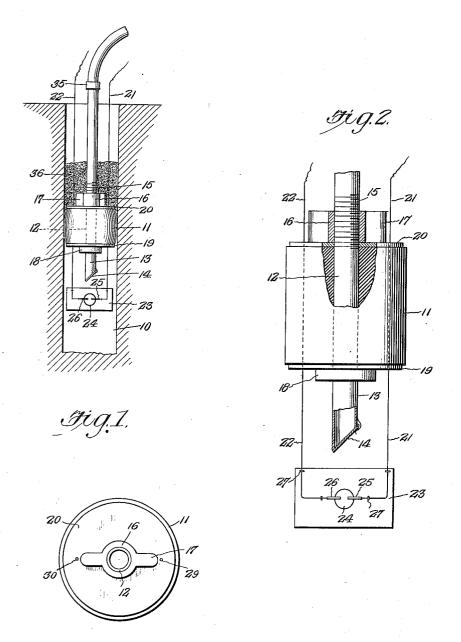
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BLASTING

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BLASTING.

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coal, hard impervious earth and the like, by taking advantage of explosions such as are used in the ordinary explosion engines, 5 namely, the explosion of a compressed mixture of hydrocarbon vapor or mist and air or oxygen, (referred to as "oxygen-containing gas") in a bore hole in the rock or other formation which the blasting is to be con-

10 ducted.

In blasting in accordance with the prior art, it has been proposed to use cartridges containing liquid air or liquid oxygen, and a fuel (in some cases a hydrocarbon mate-15 rial, such as petroleum being mentioned in some of the prior patents). In accordance with the present invention, I do not use any cartridge or anything resembling a cartridge, but I introduce the vapor mixture 20 containing the oxygen-containing gas and hydrocarbon material, such as gasoline or kerosene, or a mixture of the two, directly into the hole in the ground or other impervious formation. I use a tamping plug pref-25 erably of the kind shown herein, and if desired I may also employ ordinary earth tamping in addition thereto, although this latter is unnecessary.

The drawings represent the method used 30 in accordance with the present invention. Figure 1 represents a vertical section of a bore hole provided with the preferred form of device used in accordance with the present invention shown in place. Figure 2 represents the preferred form of tamping plug and its attachments, this being shown on a much larger scale. Figure 3 is a plan view

of the plug.

Referring to the drawings, 10 represents a 40 bore hole, in rock or other formation, which is to be broken up. 11 represents a cylindrical member made of soft rubber or similar material. This is provided with a hole 12, and a tube 13 passes vertically through the said hole. On the lower end of tube 13 is provided a simple form of check valve 14, which allows the mixture of oxygen-containing gas and oil or gasoline vapor to pass downwardly through the tube, but does not permit them to flow out again. The upper portion of tube 13 is threaded, for instance, as shown at 15, and on this threaded portion is placed a wingnut, 16, having large wings 17 by means of which the same can be turned by a long socket wrench. On the lower portion of the tube 13, but above the valve 14, hole.

The present invention is for blasting rocks, is a stationary nut or fixed projection 18. Between the nut 18 and the cylindrical rubber member 11, is plate or washer 19, of slightly less diameter, and similarly between 60 the nut 16 and the member 11 is plate 20, the plates 19 and 20 being made of strong rigid material, say, sheet iron. Plate 20 and cylindrical rubber member 11, and plate 19 are provided with two small passages for 65

carrying the wires 21 and 22.

By tightening up the wing nut 16 on the upper part 15 of tube 13, the nut 18 being rigidly attached to 13, it will be seen that the two plates, 19 and 20, will be forced nearer together, thereby causing the rubber to bulge very materially, as illustrated in Figure 1. In other words, this causes an enlargement in the diameter of the rubber cylinder 11, thereby making a tight fit in the 75 hole. It will be understood that a square nut could be used in place of the wing nut 16, but in this case, it is a little more difficult to provide a wrench used to tighten up the nut 16 upon the threaded portion 15 of tube 80 13. If desired instead of having a portion of tube 13 threaded as at 15, one or more suitable bolts may pass upwardly through plates 19 and 20, and rubber cylinder 11.

