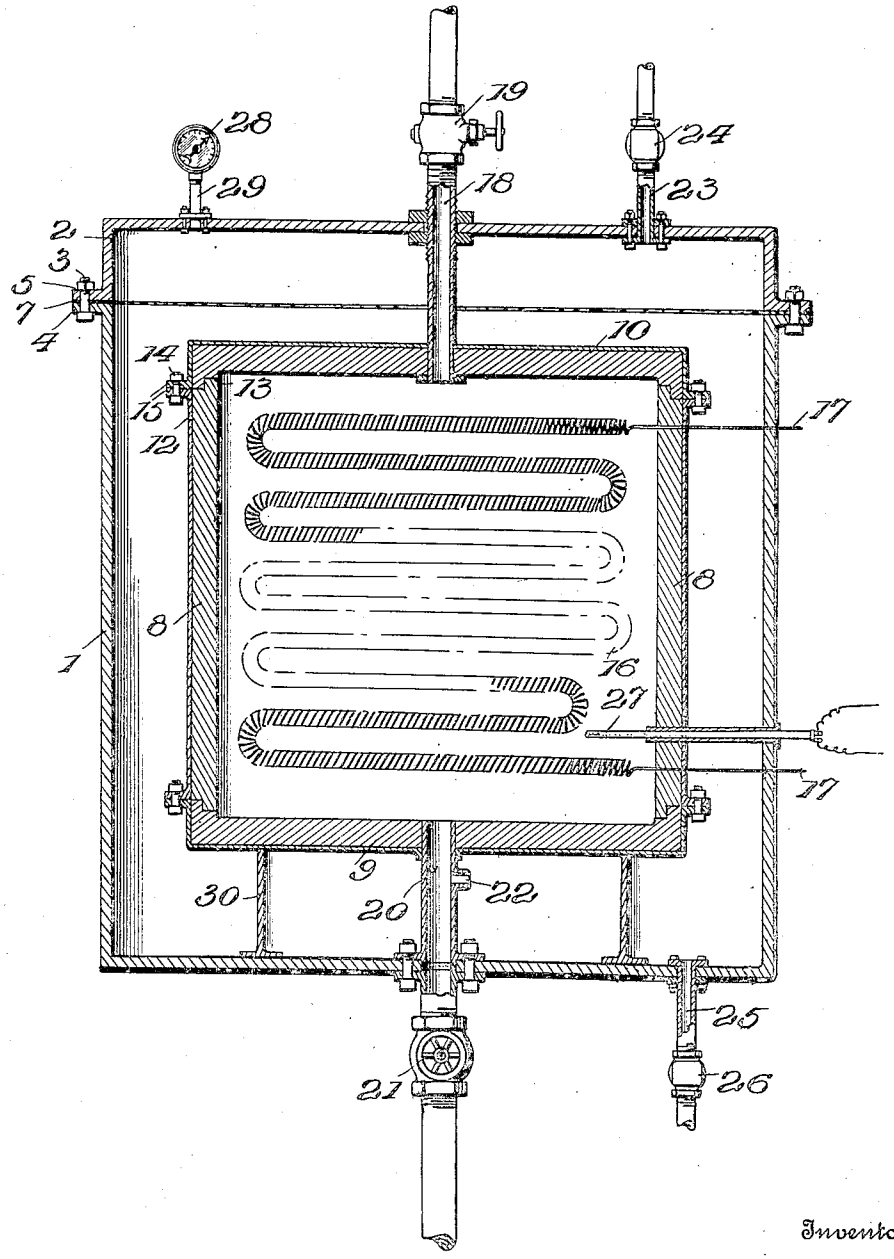
E. E. SOMERMEIER.

APPARATUS FOR SUBJECTING GASES TO THE ACTION OF HEAT AND PRESSURE.

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Inventor

Edward E. Somermeier.

By Wickes and Briesen

Attorneys

UNITED STATES PATENT OFFICE.

