(19) Canadian Intellectual Property Office

Office de la Propriété Intellectuelle du Canada

An Agency of Industry Canada

Un organisme d'industrie Canada

(11) **CA 615908** (13) **A**

(40) **07.03.1961**

(12)

(21) Application number: **615908D**

(22) Date of filing: **..**

(51) Int. Cl:

(71) Applicant: **KURT DIEBNER.**

(72) Inventor: **BAGGE ERICH ().**

(54) **METHOD OF PRODUCING THERMONUCLEAR REACTIONS**

(57) **Abstract:**

Amongst known attempts for the generation of higher 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 percussion 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, over which a condenser battery of high capacity and with a high-tension charge is briefly short-circuited.

It has now been achieved according to the invention by a combination of electrical gas discharges, converging percussion waves and spark discharges, that the temperatures being reached with the individual methods are superimposed and supplemented in an appropriate manner, in a spatial and temporal sequence corresponding to the purpose of igniting thermonuclear nuclear fuels.

In the accompanying drawings:-

Figure 1 shows diagrammatically apparatus for carrying out 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, 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 given 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 percussion 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 percussion wave reaches the centre of convergence 4, depends amongst other things on the geometry of the arrangement, 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 percussion 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 thrust 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 percussion 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 condensor C which has been charged with high tension is suddonly 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 condensor and which is available for the continuation of the working process, that 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 thrust 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 pre-heated by adiabatic compression, electrical discharges or any other means, and then to be ignited by a linear and/or if necessary converging compression thrust, or else to achieve this with adiabatically pre-heated thermonuclear fuel, as in the Ramsauer trial, using concentrated electrical discharges. Such installations as mentioned in the last example are suitable when their intermittent activity is controlled for the production of machine 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.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:-

1. A method for the ignition of thermonuclear fuels, such as deuterium or tritium, for the liberation of thermonuclear reactions, wherein converging compression shock waves are generated in hollow bodies of explosives, the said shock waves compressing the fusionable nuclear fuels, and generating concentrated electrical discharges to superimpose their temperature-raising effects, thereby reaching temperatures necessary for fusion processes in the centre of the converging shock wave.

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 according to claim 1 or 2, wherein the concentrated electrical discharge is generated at the instant when the converging shock wave just reaches the convergence centre and at which instant the shock wave still just permits and enables the addition of electrical energy.

4. A method according to claim 1 or 2, wherein a tamping of the explosive on its outer side is used to increase the effect of the converging shock wave.

5. A method according to claim 1 or 2 wherein the said thermonuclear fuels to be ignited are subjected to high pressure.

6. A method according to claim 1 or 2, wherein the said electrical discharge is generated in a space which is considerably preheated by adiabatic compression.

7. A method according to claim 1 or 2, wherein the ignited thermonuclear reactions are used for the ignition of a larger stock of thermonuclear material after the ignition is initiated in a small volume.

8. A method according to claim 1 or 2, wherein the thermonuclear reactions are carried out in a container for the maintenance of required pressure and temperatures.

9. A method according to claim 1 or 2, wherein the thermonuclear reactions are carried out in a container for the maintenance of required pressures and temperatures, the process being repeated and serving for the production of mechanical energy.

10. A method for the ignition of thermonuclear fuels to promote thermonuclear reactions therein, which consists in surrounding a thermonuclear fuel with an explosive charge in the form of a hollow body, detonating the explosive charge to generate a converging percussion wave in the thermonuclear fuel in the said hollow body, and creating a transient concentrated electrical discharge in the thermonuclear fuel at the centre of convergence of the percussion wave at an instant just before the percussion wave reaches the convergence centre, whereby electrical energy is added to the percussion wave to cause the generation of a temperature sufficient

for the ignition of the thermonuclear fuel.

11. A method for the ignition of thermonuclear fuels to promote thermonuclear reactions therein, which consists in arranging an explosive charge in the form of a hollow body in a tamper, introducing thermonuclear fuel into the interior of the explosive charge, detonating the explosive charge to generate a converging percussion wave in the thermonuclear fuel in the explosive charge, and creating a concentrated electrical discharge in the thermonuclear fuel at the centre of convergence of the percussion wave as the percussion wave reaches the convergence centre, whereby electrical energy is added to the percussion wave to cause the generation of a temperature sufficient for the ignition of the thermonuclear fuel.

12. A method for the ignition of thermonuclear fuels to promote thermonuclear reactions therein, which consists in arranging ~~nuclear fuel~~ an explosive charge in the form of a hollow body, introducing thermonuclear fuel under high pressure into the interior of the explosive charge, detonating the explosive charge to generate a converging percussion wave in the thermonuclear fuel under high pressure in the explosive charge, and creating a concentrated electrical discharge in the thermonuclear fuel at the centre of convergence of the percussion wave whereby a temperature sufficient for the ignition of the thermonuclear fuel is attained.

