UNITED STATES PATENT OFFICE.

PAUL WINAND, OF COLOGNE, GERMANY.

EXPLOSIVE MIXTURE FOR COMBUSTION-ENGINES.

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To all whom it may concern:

Be it known that I, PAUL WINAND, engineer, a subject of the King of Belgium, residing at 1 Sudermannstrasse, Cologne-on-the-Rhine, Germany, have invented certain new and useful Improvements in Explosive Mixtures for Combustion-Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

For the operation of combustion engines for the propulsion of submarine boats and torpedoes and the like wherein it is impracticable to supply the combustion chamber with air drawn from the external atmosphere, the oxygen necessary for such combustion must be carried on board in storage, either in the form of compressed oxygen or in the form of suitable substances from which the oxygen is obtainable. Where the oxygen is stored in a compressed state under pressure, the weight of the stored oxygen is but 20% of the total weight of itself and its containing receptacle. Where chemicals are stored for the production of the oxygen, as for instance, the perchlorates, the percentage, by weight, of oxygen to the total weight of the chemicals is greater, but it is necessary to employ apparatus of suitable weight for the production of the oxygen from the chemicals and the general operation is not only materially complicated and uncertain, but the yield of free oxygen never reaches, in practice, the theoretical value.

In contrast to what has been heretofore proposed, it is a distinguishing characteristic of my invention, as hereinafter described, that the oxygen bearing substance or compound employed by me can be used not only in ordinary temperatures and under low vapor pressure, but also that being already in a liquid state, it can be introduced into the engine without preliminary chemical transformation into said liquid condition. So also, my invention presents the advantage that the containing receptacles for the oxygen-bearing substance or compound, being subjected to no substantial internal vapor pressure, may be of thin wall structure and consequently of but moderate weight, which is not the case with receptacles containing compressed oxygen. Furthermore, in contrast to the difficulties experienced in generating and making available in the engine oxygen from the perchlorates and the like, my invention offers the great simplification that the oxygen-bearer is a fluid, requiring no oxygen generator for its employment, but capable of being pumped directly into the engine.

In carrying out my invention I employ as the oxygen-bearer such nitrated carbon compounds as contain a large proportion of carbon with respect to the hydrogen present therein and at the same time a smaller proportion of oxygen, as, for instance, the nitro-benzols, $C_6H_5NO_2$, $C_6H_4N_2O_4$, and $C_6H_3N_3O_6$; or such nitrated carbon compounds as contain a large proportion of nitrogen in comparison to the carbon present, as, for instance, tetranitromethane CN_4O_8. These nitrated carbon compounds, moreover, have the great advantage that they are not explosive, which is not the case with those substances which contain substantially enough oxygen to effect the complete combustion of the carbon and hydrogen present in them. In fact it is clear that these latter substances if ignited at any point are immediately consumed throughout their entire mass without the access of air.

The oxygen contained in the NO_2 groups of the nitro compounds is as available for combustion as free oxygen and it can take the place of a like weight of the latter. If the substance (as in the case for the nitro-benzols) contains less oxygen then is necessary for the complete combustion of the carbon and hydrogen contained therein there must be employed, in order to obtain complete combustion, a supplemental quantity of additional oxygen. This supplemental oxygen is, however, less than is necessary for the production of the same heating effect with an ordinary fuel. The nitro-benzols and the like may, therefore, be spoken of as oxygen-bearing fuels. By their employment from 7 to 20% of the otherwise necessary oxygen is saved. Tetranitro-methane, CN_4O_8, on the other hand, is a substance which contains an excess of oxygen inasmuch as of the eight atoms of oxygen, only two are necessary for the complete combustion of the one atom of carbon to carbonic dioxid. Three-fourths of the oxygen is therefore in excess and may be employed for the combustion of supplemental fuel introduced into the combustion chamber. Tetranito-methane may, therefore, be designated as not only an oxidizing agent or oxy-

gen-bearer, but also as a fuel bearer. By its use the employment of supplemental oxygen for the combustion of its own carbon and of additional fuel may be entirely dispensed with. The ideal mixture to be supplied, in accordance with my invention, to the combustion chamber of the combustion engine for ignition therein would consist of a nitro-benzol and tetranitro-methane, both of which are individually non-explosive and which would mutually contribute to produce the necessary explosive mixture in the working cylinder, the one supplying the excess of fuel to combine with the excess of oxygen of the other. The usual diluent for maintaining the required limitation of temperature, would preferably be supplied either by the products of combustion from the engine or from the external sea water, so that it would not be necessary to carry upon the submarine any special diluent or receptacle therefor.

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States, is:

1. An explosive mixture for combustion engines consisting of a suitable diluent, an oxidizing agent, and a non-explosive nitrated carbon compound containing hydrogen and wherein the percentage of oxygen is low and the percentage of carbon with respect to the hydrogen present is large; substantially as described.

2. An explosive mixture for combustion engines consisting of a suitable diluent, and an oxidizing agent, together with nitro-benzol; substantially as described.

3. An explosive mixture for combustion engines consisting of a suitable diluent, and two nitrated carbon compounds, which are separately non-explosive, but which are explosive when mixed; substantially as described.

4. An explosive mixture for combustion engines consisting of a suitable diluent, a non-explosive nitrated carbon compound containing a large percentage of nitrogen in proportion to the carbon present and an excess of oxygen over the quantity necessary to consume its carbon, and a combustible adapted to be consumed by said excess of oxygen; substantially as described.

5. An explosive mixture for combustion engines consisting of a suitable diluent, a non-explosive nitrated carbon compound containing a large percentage of nitrogen in proportion to the carbon present and an excess of oxygen over the quantity necessary to consume its carbon, and a combustible adapted to be consumed by said excess of carbon, said combustible consisting of a non-explosive nitrated carbon compound containing hydrogen and wherein a small percentage of oxygen is present; substantially as described.

6. An explosive mixture for combustion engines consisting of a suitable diluting agent, nitro-benzol, and tetranitro methane; substantially as described.

In testimony whereof I have affixed my signature, in presence of two witnesses.

PAUL WINAND.

Witnesses:
BESSIE F. DUNLAP,
LOUIS VANDORN.