[Second Edition.]

PATENT SPECIFICATION

464,242

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Oct. 7, 1935:

Corresponding Applications in United Kingdom

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No. 17867/36.
Dated: June 26, 1936.

(One Complete Specification Left under Section 91 (2) of the Patents and Designs Acts, 1907 to 1932.)

Specification Accepted: April 14, 1937.

2111

COMPLETE SPECIFICATION

Improvements in or relating to Apparatus for the Production of Synthetic Hydrocarbons,

We, MANNESMANNRÖHREN-WERKE, a German body corporate, of 1b, Berger Ufer, Düsseldorf, Germany, and RUHRCHEMIE AKTIENGESELLSCHAFT, a German Company, of Oberhausen-Holten, Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention has for its object improvements in or relating to apparatus for the production of synthetic hydrocarbons from oxides of carbon and hydrogen, using solid contact masses as described, for example, in United Kingdom Patent Specification No. 255,818.

It is important in the use of cooling apparatus for the above-mentioned process that the said apparatus should have a high specific heat output, e.g., large cooling surfaces, and, furthermore, that they should be capable of maintaining determined temperatures uniformly over all parts of the apparatus whilst ensuring the correct relative positions of the individual parts of the apparatus during operation.

It has hitherto been proposed to provide a cooling device which comprises a plurality of rows of cooling tubes superposed one row on the other and having a plurality of tubes in each row together with a plurality of ribs arranged at right angles to the axis on said tubes and consisting of flat plates through which each of the said tubes extends.

According to the invention, the above requirements are fulfilled by the provision in an apparatus for the production of synthetic hydrocarbons from oxides of carbon and hydrogen at normal, slightly increased or decreased pressure and increased temperatures with the use of solid contact masses of a cooling device, comprising a plurality (at least five) of rows of cooling tubes superposed one row on the other at a small distance apart, and having a plurality (at least five) of tubes in each row, together with a plurality of ribs arranged perpendicularly relatively to the said tubes and consisting of flat plates positioned at a distance of a few millimetres, e.g. 7 mm. from one another, the said tubes extending through each of the said ribs and the said ribs and portions of the tubes extending therebetween being contained in a jacket enclosing the device.

According to a feature of the invention, a catalyst mass for carrying out the process is arranged between the said ribs.

Preferably, there are provided at least double as many superposed tubes as adjacently disposed tubes and the tubes of one row are staggered with respect to the tubes of an intermediately adjacent row, in order to produce slight separations therebetween. The connection of the tubes with the ribs is effected so as to be heat conducting, for example, by means of a pressed joint such as can be produced by expanding the tubes located in the openings in the ribs.

To ensure and maintain the separation of the individual plates, these can be provided with projections or suitably shaped spacing members can be inserted therebetween, which members can be removed again after the expansion of the tubes.

The ends of all the tubes can be introduced into common collector pipes or chambers for the delivery and discharge of the cooling medium (liquid). With the cooling device according to the invention a number of tubes may be combined into tube coils, using double tube bends or reversing ends, the ends of which coils are carried to the collecting points. The individual coils may be of the same or different sizes in one and the same cooling device. In this way it is possible to provide within the same cooling device zones of different heat output, or to adapt the heat output to the cooling requirement of

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the individual zones.

Furthermore, since cooling devices undergo, during working, a modification of their dimensions caused by the working temperatures differing from the room temperature, the longitudinal variations make it very difficult to produce a gas-tight jacketting or to maintain during working an effective sealing. It is found that the joints tend to leak, chiefly at the head ends, i.e., at the jacket plates arranged perpendicularly to the axes of the tubes, through which plates extend the individual tubes. According to a further feature of the invention, however, the plates of the enclosing jacket thereof, which are rigid and resistant in themselves, are reduced in thickness at their edges to such an extent that the plates can yield in the manner of a diaphragm upon the occurrence of variations in the length of the tubes. Owing to the resilience of the jacket plates, the expansion joints of the tubes, which may also be welded, and the edge connections of the metal jacket plates are, to a large extent, relieved from injurious stresses due to heat.

The invention will be clearly understood from the following description of a preferred embodiment thereof which is given, by way of example, with reference to the accompanying drawings, in which:—

Figures 1, 2 and 3 illustrate an improved construction of cooling device according to the invention, in elevation, in side view and in plan view respectively, and

Figures 4 and 5 represent further details of the apparatus shown in Figures 1 to 3.

