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HEATING OF FLUIDS

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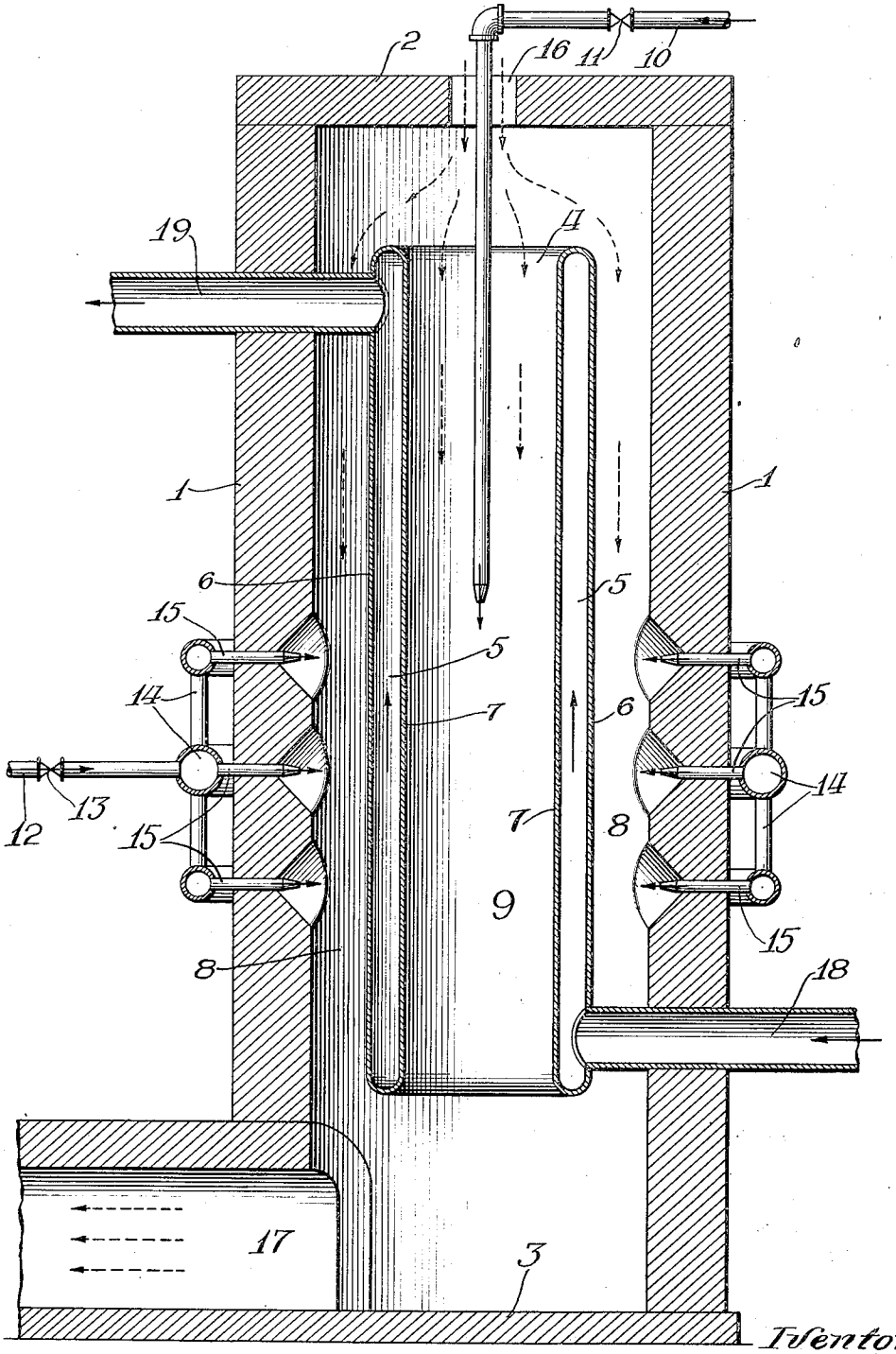

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HEATING OF FLUIDS

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1 Claim. (Cl. 122—156)

This invention particularly refers to an improved method and means for subjecting fluids to high temperatures for short periods of time.

