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DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Thermonuclear Reactions

I, KURT DIEBNER, of Eppendorfer Stieg 8, Hamburg 39, Germany, of German nationality do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method for the ignition of the thermonuclear fuels deuterium and tritium.

Amongst known attempts for the generation of very high temperatures, two in particular promise to be successful, of which each one currently permits when using a suitable arrangement, the attainment of temperatures of the order of 10^5 °K to 10^6 °K and over. One of these methods is the generation of converging shock waves through suitable ignition of an explosive in the form of a hollow body at its outer shell. The other method consists in generating highly ionised gases by concentrated discharges and making use of the pinch-effect in a restricted space. One possible method of execution recorded in the literature is given by an electric arc burning between two carbon electrodes, between which a condenser battery of high capacity and with a high voltage charge is briefly short-circuited.

The present invention consists in a method for the ignition of the thermonuclear fuels deuterium and tritium, to initiate thermonuclear reactions, wherein converging compression shock waves are produced in a hollow body by solid or liquid explosives, the generation of high temperatures in the centre of convergence of the shock waves being combined with an increase of temperature generated by concentrated electrical discharges in the fusionable nuclear fuels so that the temperature-raising effects are superimposed and temperatures necessary for fusion processes are produced at the centre of the converging shock wave.

The invention further consists in a method for the ignition of thermonuclear fuels to promote thermonuclear reactions therein, which consists in detonating an explosive charge in the form of a hollow body surrounding the thermonuclear fuel, thereby generating a converging shock wave in the interior thereof, and creating a concentrated electrical discharge in the thermonuclear fuel at the centre of convergence of the shock wave in order to attain a temperature sufficient for the ignition of the thermonuclear fuel.

[*Price 3s. 6d.*]

In the accompanying drawings:—

Figure 1 is a diagrammatic view of apparatus for carrying out the method according to the present invention, and

Figure 2 shows a wiring diagram for the apparatus of figure 1.

In carrying the invention into effect according to one convenient mode by way of example, reference 1 (figure 1) denotes an explosive body of spherical shell shape provided with two openings in the shape of a truncated cone, in which a spherically shaped high pressure container 5 is embedded for the uptake of the deuterium 2, perhaps in gaseous form under very high pressure. The spherically shaped high pressure container can however also be dispensed with, and the deuterium can be incorporated directly under pressure into the explosive material. The explosive body 1 can be surrounded by a further spherical shell 6, which tamps the explosive body towards the outside. Two insulated electrodes, for example lithium (lithium 6), between which an electric arc 4 can burn, are introduced into the high pressure container 5. For this purpose the electrode material should have a low nuclear charge number and be as thin as possible in order to maintain at a low level the larger proton reflection with its related higher nuclear charge number. Lithium 6 is furthermore particularly suitable because with it tritium is formed in the thermonuclear combustion process.

An example is shown in Figure 2 of an electric connection for the electric arc and the connected condenser, in which C represents a condenser. S is a suitable switch which can connect the condenser to the electric arc. V is the source of tension for the working of the electric arc 4. The release of the thermonuclear reaction in the deuterium gas 2 is now to proceed as follows:

The explosive material is so ignited at the boundary surface between 6 and 1, that a converging shock wave results, which after exceeding the boundary surface 5, runs towards the centre of the electric arc 4, and there contributes to an increase of the temperature of the already burning electric arc. The electric arc burns thereby in a gas of high pressure, so that under these circumstances it can already operate on its own at temperatures of the order of 10,000 degrees and more.

The height of the temperature to be reached in the moment when the shock wave reaches the centre of convergence 4, depends amongst other things on the geometry of the arrangement, and on the explosive material used (trinitrotoluol or hexogen or others). It also depends on whether a high pressure container 5 is used, and the material from which it is composed, as well as finally on the temperature, power and shape of the electric arc.

When the shock wave has reached the centre of convergence, further suitable measures are provided according to Figure 1, which permit further considerable heating of the gas (plasma) which is under the highest pressure and which has thereby become highly conductive. Because of this in the example provided, a further additional heating of the deuterium by the electric spark follows, directly before the compression shock reaches in its last phase the centre of convergence. Through this combination of the various methods in an appropriate sequence it is possible to attain the highest temperatures during the arrival of the shock wave in the centre of convergence. A further condition is that the electrodes are still active at the moment of the setting in of the discharge. Since it is an electrical process which is being dealt with, when the condenser C which has been charged with high voltage is suddenly discharged, and since on the other hand the deuterium gas in the electric arc 4 is already extensively pre-ionised, it is possible to add at least partially, to the convergence centre, the energy accumulated in the condenser. Furthermore, at the moment of connecting the condenser, because of the magnetic effects in the discharge path, an adiabatic contraction of the highly ionised plasma in the sense of the pinch-effect takes place, which has the effect of raising the temperature. In the given circumstances it is merely a question of the amount of energy accumulated in the condenser and which is available for the continuation of the working process, and the temperature in the convergence centre 4 can be increased additionally to such an extent, that the added energy is great enough to allow the thermonuclear ignition of the deuterium gas to take place.

Besides the given example, temperature effects can be superposed or supplemented, additional consideration being taken of an adiabatic compression and suitable temporal sequence with combination of gas discharges, spark discharges, a mechanically or chemically generated adiabatic compression, detonation wave or some of them, which are suitable for producing the temperatures necessary for the ignition of the gaseous, liquid, and if need be solid thermonuclear fuels. It is also possible for example, to fill the space 7 with liquid deuterium, tritium or D_2O, in the manner that the deuterium 2 serves as initiator for further larger quantities of thermonuclear fuel. Installations with half spherical-hollow bodies can also be constructed, which can also cause the ignition of the thermonuclear fuel, in the convergence centre,—such a fuel corresponding to the deuterium 2—and/or to use the latter for the initial ignition of further quantities of the same or of other thermonuclear fuels. Any other form of hollow body which permits the production of a suitable converging compression shock under suitable ignition is also admissible according to the purposes for which the ignited thermonuclear fuel is to be used, whereby it is particularly to be noted, that these installations can also be used to produce thermonuclear reactions which do not lead or need not lead to ignition.

