

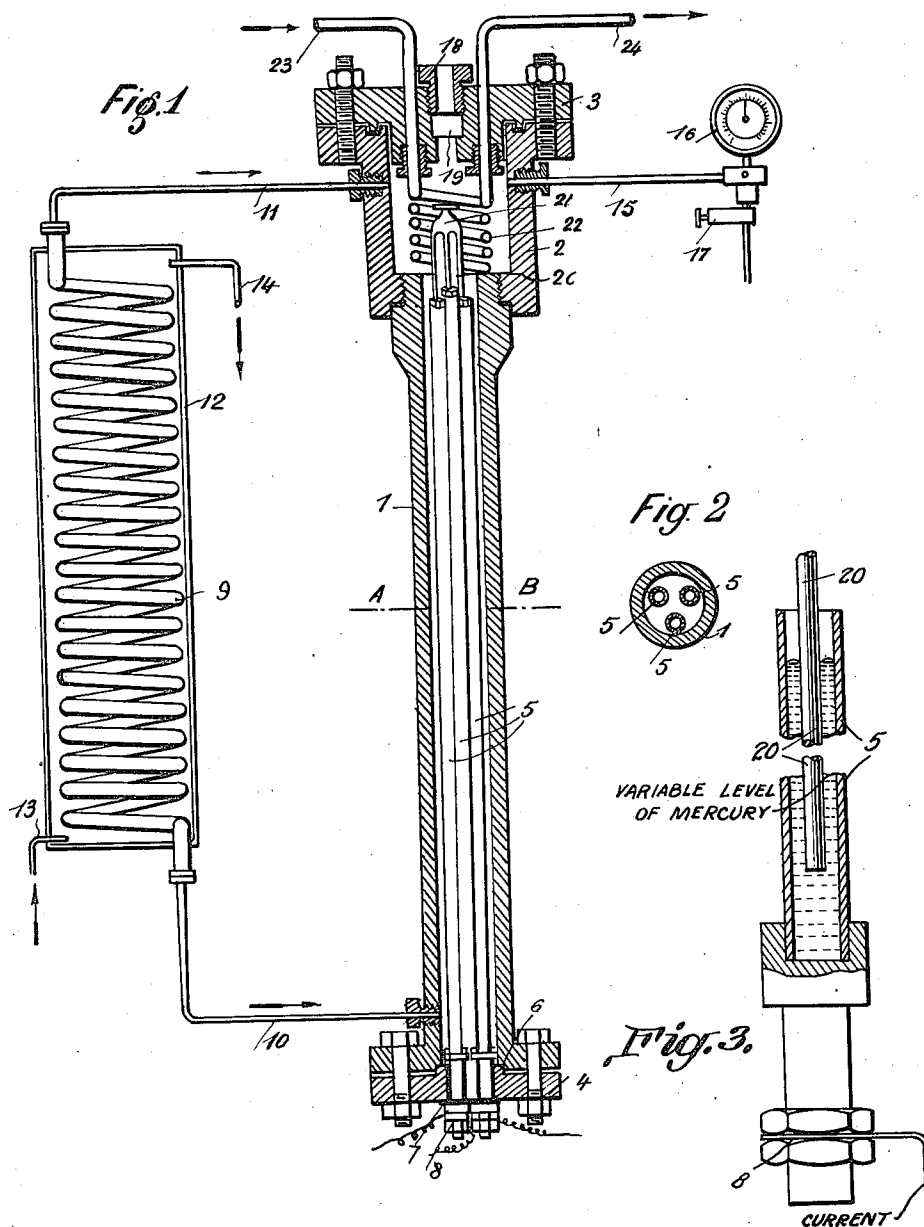
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PROCESS AND APPARATUS FOR PRODUCING PHOTOCHEMICAL RADIATIONS

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PROCESS AND APPARATUS FOR PRODUCING PHOTOCHEMICAL RADIATIONS

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The present invention has for its object an apparatus capable of producing photochemical radiations which are very active and in particular ultra-violet radiations, notably Schumann, Lyman and Millikan ultra-violet.

As is known, these latter radiations are in resonance with the electronic spheres relatively deep in the atom and thus are capable of producing extremely energetic reactions. These radiations can be composed of intramolecular transformations of electrochemical polymerizations and condensations of the photolysis, the hydrolysis of the photochemical oxydations. At maximum intensities I can even obtain radio-active reactions.

The apparatus forming the object of the present invention consists essentially of a sort of mercury vapor furnace, in which the mercury vapor, attaining pressures of several hundred kilograms, is subjected to intensities which are much higher than the intensities utilized up to the present in lamp burners of ordinary mercury.