With reference to the drawings, metal (iron) plates or ribs 1 are firmly connected with the tubes of the apparatus by expansion. The said tubes, in order to simplify the drawing, are only indicated by their axes 2 and are connected by suitable bends into coils of different size. Figure 1 shows such coils with different numbers of tubes. The cooling liquid flows through collecting pipes 3 and distributing pipes 4 to the cooling coils, whence it flows out again through pipes 5 into collecting pipes 6.

Figure 4 shows one of the numerous metal plates or ribs of the apparatus through which extend the tubes 2. The position of the individual tubes is shown in Figure 4 partly by circles and partly—in order to simplify the drawing—by the points of intersection of the centre lines.

Figure 5 shows in section one of the ends of the apparatus. The drawing is made on a much larger scale than Figures 1 to 4, so that the reduction 7 in the thickness of the jacket plate made as a diaphragm can be clearly seen. The drawing clearly shows the large number of rows of tubes and the large number of tubes in each row which amounts, in all cases, to at least five. In practice, this number is considerably greater, e.g. as shown in Figure 4, twenty-seven superposed rows of tubes and ten or eleven tubes in each row. The cooling device is consequently higher than it is wide.

Figure 5 shows the staggered arrangement of the tubes. The ribs 1 which are arranged perpendicularly to the axes of the tubes form enclosed shafts and are spaced at only a small distance from each other, e.g. about 7 millimetres, so that there takes place a considerable and uniform dissipation of heat. The ribs 1 are preferably made of flat metal plate sheets in order to avoid the danger of any obstruction in the individual shafts.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. In an apparatus for the production of synthetic hydrocarbons from oxides of carbon and hydrogen at normal, slightly increased or decreased pressure and increased temperatures with the use of solid contact masses, a cooling device comprising a plurality (at least five) of rows of cooling tubes superposed one row on the other at a small distance apart, and having a plurality (at least five) of tubes in each row, together with a plurality of ribs arranged perpendicularly relatively to the said tubes and consisting of flat plates positioned at a distance of a few millimetres, e.g. 7 mm., from one another, the said tubes extending through each of the said ribs and the said portions of the tubes extending therebetween being contained in a jacket enclosing the device.

2. Apparatus according to Claim 1, wherein a catalyst mass is arranged between the said ribs.

3. Apparatus according to Claim 1 or Claim 2, comprising at least double as many tubes superposed one on the other as there are arranged adjacent to one another.

4. Apparatus according to Claim 1 or Claim 2 or Claim 3, wherein the tubes of one row are arranged in staggered relationship with respect to the tubes of an immediately adjacent row.

5. Apparatus according to any one of the preceding Claims 1 to 4, wherein the tubes extend through the ribs by a heat conductive joint, such as by being pressed

firmly thereagainst.

6. Apparatus according to Claim 5, wherein the tubes are connected with the ribs by expansion.

7. Apparatus according to any one of the preceding Claims 1 to 6, wherein projections are provided on the plates forming the ribs or suitably shaped spacing members are inserted therebetween in order to space the said ribs from one another.

8. Apparatus according to any one of the preceding Claims 1 to 7, wherein a plurality of tubes are connected by bends or reversing ends into tube coils.

9. Apparatus according to any one of the preceding Claims 1 to 8, wherein the number of the individual tubes which are combined into a coil are different in individual zones of the device so as to obtain a different heat output in the said individual zones.

10. Apparatus according to any one of the preceding Claims 1 to 9, which is enclosed in a metal plate jacket, the walls of which perpendicular to the axes of the tubes are made as diaphragms into which the ends of the tubes are expanded or welded.

11. Apparatus according to Claim 10, wherein the jacket plates are rigid and resistant in themselves and are made into flexible diaphragms by the edges of the said plates which are welded together being reduced in thickness.

12. In an apparatus for the production of synthetic hydrocarbons from oxides of carbon and hydrogen at normal, slightly increased or decreased pressure and increased temperature with the use of solid contact masses, and improved cooling device, constructed and arranged substantially as hereinbefore described and illustrated in the accompanying drawings.

Dated this 26th day of June, 1936.

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Agents for the Applicants.