It is also conceivable, for example, for deuterium enclosed in a volume, to be preheated by adiabatic compression, electrical discharges or any other means, and then to be ignited by a linear and/or if necessary converging compression shock, or else to achieve this with adiabatically pre-heated thermonuclear fuel, using concentrated electrical discharges. Such installations as mentioned in the last example are suitable when their intermittent activity is controlled for the production of mechanical energy. The process explained in Figure 1 can also be carried out in a large pressure container and thus be suitable for maintaining in this large boiler, pressures and/or temperatures required for energy withdrawal or energy generation for certain purposes. This can take place during the intermittent or continuous running of several such processes, respectively repeated any number of times, whereby temperatures and/or pressures can be added to any desired purpose, such as heat engines, the drive of turbines, and others.

WHAT I CLAIM IS:—

1. A method for the ignition of the thermonuclear fuels deuterium and tritium, to initiate thermonuclear reactions, wherein converging compression shock waves are produced in a hollow body by solid or liquid explosives, the generation of high temperatures in the centre of convergence of the shock waves being com-

bined with an increase of temperature generated by concentrated electrical discharges in the fusionable nuclear fuels so that the temperature-raising effects are superimposed and temperatures necessary for fusion processes are produced at the centre of the converging shock waves.

2. A method for the ignition of thermonuclear fuels to promote thermonuclear reactions therein, which consists in detonating an explosive charge in the form of a hollow body surrounding the thermonuclear fuel, thereby generating a converging shock wave in the interior thereof, and creating a concentrated electrical discharge in the thermonuclear fuel at the centre of convergence of the shock wave in order to attain a temperature sufficient for the ignition of the thermonuclear fuel.

3. A method as claimed in claim 1 or 2, wherein the processes of the converging percussion wave and of the concentrated electrical discharges are temporarily connected in sequence in such a manner that, the electrical discharge is first effected at the instant when the percussion wave just reaches the convergence centre.

4. A method as claimed in claim 1, 2, or 3, wherein in order to increase the effect of the converging percussion wave a tamping of the explosive is used on its outer side.

5. A method as claimed in any of claims 1 to 4, distinguished in that, the thermonuclear nuclear fuels to be ignited, whether gaseous or liquid, are under high pressure.

6. A method as claimed in any of claims 1 to 5, distinguished in that, the electrical discharges take place in a space which is considerably pre-heated by adiabatic compression which is generated chemically.

7. A method as claimed in any of claims 1 to 6, wherein the nuclear fuel to be ignited is surrounded by a pressure container, the components of which will further increase the action of the converging shock wave.

8. A method as claimed in any of claims 1 to 7, wherein by initiating thermonuclear reactions in a small volume, the initial condition is created for initiating fusion reactions in a larger volume of thermonuclear fuel.

9. A method as claimed in any of claims 1 to 8, wherein the thermonuclear reactions take place in a suitable container for the maintenance of required pressures and/or required temperatures, and that thus the fusion energy can be utilized.

10. A method as claimed in claim 9, wherein the process is repeated periodically or not periodically, and it serves for driving turbines, heat engines and/or other power combinations.

11. A method for the ignition of thermonuclear fuels substantially as described with reference to the accompanying drawings.

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COMPLETE SPECIFICATION
This drawing is a reproduction of the Original on a reduced scale

Fig. 1

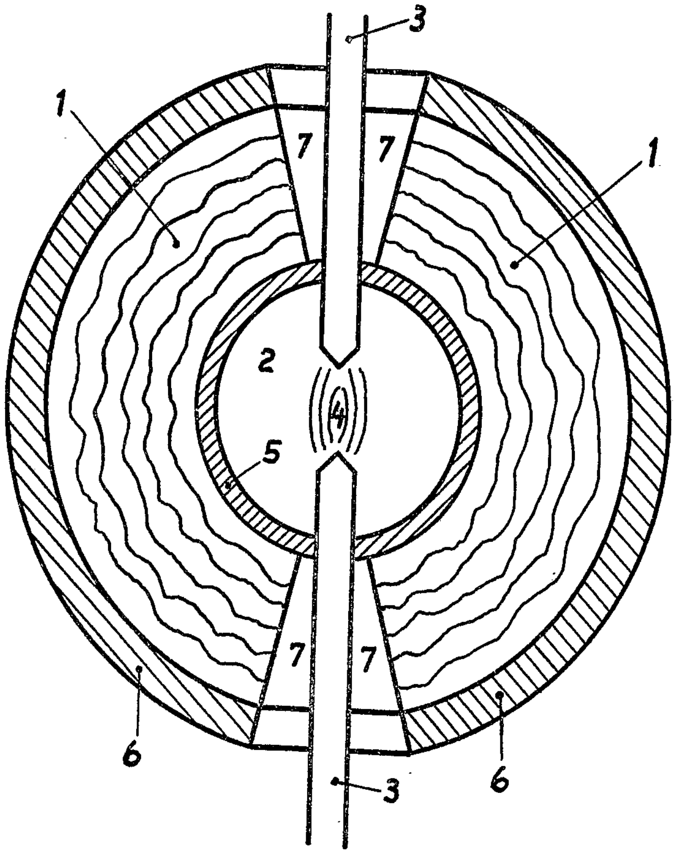

Fig. 2