Said apparatus can comprise for example a tubular body hermetically closed, in which are disposed electrode tubes filled with mercury and open at their upper part. In the mercury of these electrode tubes plunge tubulatures which terminate each in a chamber forming a burner and in which the arc jumps between the levels of mercury of the said electrodes.

The whole can be surrounded by a refrigerating liquid which circulates at high pressure around the electrode tubes which form the joint, all variations in pressure within the mercury vapor of the burner being thus transmitted to the outside of the electrode tubes in a way to realize a true automatic balancing.

The photochemical radiations produced by the jumping of the arc in the burner, the temperature of which can attain a value extremely high concentrated in a single point, can act on the outside of the apparatus by means of an aperture furnished with a suitable lens.

In the accompanying drawing there has been illustrated by way of example of non-limiting nature a form of realization of the object of the invention.

In the drawing:

Fig. 1 is a sectional view through the apparatus;

Fig. 2 is a transverse section on the line A-B of Fig. 1; and

Fig. 3 is a detail in section illustrating the mercury joint or seal.

The apparatus comprises a tubular body 1 of steel for example capable of resisting a pressure of several hundred kilograms and surmounted by a chamber 2 closed by means of a cover 3 which is tight-fitting. 4 is the bottom of the tubular body 1. It is provided with a joint capable of resisting likewise high pressures.

On the interior of the tubular body 1 are three electrode tubes 5 which traverse the bottom 4 with the interposition of insulators 6, said tubes being closed at their lower extremities by plugs 7 capable of resisting high pressures and furnished with electrical conductors 8. The said electrode tubes are filled with mercury. The liquid refrigerant issuing from a coil 9 enters by a pipe line 10 into the body of tubular form 1 and leaves the upper chamber 2 by a pipe 11 which brings it back to the coil 9. This liquid refrigerant circulates by reason of the thermo-siphon effect. The coil 9 housed in a receptacle 12 is fed at 13 with water or other cooling liquid which leaves at 14 the said receptacle 12 and which serves to cool the liquid refrigerant.

The chamber 2 is likewise provided with a branch 15 leading to a manometer 16 and a cock 17 of high pressure type. Finally 18 is a high pressure aperture disposed in the center of the cover 3 of the chamber 2 and furnished with a lens 19 of quartz or fluor-spor.

In the mercury of each of the electrode tubes 5 dips a tubulature 20 formed by a tube

of quartz open at its lower end (Fig. 3). These three tubulatures are joined at 21 in a way to constitute a sort of chamber of quartz forming a burner and in which the arc jumps between the levels which the mercury takes in each of the three electrodes.

The refrigerating liquid which circulates within the assembly composed of tubular body and chamber 2, as stated above, may be water or paraffin oil, for example. It thus completely surrounds the part 21 of the burner in which takes place all the concentration of energy of the apparatus. This liquid refrigerant thus is in contact with the upper surface of the mercury of the electrode tubes 5 (see Fig. 3), thereby forming a joint or seal, in such a way that all variation in pressure internally of the mercury vapor of the burner is transmitted to the outside part of the tubes forming electrodes by the medium of mercury which refills them. A system of auto-equilibration is thus established.

On the inside of chamber 2 and around the burner 21 may be likewise provided a coil 22 for cooling fed by a pipe 23 with liquid refrigerant leaving by a pipe 24.

Finally I may provide in the walls of the chamber 2 or of the cover 3 all devices for the passage of gas or liquids destined to produce a chemical transformation by means of the jumping arc in the burner 21.

As will be seen, with the disposition above disclosed, the temperature of the arc can attain an extremely high value. It may reach $15,000^{\circ}\text{C}$. for example, concentrated in a single point which is extremely small, as the arc is quenched electro-magnetically.

The above described apparatus can serve for realizing a large number of chemical reactions consisting for example in transformations of intra-molecular nature, polymerizations, photochemical condensations, photolysis, hydrolysis, photochemical oxydations and the like.

By way of a non-limiting example, I will hereinafter indicate how one may proceed with the synthesis of formaldehyde by means of the photochemical radiations produced by the hereinbefore described apparatus. For this purpose I introduce into a tubular system of suitable type subjected to the action of photochemical radiations emanating from the burner 21 and traversing the lens of quartz or fluorspar of the aperture 18, a mixture of oxide of carbons and hydrogen, the latter gas being in excess with respect to the oxide of carbon in the proportion of about 1:3 or more.

I may use for example a mixture as follows:

30% oxide of carbon.

45% hydrogen.

Certain known gases, issuing from the gasification integrally and containing in addition

methane, can be utilized for this synthesis.