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Fig. 1

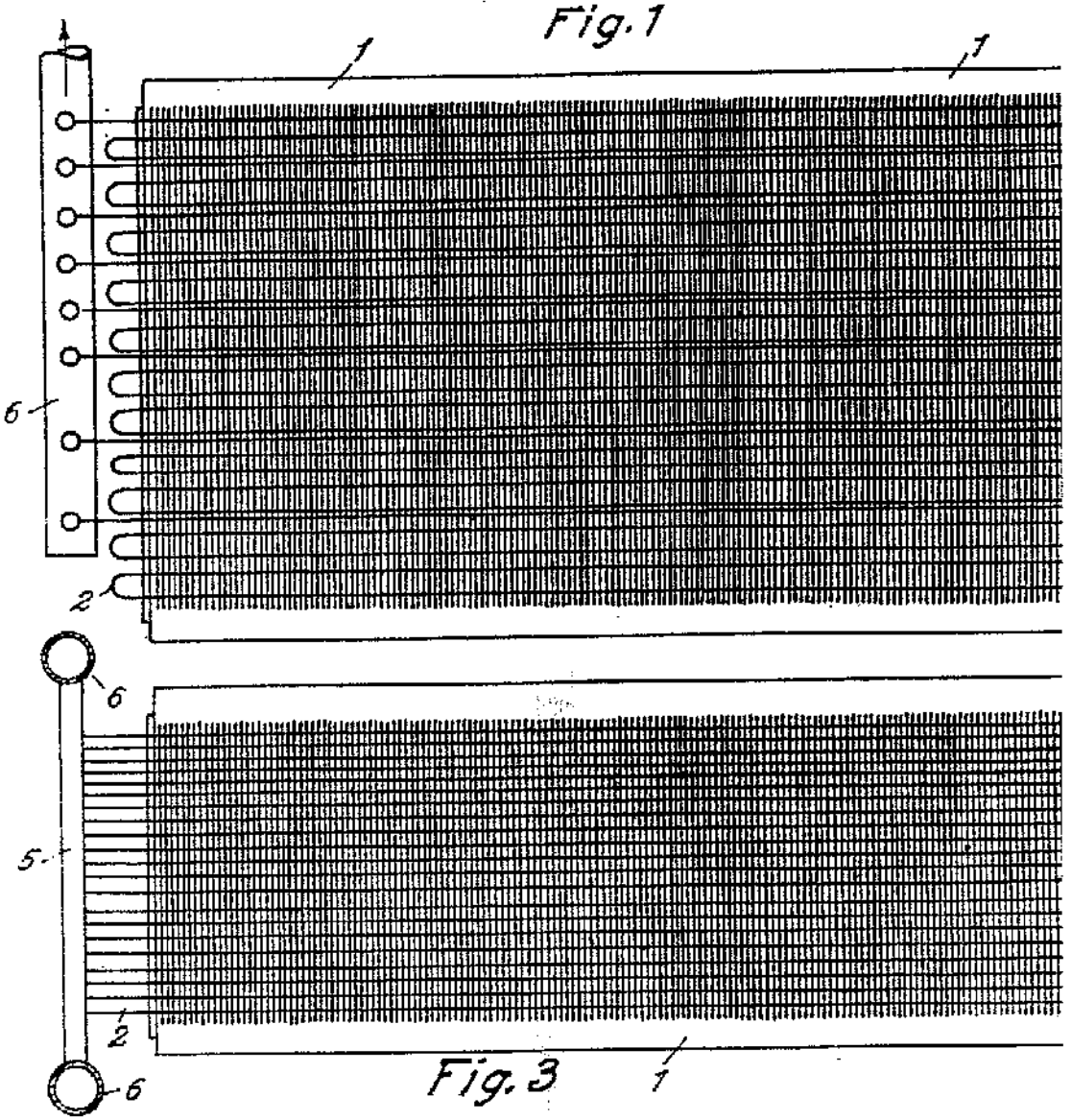


