The present invention relates to gas cutting powders and methods of using same.

In industry, it is frequently found necessary to cut metals, refractory and other hard materials in order to obtain desired shapes and sizes. The cutting of such materials by means of saws and the like is usually costly and time consuming, particularly when very hard materials are involved. In such cases, it has been found more economical to effect the cutting by means of acetylene oxygen blow torches which give extremely high temperatures and permit the cutting operation to take place by melting and/or evaporating the material to be cut. For efficient and economical operation, it is desirable to effect this operation in such a manner as to lose as little of the material being cut as possible. In order to do this, the material is preferably melted or evaporated only along a narrow line or seam and at a speed such that the heat is not unnecessarily dissipated over the remaining body of the material being cut. This is usually accomplished by the use of a temperature as high as can be practically obtained.

In the past, it has become the custom to facilitate the gas cutting operation by adding to the gas finely divided materials such as metallic aluminum, iron, manganese, tin, magnesium, calcium, ferromanganese or quartz sand. By adding such materials to the gas before the jet is reached, the finely divided metals become thoroughly mixed with the oxygen and upon combustion, form a very high temperature with the result that the cutting operation is greatly facilitated.

While the above materials have been quite effective, it has been found extremely difficult to produce economically the desired materials in sufficiently finely divided form to make their use economical.

It has now been discovered in accordance with the present invention that finely divided carbides of calcium, boron, aluminum, and silicon and/or the borides of magnesium, calcium, aluminum and silicon, and mixtures thereof, all of which can be economically obtained in finely divided form, can be satisfactorily and very effectively used as gas cutting powders, although this had previously been thought not to be possible because of their low rate of combustion.

The carbides and the borides of the present invention are used in the same general form and manner as in the conventional gas cutting procedures using finely divided metals. Preferably, the said carbides and borides should be of a degree of fineness of the order of 0.2 mm. or smaller, although satisfactory results can be obtained with somewhat larger size material, depending upon the temperature of the burning zone, the desired cutting rate and such factors. The disadvantage in the use of particle sizes greater than approximately 0.2 mm. results from the fact that some of the particles may not be completely burned.

In addition to being as effective as metal powders, the use of our finely divided carbides and borides gives certain decided advantages. For example, as previously noted, they can be produced more economically than the finely divided metals. In addition, the oxides formed during the cutting operation serve as fluxes of the metals, ceramic materials or natural stones being cut, and thus facilitate the cutting.

Basically, the carbides and borides of our invention are used as gas cutting powders by introducing them into a vessel where a jet of oxygen causes the required amount of powder to be entrained and blown thereby through a tube onto the highly heated spot or seam to be cut. At this point, the finely divided powder ignites and develops intense heat which quickly melts the metal or ceramic object to be cut. The molten metal or ceramic slag is blown away from the heated area by the flow of gas from the jet. As previously noted, this operation is conventional and represents no part of our claimed invention which comprises substituting finely divided metal carbides and borides, previously thought to be not usable, for the finely divided metals previously used.

In using our finely divided metal carbides and borides as gas cutting powders, it is preferable that the operation be conducted in such a manner that the amount of carbide or boride powder entrained by the oxygen jet is not substantially in excess of that which can be completely burned (reacted) by the oxygen during the cutting operation. When cutting ceramic objects or natural stones, it is particularly important that an excess of carbide or boride is not present. During the cutting of metals, it is preferred that an excess of oxygen be present in the cutting flame so that the cut sections of metal be oxidized.

The finely divided carbides and borides of our invention can be produced by any conventional method, as, for example, by melting together the required materials in elemental form, or in the form of ores or mixtures containing the carbides or borides in the form of chemical mixtures. The particular method of obtaining the metal carbides and borides constitutes no part of the present invention.

The general method of carrying out our claimed invention has been described in detail above. The following specific example is given merely for the purpose of further illustrating it. Any variations from the described procedure which would be obvious to one skilled in the art which do not depart from the basic concept set out above are intended to come within the scope of the appended claims.
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3 Example

Boron carbide having a grain size of about 100µ and finer was obtained electrothermically from boric acid and ground in a ball mill to obtain the desired fineness. The sieve analysis showed the following grain distribution:

<table>
<thead>
<tr>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>150µ</td>
</tr>
<tr>
<td>135µ</td>
</tr>
<tr>
<td>100µ</td>
</tr>
<tr>
<td>90µ</td>
</tr>
<tr>
<td>80µ</td>
</tr>
<tr>
<td>60µ</td>
</tr>
<tr>
<td>50µ</td>
</tr>
<tr>
<td>Finer than 50µ</td>
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<td></td>
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</tbody>
</table>

The boron carbide prepared as above described was introduced into a powder burner of the AC type having a No. 10 nozzle where it was entrained by a flow of oxygen gas under a pressure of 5 atmosphere. The green flame thus produced having a temperature of more than 3000° C, was then directed into a concrete slab, where this high temperature and the boron carbide flux which was produced by oxidation permitted rapid melting and cutting of the concrete slab along a smooth narrow cut.

Similar results were obtained with calcium carbide, aluminum carbide, silicon carbide, magnesium boride, calcium boride, aluminum boride and silicon boride, and with mixtures thereof in the cutting of both metals, ceramic objects and natural stones. Effective results were also obtained by mixing the said carbides and borides with finely divided metals conventionally used as gas cutting powders.

What is claimed is:

1. A process for cutting metals, ceramic objects and natural stones by high temperature flames from oxygen-containing gases directed onto the surface of the said object, the improvement which comprises incorporating in said oxygen-containing gas before ignition thereof at the surface to be cut a powdered material selected from the group consisting of aluminum carbide, calcium carbide, magnesium carbide, boron carbide, silicon carbide, magnesium boride, calcium boride, aluminum boride, silicon boride, and mixtures thereof.

2. The process of claim 1 wherein the particle size of said materials is not substantially greater than 0.2 mm.

3. The process of claim 1 wherein said materials are introduced into the stream of said oxygen-containing gas in an amount not substantially greater than that which can be completely reacted by the oxygen of said oxygen-containing gas.

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L. DEWAYNE RUTLEDGE, Primary Examiner

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U.S. Cl. X.R.

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