UNITED STATES PATENT OFFICE.

HERMAN L. HARTENSTEIN, OF CONSTANTINE, MICHIGAN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO CONTINENTAL INVESTMENT COMPANY, OF DULUTH, MINNESOTA, A CORPORATION OF MINNESOTA.

METHOD OF MANUFACTURING CARBID AND PRODUCTS OF SAME.

946,432. Specification of Letters Patent. Patented Jan. 11, 1910.

No Drawing. Application filed February 18, 1907. Serial No. 358,014.

To all whom it may concern:

Be it known that I, HERMAN L. HARTENSTEIN, a citizen of the United States, residing at Constantine, in the county of St. Joseph and State of Michigan, have invented certain new and useful Improvements in the Method of Manufacturing Carbid and Products of Same, of which the following is a full, clear, and exact description.

This invention relates to methods of manufacturing carbid and products of same; and it comprises a method of producing solid carbid wherein molten carbid is treated by incorporating therein fine preformed carbid such as carbid fines prior to allowing such molten carbid to solidify; and it also comprises as a new form of carbid a fine grained substantially non-crystalline magma or conglomerate of preformed fine fragmentary carbid cemented by a matrix of set molten carbid; all as more fully hereinafter set forth and as claimed.

In the art of making carbids, and particularly calcium carbid, the usual practice is to allow the molten carbid after formation to cool and solidify naturally as a body. Ordinarily the carbid is permitted to solidify either in the furnace in which it was formed or in separate ingot molds, in either case cooling relatively slowly from the intense temperature at which it is formed and solidifying in bulk. As carbid is a relatively bad conductor of heat, in cooling in this manner piping, segregation and the like take place, the ingot or the block of carbid cooling and solidifying first on its exterior surfaces while the interior remains molten for a relatively longer time. Ingots or blocks so formed are found to be much harder on the exterior than in the interior, and at the center there is usually a cavity or passage; a piping. For some reason, the softer carbid which separates toward the interior of the block in the stated ordinary process of relatively slow cooling is more efficient in producing acetylene than is the relatively harder, first solidifying carbid on the exterior of the block or ingot. This superior carbid of the interior being relatively soft gives a much greater proportion of fines than does the exterior portion, in reducing the whole mass to granular form by crushing and breaking. Carbid fines however are substantially valueless commercially as such since they undergo rapid deterioration on keeping though relatively high in gas producing value when first formed, and since they are not well adapted for the ordinary types of acetylene generator. Nor have the methods of recovering these fines heretofore proposed been commercially practicable. It has been, for instance, proposed to utilize this fine dust-like or powdered material by collecting it until enough accumulates and again submitting it to the action of the electric current in the reducing furnace; that is, it has been proposed to simply melt it down in order to reform block or ingot carbid. But it has been found that on re-melting such fines, the product obtained is not as good as the original carbid and does not give as great a yield of acetylene on treatment with water even as did the original as fines. This is probably due to the fact that the fines, which expose an inordinately large surface to the action of the atmosphere, quickly undergo an aerial hydration, carbonatation, and oxidation, which not only destroys a portion of the carbid but produces new substances which, on fusing the mass, act upon the residual carbid and further diminish its total proportion.

The present invention has for its object the utilization of these fines and the simultaneous production of a new form of carbid which is practically more efficient than the ordinary types of calcium carbid. I have found that by incorporating finely powdered carbid as it comes from the crushing and sizing apparatus into the molten carbid coming from the furnace, a magma is produced which solidifies without the usual piping and segregation, giving a fine grained homogeneous carbid block or body of uniform quality throughout and yielding but a relatively small proportion of fines on comminution. In this article preformed solid carbid fines may be said to form the aggregate while the molten carbid forms a matrix or binder therefor. The fines from the mill are fragments of a broken down crystal aggregate and are sharp-edged and angular

so that microscopically the new carbid article displays a sort of concrete of angular particles in a cementing carbid matrix.

In the usual practice of my invention, I first produce molten calcium carbid according to the usual or any suitable manner, allowing the molten product to solidify as usual. In producing calcium carbid the reagents employed may be, as usual, lime or limestone and a carbonaceous material, but the particular reagents are not important so far as the hereindescribed invention is concerned. After producing the solid mass or ingot of carbid, it is crushed or broken in the usual manner, the fine unmerchantable grains or dust being separated from the granular merchantable carbid as usual and by the usual sizing and sifting means. The fine dust or carbid waste is now stirred into, incorporated with or kneaded into a quantity of freshly produced carbid while the latter is in a molten, fluid, semi-fluid or plastic condition.