EDWARD E. SOMERMEIER, OF ENGLEWOOD, FLORIDA.

APPARATUS FOR SUBJECTING GASES TO THE ACTION OF HEAT AND PRESSURE.

1,286,135. Specification of Letters Patent. Patented Nov. 26, 1918.

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To all whom it may concern:

Be it known that I, EDWARD E. SOMERMEIER, of Englewood, in the county of Manatee and State of Florida, have invented certain new and useful Improvements in Apparatus for Subjecting Gases to the Action of Heat and Pressure; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to a process and apparatus for subjecting gases, vapors or vaporized liquid simultaneously to the action of heat and pressure.

In many reactions of modern industrial and research chemistry it is necessary or desirable to subject gases, vapors or vaporized liquids simultaneously to a high temperature and to a high pressure, as for example, in the treatment of crude petroleum or high boiling point hydrocarbons for the purpose of cracking the same into aliphatic or aromatic compounds, for the treatment of natural gas, the production of reactions between nitrogen and oxygen or their compounds, for determining the effects of catalytic reagents in such reactions as those above mentioned, and for many other chemical reactions.

Research in these and similar reactions, and the industrial application of such reactions has hitherto been greatly restricted by reason of the difficulties arising in the construction of furnaces which will withstand the effects of the extremely high temperatures and pressures involved, and will at the same time be simple in construction, easily operated, and readily taken apart and repaired. The subject of the present invention is a mode of operation and a construction whereby these features will be attained.

In accordance with my invention I provide for effecting the primary heating within a reaction chamber exposed both interiorly and exteriorly to the pressure at which it is desired that the reaction take place, surrounding said reaction chamber by a further chamber adapted to withstand interiorly the high pressures used. This I effect by inclosing the heated reaction chamber within a strong pressure chamber with the interior of which it freely communicates, whereby the pressure within the heated reaction chamber and the surrounding pressure within the inclosing pressure chamber are identical.

My invention is illustrated by the accompanying drawing, in which 1 indicates a strong steel or other metal chamber provided with a suitable cover 2 attached removably thereto in suitable pressure resisting manner, as for example, by bolts 3 passing through flanges 4 and 5 of the body of the chamber and of its top respectively and the interposed gaskets 7. Within this chamber, which forms the external, pressure resisting chamber, I inclose the heating chamber proper, which in the form illustrated is constructed of side members 8, bottom member 9 and top member 10 and supported therein by any suitable means, as, for example, the standards 30. Each of these members forming the interior reaction chamber may be suitably constructed of refractory material, which may be supported or reinforced by an external armor 12 and fitted together in any suitable manner, as for example, by the chamfered edges 13 and bolts 14 passing through the flanges 15 of the external armor of the elements of the chamber. The interior of the chamber is provided in the case illustrated with suitable electric heating means 16, to which leads 17, 17 pass from without the external pressure chamber. An inlet pipe 18 provided with a suitable valve 19 passes through the external pressure chamber into the inclosed heating chamber for the admission thereinto of the gases or vapors which are to be subjected to the reaction heat and pressure. An outlet pipe 20 provided with a suitable pressure valve 21 leads from within the internal heating chamber out of the external pressure chamber to any suitable condenser or receiving device (not shown). The outlet pipe 20 is provided without the chamber, but within the pressure chamber with an opening 22, whereby free communication is established between the heating chamber and the reaction chamber, and the same pressure is maintained in both. The outer pressure chamber is provided with an outlet pipe 23 provided with a suitable pressure valve 24 for the exit of gases and an outlet pipe 25 provided with

a suitable pressure valve 26 for the outlet of fluids which may condense within the pressure chamber. The temperature of the heating chamber may be observed by means of a suitable pyrometer 27, and the pressure prevailing in the device may be measured by a suitable manometer 28 communicating through pipe 29 with the interior of the outer chamber.

