subsequently attached, and the plates E tightened against the plates D.

The described apparatus presents a large heating-surface in comparison to the space which it occupies. It may easily be taken to pieces for cleaning it, and it can be manufactured at a comparatively low cost. The apparatus may be applied for the heating and ventilation of rooms, as surface-condenser for steam-engines, for dephlegmating and condensing in distilleries, and for other similar purposes requiring a heating or cooling of liquids, vapors, gases, and air.

If it is desired to use the described apparatus for heating or cooling liquids which corrode metals, or upon which metals would have a prejudicial influence, such as acids, solutions of other metals, &c., the same may be made of glass. For the purpose of facilitating the construction in this case, the ledges *d*, *e*, and *f* of the plates D may be left away; for if the latter are made sufficiently thick, so as not to cut into the india-rubber packing of the plates E and F, tight joints may be obtained without the ledges. The proper distribution of the liquids is, in this case, caused by the channel parts B B' and the perforated plates F only, which may both also be made of glass, the latter being lined by india-rubber, as described above.

I claim as my invention—

1. The plates D, having the ledges *d* and the ledge-pieces *e f*, in combination with a casing, A, and with the channel parts B and B', having the channels 1 3 5 7, &c., leading from the tube I or I' into the spaces *s u w*, &c., between the plates D, and the channels 2 4 6 8, &c., leading from the tube H or H' into the spaces *t v x*, &c., between the plates D, substantially as and for the purpose specified.

2. In combination with the plates D, having the ledge-pieces *e f*, and with the channel part B or B', a perforated packing-plate, made of metal and india-rubber, substantially as and for the purpose set forth.

3. In combination with the described refrigerating and heating apparatus, the plates D, provided with protuberances, substantially as specified, and for the purpose set forth.

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Witnesses:

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