Fig. 3

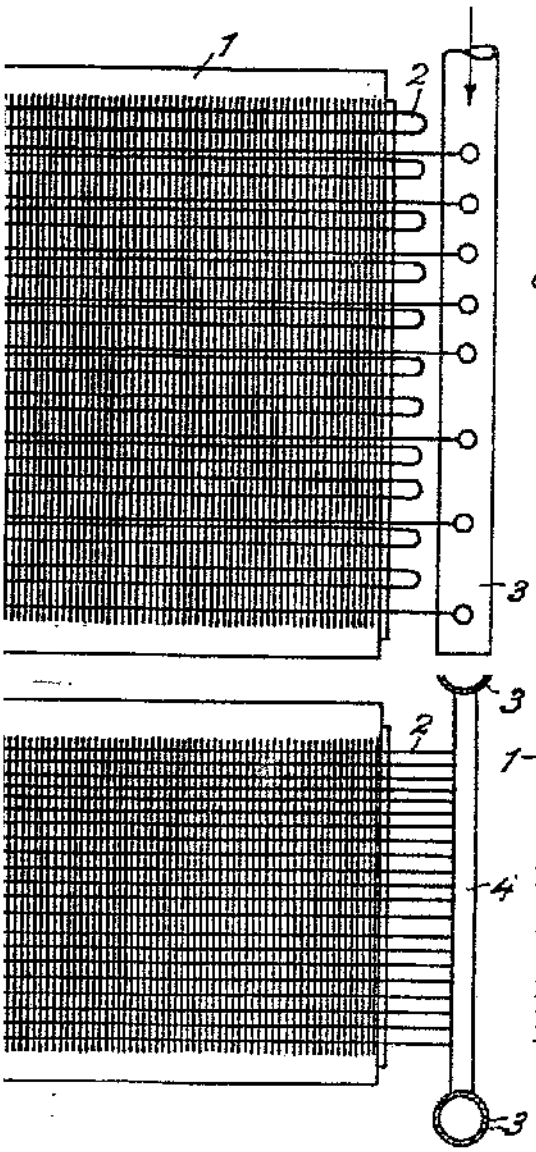
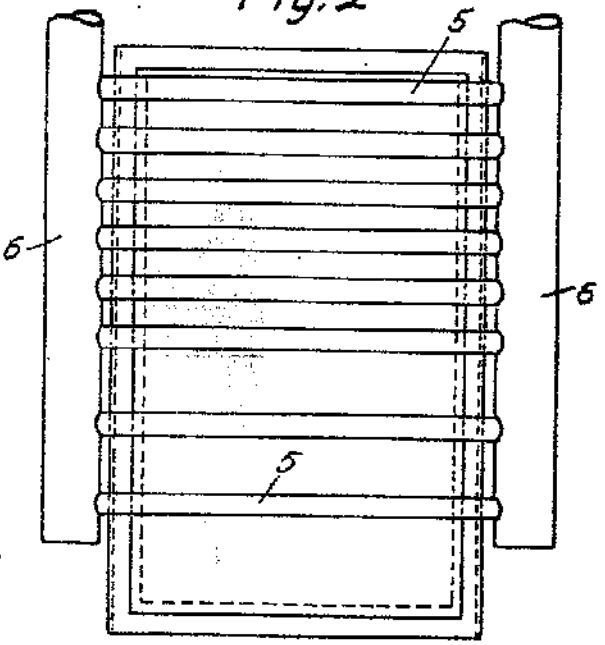


