[Second Edition.]

PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION

Improvements in and relating to Chemical Reaction Chambers.

We, ALFRED AUGUST AICHER, a British Subject, of 22, Holland Avenue, Wimbledon, in the County of Surrey, and SYNTHETIC OILS LIMITED, a British Company, of 31, East Street, Epsom, in the county of Surrey, do hereby declare the nature of this invention to be as follows :—

This invention relates to chambers for exothermic chemical reactions. In controlling such reactions, use may be made of a liquid, maintained at its boiling point, to which the heat of reaction is transferred and the vapour thereby produced is condensed by a reflux condenser and returned to the liquid bath.

In commercial plants, the bulk of liquid employed is considerable with the result that variation in temperature may occur from point to point in the chamber. When a local fall of temperature occurs the reaction is slowed at that part and less heated produced, with the result that a cumulative effect arises. The present invention has for its object to provide a reaction chamber improved in this respect.

According to the present invention control of an exothermic reaction chamber is effected by a liquid bath or jacket and in addition by the vapour of the liquid bath, in such manner that the heat of reaction produces evaporation of the liquid bath, whilst in the event of a temperature fall condensation of the vapour occurs and the latent heat produces a correcting temperature rise.

In one embodiment of the invention I provide a reaction vessel comprising a shell within which is a nest of vertical reaction tubes containing a catalyst, communicating with an upper and a lower header space and with suitable inlet and outlet conduits. The tubes are each surrounded by a common jacket containing an appropriate liquid maintained at a suitable level. The upper part of the jacket communicates with a reflux condenser and with a further tube or tubes adapted to contain only vapour from said liquid, the tubes being provided with suitable draining means.

The reagents are supplied to the vessel and reaction takes place in the reaction tubes, the heat produced thereby causing evaporation of the liquid in the jacket. This vapour fills the tubes in communication with the jacket and the excess is condensed by the reflux condenser and returned in a closed system to the jacket or to a reservoir and heating means.

This condition will continue for as long as the correct temperature is maintained but should the temperature fall for any reason there will be a corresponding fall in temperature of the walls of the tubes containing vapour and the vapour in the tubes will condense. In doing so, the latent heat of condensation is transmitted to the walls, and the temperature fall corrected so that the reaction temperature is maintained. The condensed liquid may conveniently be returned by a pump to the closed system from which the liquid is evaporated.

Dated this 19th day of November, 1937.

A. A. THORNTON,
Chartered Patent Agent,
7, Essex Street, Strand, W.C.2,
For the Applicants.

COMPLETE SPECIFICATION

Improvements in and relating to Chemical Reaction Chambers.

We, ALFRED AUGUST AICHER, a British Subject, of 22, Holland Avenue, Wimbledon, in the County of Surrey, and SYNTHETIC OILS LIMITED, a British Company, of 31, East Street, Epsom, in the county of Surrey, 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 relates to chemical reaction chambers and has reference to the control of the temperature of chambers in which exothermic chemical reactions take place. The apparatus of the invention is of the kind in which evaporative cooling is employed, the reaction chamber being in heat exchanging relation-

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ship with a liquid which (under the prevailing pressure conditions) boils at the temperature at which the reaction chamber is to be maintained, so that the excess heat generated by the reaction is absorbed by the latent heat of vaporisation of the liquid. The object of the present invention is to provide improved apparatus of this kind adapted for use in plants operating upon a commercial scale.

The present invention comprises apparatus for carrying out exothermic reactions in which the reaction chamber is formed by a plurality of tubes, which are connected together at their ends by headers forming an inlet and an outlet for the reaction materials, and these tubes are surrounded by a common casing partly filled by a liquid which (under the prevailing pressure conditions) boils at the temperature at which the reaction chamber is to be maintained, the lower part of the casing being provided with an inlet for such liquid, while the upper part of the casing contains the vapour produced by the boiling liquid and is provided with an outlet for such vapour, and wherein one or more additional tubes are provided which communicate at their upper ends with the vapour space of the casing and extend into the liquid space of the casing but do not communicate therewith. Preferably the additional tube or tubes extend completely through the liquid space, so that any liquid condensed within them may at once be removed. A commercial plant will ordinarily comprise a large number of such units and the vapour spaces of the casings of all these units are then preferably placed in communication with one another. Similarly the liquid inlets and/or the inlets and/or the outlets for the reaction products of all the units may respectively be connected together.