In operation the gases or fluids which are to be treated are forced through pipe 18 into the interior of the internal heated chamber. Here they are subjected to the heating effect of the heating elements 16, whereby, in the case of resistance coils, a temperature as high as 1200 to 1400 degrees C. may be produced. It is obvious that, if desired, higher temperatures than this may be attained by the use of other suitable heating means. While undergoing this high temperature the gases or vapors are simultaneously subjected to high pressure, which may be that produced by the action of the heat on the gases or vapors themselves, or may be produced by forcing reaction products, inert gases, or the like into the external reaction chamber. By reason of the free communication between the internal and external chambers through the opening 22 the pressure within the two chambers remains identical. The heating, however, is confined to the interior of the heated reaction chamber, into which all of the gases treated are forced to enter. The outer chamber, on the other hand, is not caused to withstand the high temperatures prevailing within the heated reaction chamber, being comparatively cool, but may be cooled by contact with the air or, if desired, may even be water cooled. The desired pressure is maintained within the system by suitable adjustment of the pressure valves of the various outlet pipes.

The gases or vapors entering the heated reaction chamber through the inlet pipe 18 for the greater part pass out through the main outlet pipe 20, after having been subjected to the reaction temperature and pressure. That portion of the gases and vapors which, after having passed through the reaction chamber, passes into the external pressure chamber and aid there in maintaining the pressure in the system, escape as gases through the outlet pipe 23, or as condensed liquids, through the outlet pipe 25. This pressure may obviously be above the limits of safe operation of other devices previously known, and may be from 300 to 400 pounds per square inch to many times this pressure, being limited only by the pressures which the external pressure chamber may be built to withstand. As this chamber is not required to withstand the high heat prevailing in the internal reaction chamber, it is obvious that the pressure strains which it will withstand are much greater than would be the case if it were also subjected to the high heat of the reaction. Furthermore it is obvious that the inner chamber, which is subjected to the extreme heat of the reaction, is not subject to the pressure strains, and is consequently less liable to deterioration and will require fewer repairs than would be the case were it also subjected thereto. It is also apparent that the device is constructed so that the parts thereof are readily accessible and may be easily removed and repaired.

It is apparent that the details of structure, proportions, shape, etc., of the device may be varied to adapt the same to the reactions for which it is to be used without departing from my invention, and within the scope of the claims hereunto appended, such changes being within the skill of one expert in the art.

I claim:

1. An apparatus for effecting reactions under heat and pressure comprising a reaction chamber, means for heating said chamber interiorly, a pressure chamber surrounding the same, means whereby free communication is established between the interiors of said reaction chamber and of said pressure chamber, means for maintaining the desired pressure within the pressure chamber and means for supplying material to be treated to the interior of said reaction chamber and for withdrawing products of reaction from the reaction and pressure chamber.

2. An apparatus for effecting reactions under heat and pressure comprising a metallic pressure chamber, a refractory reaction chamber supported therein, heating means within said reaction chamber, means for supplying material to be treated to said reaction chamber and means for establishing free communication between the interiors of the reaction and pressure chambers.

3. An apparatus for effecting reactions under heat and pressure comprising a metallic pressure chamber, a refractory reaction chamber supported therein, electric heating means within said reaction chamber, means for supplying material to be treated to the interior of said reaction chamber, an outlet pipe from the reaction chamber to the exterior of the pressure chamber, said pipe being provided within the pressure chamber with an opening whereby free communication is established between the interiors of the reaction and pressure chambers, outlet pipes from said pressure chamber, and means connected with each of said outlet pipes for maintaining the desired pressure within the pressure chamber.

4. An apparatus for effecting reactions under heat and pressure comprising a metallic pressure chamber, said chamber being provided with a removable cover, a separable refractory reaction chamber supported

within said reaction chamber, means for supplying material to be treated to said reaction chamber and for withdrawing products of reaction from the reaction and pressure chambers, and means for establishing free communication between the interiors of the reaction and pressure chambers.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses.

EDWARD E. SOMERMEIER.

Witnesses:

GILES W. CHAPMAN,

FLORENCE E. BUCHAN.