The tubular system in question in which has been introduced the gaseous mixture is heated to about 300°C . for eliminating all polymerization of the formaldehyde and preventing the formation of other reactions.

There will be more in mixing with the oxide of carbon and hydrogen steam, if the output in CH_2O is not diminished and the risk of forming a large quantity of formic acid.

The formaldehyde produced, mixed with the steam, is condensed in any suitable apparatus, for example in a column of cold water which thus enriches in formaldehyde as fast as the reaction takes place.

I may likewise obtain by the action of these radiations photochemically on the same gas, an action of polymerization with the formation of formose, this latter body being reduced by the excess of hydrogen which is uncombined (to which is added if necessary the desired amount of surplus hydrogen) in a way to give way to essences or oils.

In the case where the gas utilized contains methane I can obtain with the same apparatus a reaction of condensation between the methane and the formaldehyde, with production likewise of essences and oils.

Having described my invention what I claim as new and desire to secure by Letters Patent is:

1. Apparatus for the production of photochemical radiations of high activity comprising a high pressure inclosure, mercury filled electrode tubes having their upper extremities open, hollow tubes dipping in the mercury of said electrode tubes, the upper ends of said hollow tubes being connected together to form a chamber constituting a burner, and means for circulating a cooling fluid at high pressure around said hollow tubes, the mercury intermediate the high pressure inclosure and said burner forming a seal whereby all variations in internal pressure of the mercury vapor are transmitted to the cooling fluid and autoequilibration is established.

2. Apparatus for the production of photochemical radiations of high activity comprising a high pressure inclosure, mercury filled electrode tubes having their upper extremities open, hollow tubes of quartz dipping in the mercury of said electrode tubes, the upper ends of said hollow tubes being connected together to form a chamber constituting a burner, and means for circulating a cooling fluid at high pressure around said hollow tubes, the mercury intermediate the high pressure inclosure and said burner forming a seal whereby all variations in internal pressure of the mercury vapor are transmitted to the cooling fluid and autoequilibration is established.

3. Apparatus for the production of photo-

chemical radiations of high activity comprising a high pressure inclosure, mercury filled electrode tubes having their upper extremities open, hollow tubes dipping in the mercury of said electrode tubes, the upper ends of said hollow tubes being connected together to form a chamber constituting a burner, means for transmitting the radiations from the high temperature arc formed to a point outside of the apparatus and means for circulating a cooling fluid at high pressure around said hollow tubes, the mercury intermediate the high pressure inclosure and said burner forming a seal whereby all variations in internal pressure of the mercury vapor are transmitted to the cooling fluid and autoequilibration is established.

4. Apparatus for the production of photochemical radiations of high activity comprising a high pressure inclosure, mercury filled electrode tubes having their upper extremities open, hollow tubes of quartz dipping in the mercury of said electrode tubes, the upper ends of said hollow tubes being connected together to form a chamber constituting a burner, means for transmitting the radiations from the high temperature arc formed to a point outside of the apparatus and means for circulating a cooling fluid at high pressure around said hollow tubes, the mercury intermediate the high pressure inclosure and said burner forming a seal whereby all variations in internal pressure of the mercury vapor are transmitted to the cooling fluid and autoequilibration is established.

5. Apparatus for the production of photochemical radiations of high activity comprising a high pressure inclosure provided with an aperture, mercury filled electrode tubes having their upper extremities open, hollow tubes dipping in the mercury of said electrode tubes, the upper ends of said hollow tubes being connected together to form a chamber constituting a burner, said aperture provided with a lens for transmitting the radiations from the high temperature arc formed to a point outside of the apparatus, and means for circulating a cooling fluid at high pressure around said hollow tubes, the mercury intermediate the high pressure inclosure and said burner forming a seal whereby all variations in internal pressure of the mercury vapor are transmitted to the cooling fluid and autoequilibration is established.

6. Apparatus for the production of photochemical radiations of high activity comprising a high pressure inclosure provided with an aperture, mercury filled electrode tubes having their upper extremities open, hollow tubes of quartz dipping in the mercury of said electrode tubes, the upper ends of said hollow tubes being connected together to form a chamber constituting a burner, said aperture provided with a lens for transmitting the radiations from the high temperature

arc formed to a point outside of the apparatus, and means for circulating a cooling fluid at high pressure around said hollow tubes, the mercury intermediate the high pressure inclosure and said burner forming a seal whereby all variations in internal pressure of the mercury vapor are transmitted to the cooling fluid and autoequilibration is established.

In testimony whereof I have signed this specification.

HENRY SPINDLER.