One embodiment of the invention is illustrated in the accompanying drawing which shows three of the units of an apparatus comprising a large number of identical units, one of the units illustrated being shown in section.

In the apparatus illustrated, each of the units (designated in general by the letter A) comprises a plurality of parallel vertical tubes 1, which are filled to within a short distance of their upper ends with catalytic material 2 and together constitute the reaction chamber. The upper ends of these tubes communicate with a header 3, common to all the units A, into which the reaction materials are continuously introduced through an inlet pipe 4. In a similar manner the lower ends of the tubes 1 communicate with a header 5, common to all the units A, from which the products of reaction are continuously withdrawn through an outlet pipe 6.

The tubes 1 of each unit are surrounded by a common casing 7, partly filled with a liquid 8, whose boiling point at the pressure prevailing within the casing 7 is equal to the temperature at which it is desired that the reaction should proceed. The surface level of the liquid 8 is some what above the level of the top of the catalytic material 2 in the reaction tubes 1. The upper part of the casing 7 above the level of the liquid 8 constitutes a vapour space 9 which communicates through a tube 10 with a pipe 11, common to all the units, through which the vapour of the liquid 8 produced by the heat of the reaction is continuously withdrawn from the casing. Fresh liquid is continuously admitted to the casing 7 through a tube 12 communicating on the one hand with the lower part of the casing and on the other hand with a liquid supply pipe 13, common to all the units. The vapour withdrawn through the pipe 11 may be condensed and the recovered liquid returned to the casings through the pipe 13, thus forming a closed system for the cooling liquid.

When the reaction is proceeding normally, the heat generated in the reaction tubes 1 is transmitted through the walls of these tubes to the liquid 8 and causes vaporisation of that liquid, the temperature of the whole system being thus maintained at the boiling point of the liquid 8. It may, however, easily occur in practice that the temperature of some part of the apparatus falls below the desired point and such variations in temperature are detrimental to the progress of the reaction.

In order to minimise any such fall in temperature and ensure its rapid correction, each unit A is provided with at least one tube 14 which communicates at its upper end with the vapour space 9 of the casing, passes through the liquid space of the casing without communicating therewith and is connected at its lower end to a tube 15, through which it communicates with a drainage pipe 16, common to all the units. When the reaction is proceeding normally throughout the apparatus, the tubes and pipes 14, 15 and 16 contain only the vapour of the liquid 8, as do the vapour spaces 9 and the tubes and pipes 10 and 11. If the temperature of any unit should fall below the desired temperature (that is the boiling point of the liquid 8), vapour will condense on the inner surface of the wall of the tube 14 in the unit affected. The latent heat of vaporisation of the vapour

is thus given up to the tube 14 and transmitted to the liquid 8 in the unit affected. This process continues, fresh vapour flowing into the tube 14 of the affected unit from the remaining units of the apparatus, until the temperature of the unit in question has been restored to normal. The vapour condensed in the tubes 14 is withdrawn through the tubes 15 and the pipe 16 and either runs to waste or is returned together with the condensate from the pipe 11 to the liquid inlet pipe 13.

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. Apparatus for carrying out exothermic reactions in which the reaction chamber is formed by a plurality of tubes, which are connected together at their ends by headers forming an inlet and an outlet for the reaction materials, and these tubes are surrounded by a common casing partly filled by a liquid which (under the prevailing pressure conditions) boils at the temperature at which the reaction chamber is to be maintained, the lower part of the casing being provided with an inlet for such liquid, while the upper part of the casing contains the vapour produced by the boiling liquid and is provided with an outlet for such vapour, and wherein one or more additional tubes are provided which communicate at their upper ends with the vapour space of the casing and extend into (and preferably through) the liquid space of the casing but do not communicate therewith.

2. Apparatus for carrying out exothermic reactions comprising a plurality of units constructed in accordance with claim 1, the vapour spaces of the casings of all the units being in communication with one another.

3. Apparatus in accordance with claim 2 wherein the liquid inlets and/or the inlets and/or the outlets for the reaction products of all the units are respectively in communication with one another.

4. Apparatus for carrying out exothermic reactions, substantially as herein described with reference to the accompanying drawing.

