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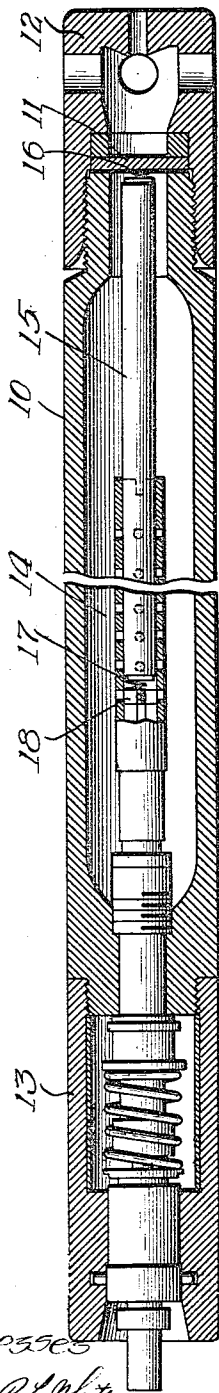
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1,882,365

HEATING CARTRIDGE

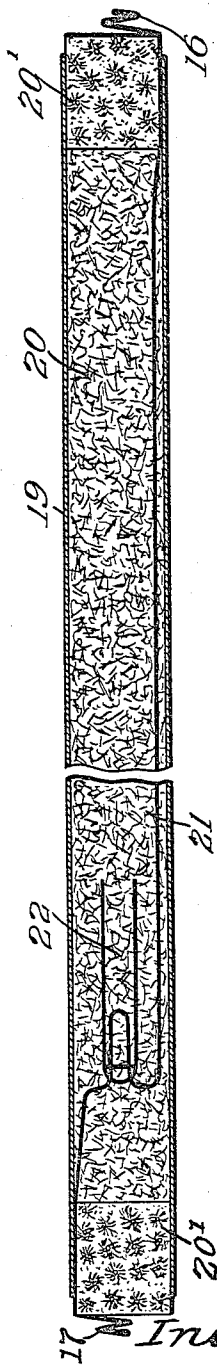
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FIG. 1.



Witnesses
Harry R. L. White
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FIG. 2.



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UNITED STATES PATENT OFFICE

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HEATING CARTRIDGE

Application filed May 16, 1929. Serial No. 363,545.

The present invention is concerned with the production of heat in predetermined quantities and within relatively short predetermined time intervals and the same is applicable to any use involving these conditions.

One very advantageous use of the heating means of the present invention is in connection with blasting cartridges of the type shown in the copending application of Dent Ferrell and Arthur W. Helmholtz, Serial No. 169,441, filed February 19, 1927, and for purposes of illustration the present invention is herein shown as applied to a cartridge of this general type.

In blasting cartridges of the type referred to the blasting medium is a liquefied gas such, for example, as carbon dioxide and it is essential that this medium be raised to its critical temperature practically instantaneously in order to produce a substantially instantaneous pressure increase such as will operate the venting means of the cartridge and suddenly liberate the entire gaseous charge. A slow increase of pressure due to the slow development of heat within the cartridge will result in an incomplete operation of the venting means and hence an ineffective discharge of the cartridge.

Accordingly, it is an object of this invention to provide a means which is capable of producing a substantially predetermined amount of heat in a practically instantaneous manner.

It is also an object of the present invention to provide a heat producing compound which is not sufficiently sensitive to friction and shocks to render the manufacture or handling of the same unsafe.

A further object of the invention is to provide a compound of the character described which is relatively stable, that is, one which is but little affected by weather conditions.

Specifically, it is an object of the invention to provide a heat producing means which is capable of functioning within a blasting cartridge containing a charge of liquefied gas under pressure and operative to effect a substantially instantaneous vaporization of the charge.

Other more specific objects will appear in connection with the following detailed description.

In the drawing,

Figure 1 is a view in longitudinal section of a blasting cartridge of the type hereinabove referred to and showing the improved heat producing device of the present invention applied thereto.

Figure 2 is an enlarged detailed view of the heat producing unit.

Referring to the drawing, it will be noted that the present invention is disclosed as embodied in a cartridge comprising a casing 10 having a rupturable disc 11 and a directing cap 12 at the discharge end and means 13 for establishing an electrical connection for the heating element and for introducing the blasting medium into the interior 14 of the cartridge. The cartridge construction will not herein be described in detail inasmuch as it is substantially the same as that shown in the copending application above referred to.

The heat producing unit 15 is adapted to be inserted in the position shown in Figure 1 with its electrical connection 16 at one end thereof in contact with the rupturable disc 11 and the electrical connection 17 at the opposite end thereof in contact with the plate 18 constituting the other terminal for the electrical circuit.