I have previously disclosed processes for the production of high yields of olefins (both liquid and gaseous) by subjecting hydrocarbon vapors and/or gases of a more saturated nature to high conversion temperatures of the order of 1100 to 2200° F. for exceptionally short periods of time of the order of 0.005 to 0.1 seconds, preferably at substantially atmospheric or subatmospheric pressure. Obviously, accurate control over the conversion time to within small fractions of a second requires exceptionally high rates of heating involving not only high temperatures but also high velocities for the hydrocarbons undergoing treatment, and also necessitates rapid cooling of the conversion products in order to stop the conversion at the desired point.

The improved method and means of heating provided by the present invention is especially well adapted to meet the requirements of such processes although it is not intended to so limit its application as it may be equally suitable in other processes requiring high rates of heating and accurate control of the time during which the materials undergoing treatment are maintained at elevated temperature.

In the preferred form of the present invention the fluid conduit through which the material undergoing treatment is passed comprises concentric heating surfaces enclosing an annular space through which the fluid may pass at high velocity. The surfaces are heated by the combustion of a suitable fuel, the combustion gases passing over the surfaces counter-current to the general direction of travel of the fluid undergoing treatment, and air required for combustion of the fuel is indirectly contacted with the reaction products leaving the heating zone in order to cool them to below the temperature at which appreciable further conversion will occur, the air being thereby preheated, prior to its introduction into the combustion zone.

The extreme simplicity of the apparatus in which the various features of the invention are accomplished and its advantages will be readily apparent with reference to the accompanying diagrammatic drawing and the following description thereof. The drawing illustrates one specific form of the apparatus of the present invention although various modifications of the specific form of apparatus illustrated may be employed without departing from the scope of the present invention.

Referring to the drawing which is a sectional side elevation of the apparatus, shown partially in cross-section, a circular furnace comprising side walls 1, a roof 2 and a floor 3, preferably constructed of suitable refractory material, encloses a fluid conduit 4, the lower portion of which is heated and the upper portion of which is cooled.

In the preferred form of the invention here illustrated the fluid conduit comprises an annular space 5 of relatively small cross-sectional area confined between concentric walls 6 and 7 which are preferably of a suitable metallic alloy such as chromium steel or nickel chromium steel or any other suitable material capable of withstanding high temperatures and stresses, due to the wide difference in temperature between the upper and lower portions of the walls.

A combustion zone 8 is provided between walls 1 of the furnace and outer walls 6 of the fluid conduit and a combustion zone 9 is provided within the space enclosed by the inner walls 7 of the fluid conduit. Suitable fuel for combustion, gaseous fuel being preferred although liquid or pulverized solid fuel may be employed, when desired, is supplied to combustion zone 9 through line 10 controlled by valve 11 and is also supplied to combustion zone 8 through line 12 controlled by valve 13 and in the case illustrated through the manifold arrangement 14 and burner jets 15. All or at least a portion of the air required for combustion enters the upper portion of the furnace, in the case illustrated, through port 16, passing downward on both sides of the fluid conduit 4 to combustion zones 8 and 9 wherein the air and fuel mix and combustion occurs. The combustion gases leave the furnace through flue 17 leading to a suitable stack, not shown in the drawing.

The vaporous or gaseous hydrocarbons to be treated enter the lower portion of the fluid conduit through line 18 passing upward through the annular space 5 at high velocity and the products leave the upper portion of the fluid conduit through line 19. The fluid passing through conduit 4 is quickly heated in the lower portion of the conduit surrounded by combustion zones 8 and 9 to the required conversion temperature and as it passes through the upper portion of the conduit is cooled by the incoming air for combustion to a temperature at which no excessive further conversion of the materials will occur, the heated products passing through

the upper portion of the fluid conduit serving, in this manner, to preheat the air for combustion by indirect contact therewith.

I claim as my invention:

A fluid heating apparatus comprising a furnace, a first cylindrical wall defining an open-ended passageway within the furnace, a second cylindrical wall concentric with said first wall and forming a closed annular heating compartment therewith, fluid inlet and outlet means adjacent opposite ends of said compartment, burner means within said passageway and spaced a substantial distance from the inlet end of said compartment for applying heat to a portion of said first wall, additional burner means for applying heat to the corresponding portion of said second wall and also positioned a substantial distance from the inlet end of said compartment, and means for passing air through said passageway over the unheated portion of said first wall to the first-mentioned burner means and around the corresponding unheated portion of said second wall to said additional burner means.

HANS TROPSCH.