Dated this 9th day of November, 1938.
A. A. THORNTON,
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7, Essex Street, Strand, W.C.2,
For the Applicants.

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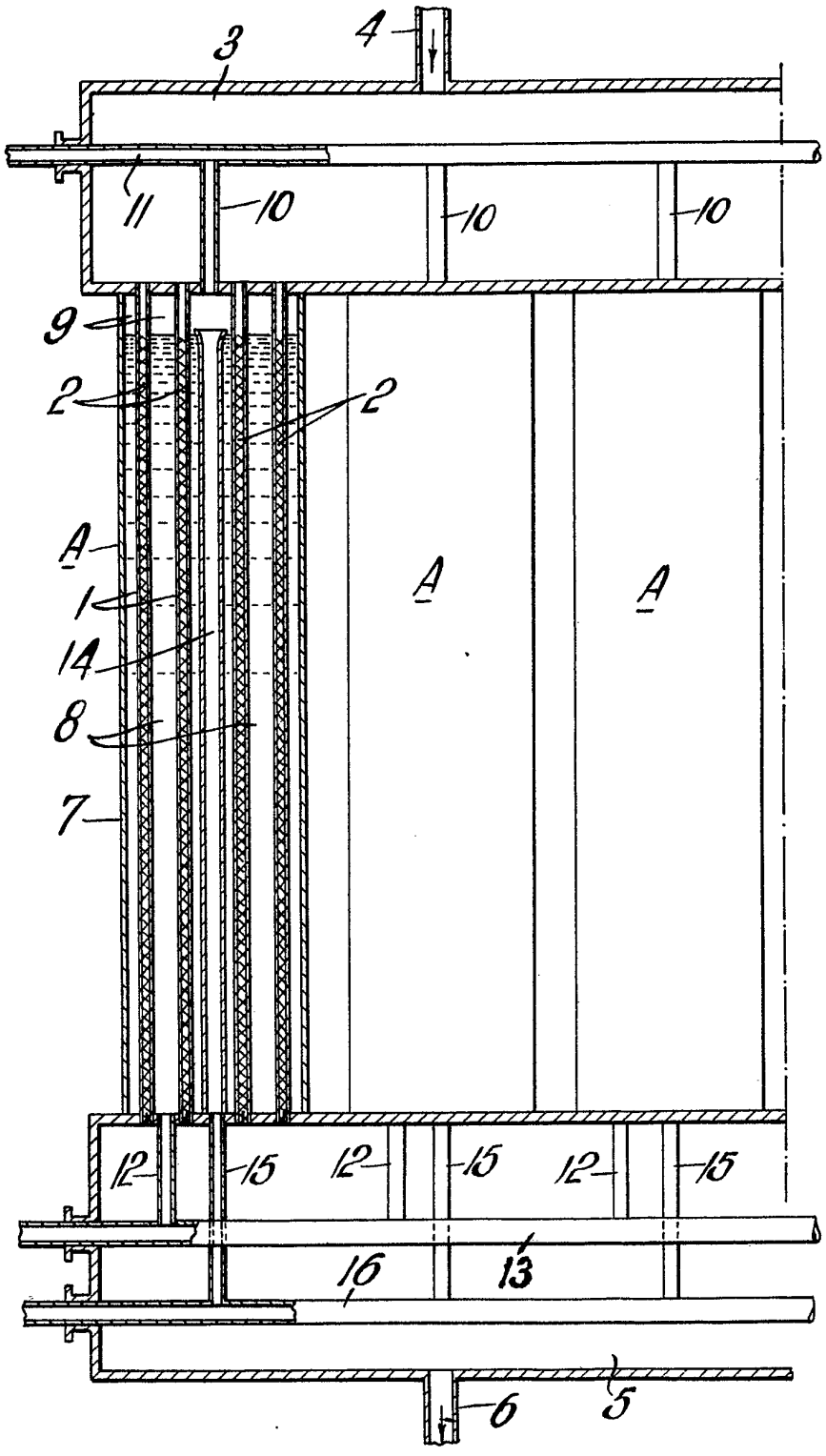
505,452 COMPLETE SPECIFICATION 1 SHEET

2nd Edition



[This Drawing is a reproduction of the Original on a reduced scale.]

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