Passing through a pair of small holes in 85

the cylinder 11, plate 20 and plate 19 are the electric wires 21 and 22, these being attached to a suitable insulating support, 23, which can be conveniently made of fibre board or similar material, preferably having 90 a central hole 24. This is provided with fastening means, shown simply in the drawing as wire staples 27. The ends of the wires (insulation removed) are brought close together, but not actually in contact with 95 each other, as shown at 25 and 26. The device 23, with the central hole 24, and its attached wires will accordingly be seen to constitute a simple form of graphs.

stitute a simple form of spark plug.

If desired, the insulating support 23 can 100 be attached directly to the plate 19, nut 18, or tube 13, but since there is no considerable weight to this, it can be suspended by means of the wires 21 and 22 through which the. current is supplied. 29 and 30 represent 105 beads carried by the wires 21 and 22 in order to allow the plate 23 to be at the proper distance below the stopper 11, which distance can vary substantially, depending upon the depth of the hole, and the distance 110 that 11 is placed above the bottom of the

It will be seen that the mixture gasoline vapor and air or oxygen is forced into the hole under a pressure of, say 60 pounds, and a spark is made by passing a current between 25 and 26 of the wires 21 and 22, an explosion will be produced in the vapor below plug 11, for breaking up the rock, coal, hard earth or any other formation which there exists.

In place of using gasoline, it will be understood that kerosene can be used, or a mixture of gasoline and kerosene can be used, or other similar oil. I prefer to use a pressure of from 50 to 100 pounds, but higher or lower pressures can be used, depending on the hardness of the rock, etc.

It will be understood that these figures (as to pressures, etc.) are given purely for the purpose of illustration and that they can 20 be substantially varied.

I have above referred to the use of oil or gasoline in an atomized state, which operates in very much the same manner as in vapor state, so far as transmitting the explo-

vapor state, so far as t sion is concerned.

In the preferred form of operation, I first tighten up the nut 16 until the rubber member 15 expands to make a tight closure in the hole. I then pass a current of air or 30 other oxygen-containing gas through a va-porizer or atomizer (i. e. carbureter) containing gasoline, kerosene or the like, to produce an explosive mixture which is then pumped into the hole through the tube 13 and past check valve 14, until a desired pressure (say 60 pounds) exists therein. sired, the upper part of tube 13 can then be disconnected (say at 35). A quantity of earth, sand or other ordinary tamping material can then be put into the hole, as shown at 36, which can be beaten or tamped down or not, as desired. The wires 21 and 22 are then connected to the source of current (say a spark coil) to produce and maintain a spark between 25 and 26, which causes the explosion.

I am aware that gaseous or liquid oxygen with hydrocarbon fuels have heretofore been

used in blasting, but in all the prior art some kind of a cartridge is used. In my invention nothing in the way of a cartridge is needed, and nothing whatever is used except the tamping plug and its connections, which in many cases can be recovered and reused. It will be understood that the examples of 55 procedure as above, have been given merely for the purpose of illustration and for explaining the nature of operation of the invention, and not for restricting the invention thereto.

I have above referred to liquid hydrocarbons; e. g. gasoline. In some cases natural gas or other hydrocarbon gas or combustible gas can be substituted, without making any

other change.

In the drawing I have shown the hole as being vertical and in the above description I have discussed blasting in a vertical hole. However, it is to be understood that the invention is equally useful in the case of holes 70 which are horizontal or inclined.

I claim:

1. A process of blasting which comprises introducing into a plugged hole in a substantially impervious formation, an uncon-75 fined mixture of oxygen-containing gas and hydrocarbon fuel, under substantial superatmospheric pressure, all without any cartridge for holding the same, and igniting the mixture by an electric spark.

2. A process as in claim 1, in which gasoline and air form the two primary materials

introduced into the hole.

3. A tamping plug for use in blasting comprising a soft rubber substantially cylindrical member, rigid plate-like members carried above and below the same, a tubular connection passing through such assembled members with a check valve carried thereby, a nut carried upon a threaded device passing through such assembled members, by screwing up which nut the said soft rubber cylindrical member is compressed vertically and expanded laterally.

In testimony whereof I affix my signature. WILLIAM O. OWEN.