Referring particularly to Figure 2, it will be observed that the heat producing unit structurally consists of a substantially tubular container 19 within which the heating compound or mixture 20 is placed. The opposite ends of this tube are preferably closed by means of plugs 20' which may be formed of wood, cork or any other suitable material. The container 19 is preferably formed of waxed paper or some other combustible material. The contacts 16 and 17 are formed on the respective ends of an electrical conductor 21 which passes entirely through the heating device from end to end. Any suitable arrangement may be made for accommodating the conductor at the opposite ends of the heating unit and as herein shown, the conducting wire simply passes between the casing 19 and the closing plugs 20'. The

conductor 21 is provided at a point intermediate its ends with an igniting device 22 which may take the form of a matchhead or squib. In either case the device is adapted to be energized by the passage of current through the conductor 21.

The heat producing compound 20 consists essentially of an oxygen carrier and one or more reducing agents. The former may be of the chlorate, perchlorate or nitrate groups, while the latter may be any suitable metal such, for example, as aluminum, carbon, magnesium or manganese or any suitable combination of these.

It has been found from extensive experiments that the perchlorates are far more suitable for the production of heat in general and especially for use in connection with blasting cartridges of the type referred to. The reason for this is that the perchlorates have a greater oxygen content than do either the chlorates or nitrates, thus making it possible to secure a given amount of heat with a less amount of the mixture. It has also been found that perchlorates are substantially more stable than the chlorates and for this reason their use under a variety of weather conditions is of considerable advantage. From the safety standpoint perchlorates offer advantages over either the chlorates or the nitrates due to the fact that the perchlorates are much less sensitive to ignition by friction or shock.

As hereinabove pointed out, there are quite a number of metals suitable for use as reducing agents. However, it has been found that aluminum is the most satisfactory for use in this combination. The only difficulty in the use of aluminum is due to the fact that its temperature of ignition is relatively high, thus requiring a considerable amount of heat to energize the mixture. This difficulty is overcome according to the present invention by adding to the mixture a relatively small quantity of a different reducing agent which has a relatively low ignition temperature. The most suitable secondary reducing agent thus far discovered is carbon, although it should be appreciated that any other reducing agent having a low temperature of ignition as compared with that of aluminum may be used to serve the same purpose. By combining two different agents of the character specified it is necessary to use only sufficient heat to raise the secondary reducing agent to the point of ignition and this agent then gives off the additional amount of heat required to raise the primary reducing agent to its point of ignition.

The mixture which is generally described above may consist either of sodium perchlorate or potassium perchlorate together with aluminum and carbon or their equivalents. It will be appreciated that the proportions in which these ingredients are used may be

varied in accordance with the work to be done. The following are examples of mixtures which have been found to be particularly suitable for use in connection with gas charged blasting cartridges. It will be noted that one of these mixtures embodies sodium perchlorate whereas the other is based upon potassium perchlorate.

1.

77.8% sodium perchlorate.
15.75% aluminum
6.45% carbon

2.

79.8% sodium perchlorate
14.65% aluminum
5.7% carbon

It should be appreciated that the heat producing compound of the present invention may be put up in any desired form according to the requirements of different kinds of work. For use in connection with blasting cartridges it has been found desirable to enclose the heat producing mixture in a cartridge-like tube as shown in the drawing. The tube may either be filled completely with the heat producing mixture or it may be filled in part by some inert substance such as fuller's earth in case a less amount of heat is required. In the present instance, where the compound is encased in a paper cartridge, it is desirable to regard the paper or other material of which the casing is made as a part of the reducing agent of the compound and to calculate the proportions of oxygen carrier and reducing agent so as to provide for the complete combustion of the container. The action of the improved heat producing device should be apparent from the foregoing description but may be briefly characterized as follows:

When it is desired to energize the heating device it is merely necessary to connect a source of current thereto so that the squib or matchhead 22 will be ignited. The heat produced by the squib or matchhead serves to raise the temperature of the reducing agents to the point of ignition and at the same time causes the oxygen carrier to give off free oxygen which then combines with the reducing agents to produce combustion. Once this combustion has been started it continues until the entire heating unit is consumed and in this way the amount of heat for which the particular heater has been designed is generated in a practically instantaneous manner. By varying the amount of mixture used, the amount of heat produced can be controlled within very fine limits.

It will be obvious to those skilled in the art that modifications can be made in the details and in the use of chemical equivalents, as well as in the matter of the structural form of the invention. Therefore, the invention is

not to be regarded as limited in any way other than by the state of the prior art and as the appended claims may require.

I claim:

5 1. A heater for carbon dioxide blasting cartridges comprising a tubular paper container, closures for the ends of said container, an electric igniting device within said container and having leads extending to the exterior thereof, and a chemical mixture within
10 said container to be ignited by said igniting device and rapidly produce high heat, said mixture comprising potassium perchlorate, approximately 80% aluminum approximately
15 14% and carbon approximately 6%.

2. A heater substantially as set forth in claim 1, characterized in that the quantity of potassium perchlorate is calculated to provide an excess of oxygen.

20 Signed at Chicago, this 14th day of May, 1929.

BEN L. LUBELSKY.

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