13. A method for the ignition of thermonuclear fuels to promote thermonuclear reactions

therein, which consists in arranging ~~nuclear fuel~~ an explosive charge in the form of a hollow body, introducing thermonuclear fuel under high pressure into the interior of the explosive charge, heating the thermonuclear fuel by adiabatic compression, detonating the explosive charge to generate a converging percussion wave in the thermonuclear fuel under high pressure in the explosive charge, and creating a concentrated electrical discharge in the thermonuclear fuel at the centre of convergence of the percussion wave whereby a temperature sufficient for the ignition of the thermonuclear fuel is attained.

14. A method for the ignition of thermonuclear fuel 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, 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, and igniting a larger volume of thermonuclear fuel by means of the first-mentioned ignition of thermonuclear fuel.

Fig. 1

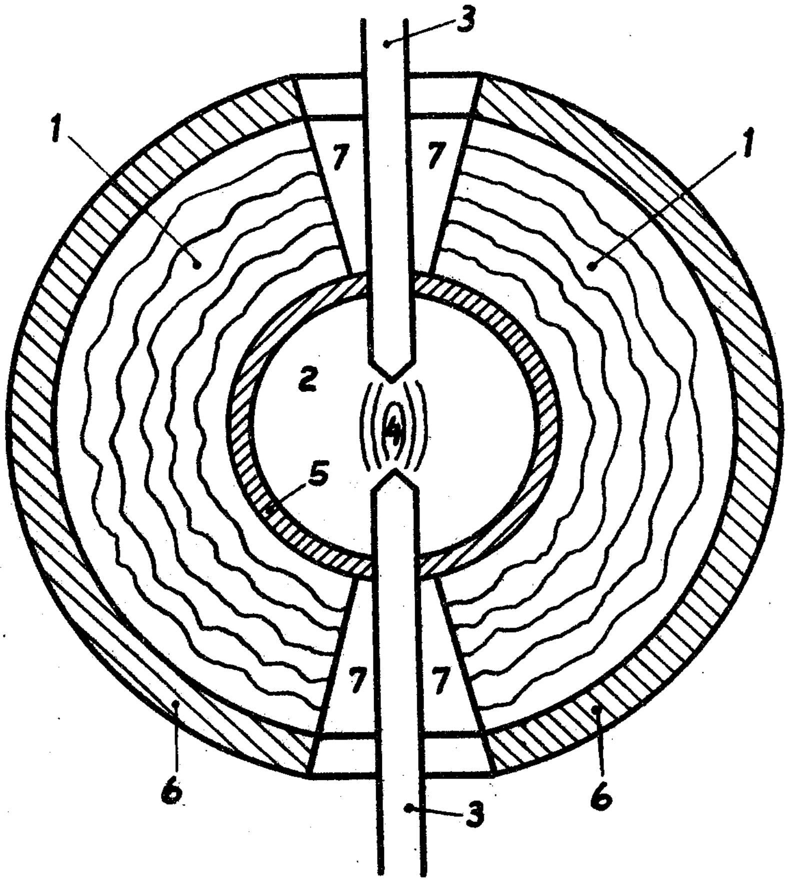
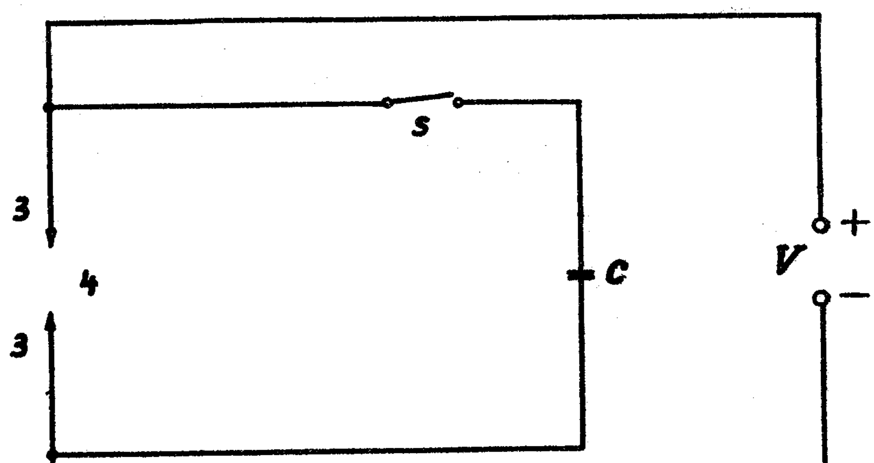


Fig. 2



E. Bagge
K. Diebner
Marks & Clerk
Patent Agents