In practice I may place a quantity of the dust-like waste carbid in the bottom of an ingot mold or other suitable container and run a portion of the molten carbid thereinto. The molten carbid and the carbid waste are now stirred or mixed together until a good incorporation is secured, when a further quantity of dust or fines is thrown into the mold, a further supply of the molten carbid cast in and stirred up with the dust, and so on until the entire quantity of waste carbid has been taken up and incorporated in the molten or semi-molten mass. Or the furnace may be tapped and the molten carbid allowed to flow continuously into the ingot molds or other receivers; the fines or dust being thrown into the flowing mass or into the molten carbid in the mold from time to time or continuously, as may be desired, the mixture being stirred to cause a good incorporation. The operation may be facilitated by the addition of a small quantity of common salt or sodium chlorid to the molten material, since this acts as a flux and assists in the union of the solid particles with the molten portion of the charge, allowing a more thorough and easier incorporation of the solid and the molten carbid. With an ingot of carbid thus produced, consisting of a magma of preformed dust-like solid particles of carbid and a cementing matrix of other carbid, it is found that on cooling the ingot is practically homogeneous throughout, displaying no central piping, sponginess or voids, the presence of the solid carbid diminishing proportionally to its amount the contraction of the whole body due to the contraction of the liquid carbid. The compound ingot so formed is substantially uniform in hardness throughout and has no large crystals with attendant crystal planes, and as a consequence produces a much smaller percentage of dust or fines in crushing to form commercial granulated carbid. With the admixture of solid carbid, the temperature of the whole mass is lowered to about the melting point of carbid with the result that there can be but little temperature differential between the exterior and the interior of the block during the act of solidification, and consequently there is little or no opportunity for segregation, development of pronounced crystallization or formation of voids. Where, as usual in the art, the exterior of the superheated mass of molten carbid is allowed to cool and become hard while the interior remains heated and freely molten for a relatively long period, all the contraction due to solidification is accumulated at the center where there is apt to be a void or hollow space. In the present invention, there being no opportunity for segregation or separation of different kinds of crystals the interior is of the same nature and hardness as the exterior.

The admixture of molten and solid carbid may be performed in any desired manner and with the use of any desired apparatus. Molten or semi-molten carbid, for instance, may be fed together with the fines or dust through a set of rolls driven together in any suitable way. The product emerging from the rolls as a thin layer will cool more rapidly than when in bulk. Any form of apparatus comprising internally heated rolls, such as those used in the manufacture of glass, may be employed for this purpose.

The product produced as described and stirred, kneaded or agitated in the presence of solid carbid, upon solidifying instead of being pronouncedly crystalline in structure is characterized by a texture which in appearance is like that of porcelain or flint; that is, it is fine-grained, dense and homogeneous. In the practical use of the carbid this texture is advantageous since the absence of crystals and crystal planes offers no avenue for the penetration of moisture during storage or during the operation of forming acetylene. With a coarsely crystalline aggregate, the crystalline planes offer an avenue for the penetration of water. It is substantially desirable in making acetylene that the action of the water be confined to the exterior of a granule of calcium carbid and shall be strictly proportionate to the surface offered by such exterior.

What I claim is:—

1. In the manufacture of carbid, the process which comprises producing a fused body of carbid and mixing therewith hardened particles of carbid.

2. In the manufacture of calcium carbid, the process which comprises producing a fused body of calcium carbid and mixing therewith hardened particles of calcium carbid.

3. In the manufacture of carbid, the process which comprises crushing a body of solid carbid and separating into fines and granular material, and mixing said fines with molten carbid.

4. In the manufacture of calcium carbid, the process which comprises crushing a body of solid calcium carbid and separating into fines and granular material, and mixing said fines with molten calcium carbid.

5. In the manufacture of carbid, the process which comprises producing a fused body of carbid and mixing therewith hardened particles of carbid, the mixture being stirred during the solidification of said fused body.

6. In the manufacture of calcium carbid, the process which comprises producing a fused body of calcium carbid and mixing therewith hardened particles of calcium carbid, the mixture being stirred during the solidification of said fused body.

7. In the manufacture of carbid, the process which comprises crushing a body of solid carbid and separating into fines and granular material, and mixing said fines with molten carbid, the mixture being stirred during the solidification of said fused body.

8. In the manufacture of calcium carbid, the process which comprises crushing a body of solid calcium carbid and separating into fines and granular material, and mixing said fines with molten calcium carbid, the mixture being stirred during the solidification of said fused body.

9. In the manufacture of carbid, the process which comprises forming an ingot of carbid by gradual introduction of molten carbid into a mold and during such introduction stirring fine solid carbid into the molten carbid.

10. In the manufacture of calcium carbid, the process which comprises forming an ingot of calcium carbid by gradual introduction of molten calcium carbid into a mold and during such introduction stirring fine solid calcium carbid into the molten carbid.

11. As an article of manufacture, a body of solid carbid comprising solid particles of preformed carbid embedded in and cemented together by carbid solidified in place.

12. As an article of manufacture, a body of solid calcium carbid comprising solid particles of preformed calcium carbid embedded in and cemented together by calcium carbid solidified in place.

13. As an article of manufacture, a body of solid carbid comprising angular fragments of preformed carbid embedded in and cemented together by a matrix of carbid.

14. As an article of manufacture, a body of solid calcium carbid comprising angular fragments of preformed calcium carbid embedded in and cemented together by a matrix of calcium carbid.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 16th day of February A. D. 1907.

HERMAN B. HARTENSTEIN.

Witnesses:

FRANCIS A. HOPKINS,

FRANK T. BROWN.