Fig. 2



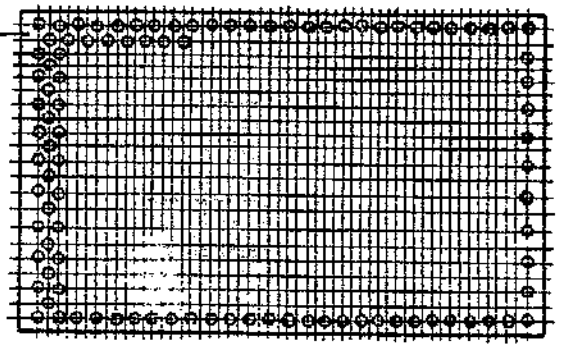


Fig. 4

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2 SHEETS SHEET 1

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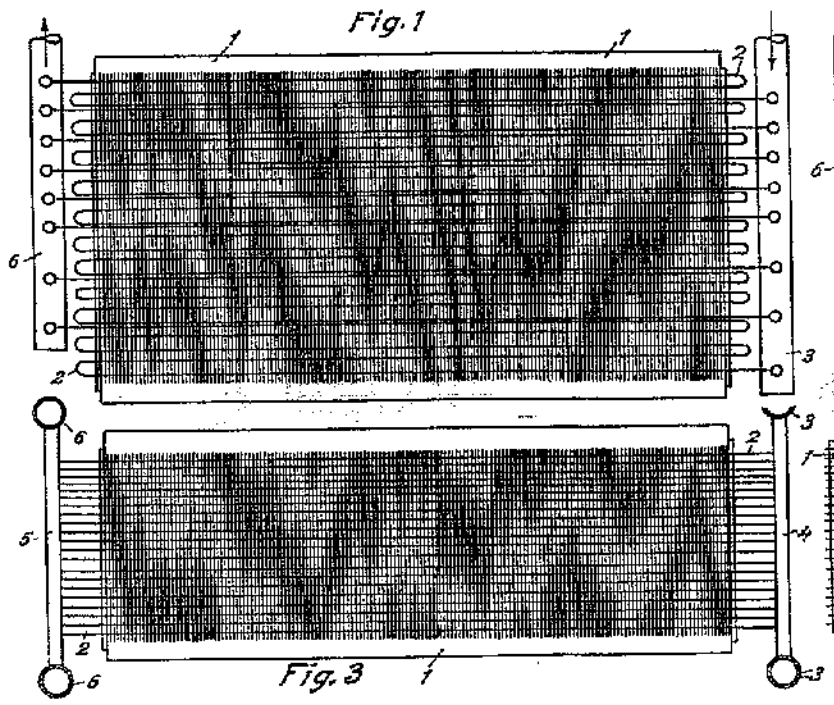
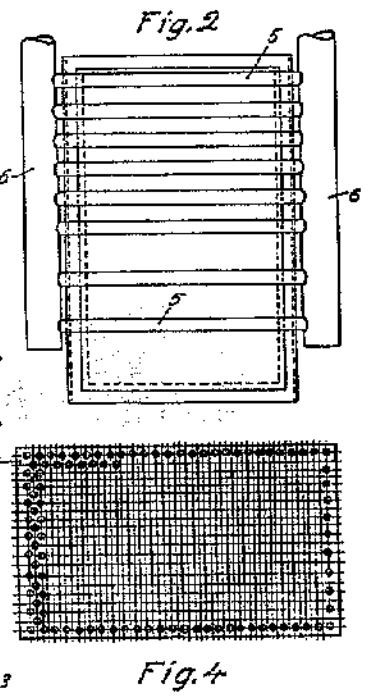
[This Drawing is a full-size reproduction of the Original.]





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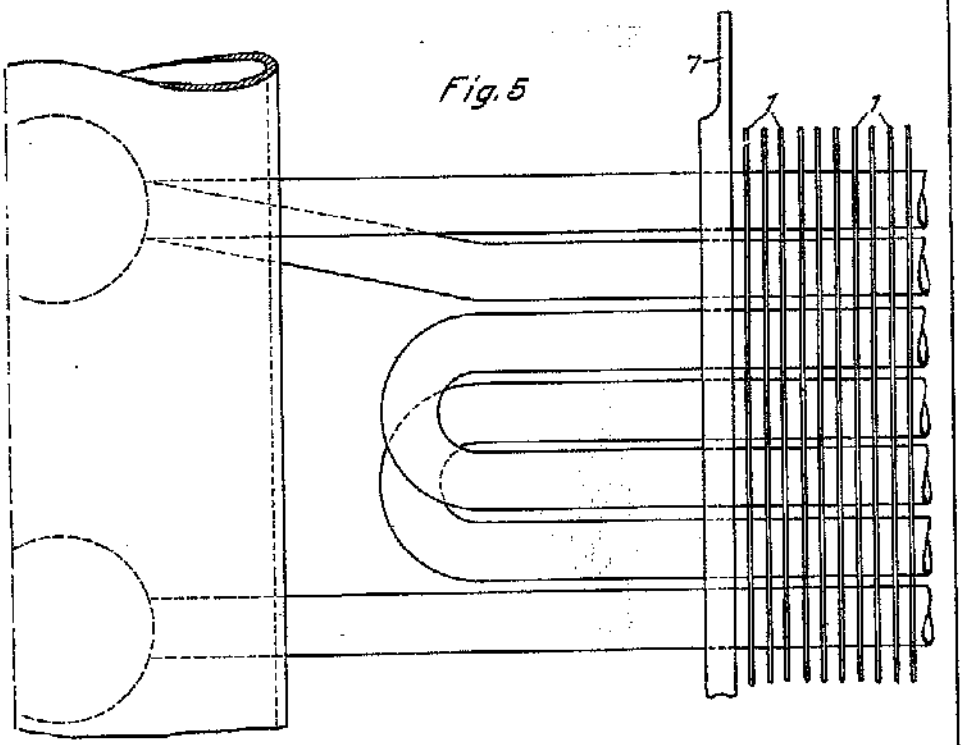

Fig. 5

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