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METHOD OF TREATING SHAPED CARBON ARTICLES

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The invention relates to improvements in the art of making shaped carbon articles. It more particularly concerns an improved method of making shaped articles from carbon, wherein a carbonaceous material is mixed with a suitable binder and thereafter subjected to carbonization or graphitization as desired.

Shaped carbon articles useful for structural forms, electrodes, and the like are usually made from anthracite coal or petroleum coke and a binder, such as a pitch derived from coal tar or the like. The ingredients are mixed, heated to soften or melt the pitch and, when a uniform mixture is obtained, molded or extruded in the hot state to the desired form or size. The extruded or molded form, thus obtained, is then subjected to a baking operation at a gradually increasing temperature to drive off volatile matter and carbonize the pitch or binder. If it is desired to convert the amorphous carbon article thus produced into graphite, as is generally the case, if electrodes are to be produced, the heating operation is continued until a much higher final temperature is reached than is necessary to merely convert the article into elemental amorphous carbon. In the above manner, carbon articles of practically any desired shape or form can be produced possessing excellent strength characteristics.

In carrying out the process briefly outlined above, serious difficulty is usually encountered during the heating or baking operation because, if the articles are heated in intimate contact with each other as a charge, they bond together strongly as the pitch binder is caused to carbonize. As a result, the whole charge becomes strongly welded together so that a great deal of breakage occurs when the articles are forcibly parted. This difficulty is further accentuated by the fact that it is necessary to pack the articles tightly in the kiln or furnace during the heating operation so that they will be supported by each other and by the walls of the heating chamber, for otherwise, a deformed or distorted product will result due to the fact that the articles pass through a stage during which they are very plastic or pliable and bend or distort readily even under their own weight.

To overcome the above difficulty, it has been proposed to separate each article from another in the charge by placing a layer or blanket of coke, powdered carbon, or the like completely around each article. It is necessary that the layer of filler or protecting agent be of a substantial thickness in order to prevent the articles

bonding with each other. It is further essential that the layer of filler be spread uniformly around the articles for otherwise distortion or deformation of the product will result as the articles soften up during the heating operation.

However, the proposed solution does not generally satisfactorily solve the problem because it is difficult in the practical operation of the process to obtain a layer of the protecting agent of exactly the right thickness to prevent sticking or bonding while still attempting to conserve space for as large a charge as possible. Further, it is difficult to spread the protecting agent in a layer of the uniformity required so as to prevent a distorted or deformed product from being formed. In any event the method has the disadvantage that a substantial portion of the space in the heating chamber is filled with the protecting agent with the result that there is proportionately less room for the charge. Thus the operating costs of the process are increased due to the fact that the size of each charge is necessarily diminished while heat must be supplied each time to raise the temperature of the protecting agent or filler as well as that of the charge.

It is, therefore, the principal object of the invention to provide a method whereby shaped carbon articles formed of carbonaceous matter and a binder, such as pitch, may be subjected to the heating necessary to convert the articles to amorphous carbon, or graphite, if desired, while in intimate contact with each other without danger of the articles becoming welded or bonded to each other.

Other objects and advantages will be apparent as the description of the invention proceeds.

I have discovered that if graphite preferably in powdered form is rubbed on or otherwise caused to firmly adhere to the surface of a carbon article prior to the carbonizing or graphitizing operation and while the article is at a temperature at or preferably slightly above the softening point of the pitch employed as the binder, the article so treated may be placed in intimate or direct contact with other carbon articles similarly treated and thereafter subjected to a temperature sufficient to bring about conversion of the articles to amorphous carbon or graphite as desired without danger of the articles sticking or bonding to each other.

In carrying out the method of the invention in connection with the production of electrodes, for example, of the type ordinarily used in electrolytic cells for the electrolysis of brine to produce caustic soda and chlorine, the following procedure may be

satisfactorily employed. The carbonaceous matter and the pitch binder preferably of the kind and in the state of subdivision or fineness ordinarily used in making shaped carbon articles of this type are mixed in the known proportions. The mixture is then heated and, when the temperature of the mix is suitable, the electrodes are extruded to produce the desired form or shape. The temperature at which the extrusion press is operated depends, of course, upon the melting point of the pitch employed as the binder. In general, it is satisfactory to operate at a temperature approximating that of the melting point of the pitch. For example, the extrusion operation can be carried out at a temperature between about 196° to 210° F. when employing a pitch having a melting point of 210° F. As the shaped articles come from the extrusion press, powdered graphite, preferably in a finely divided state, is applied to the surface of the electrode as by placing a quantity on a cloth and rubbing it into the surface of the electrode. While the article is still hot, a considerable quantity of the graphite adheres firmly to, or is absorbed by, the article. The temperature at which the graphite should be applied to the surface of the carbon article depends upon the melting point of the pitch employed. A temperature of between about 196° to 210° F. and preferably around 200° F. has been found satisfactory when employing a pitch having a melting point of approximately 210° F. and a softening point of 196° F. This temperature range is accordingly higher or lower as the melting point and softening point of the pitch employed varies. In general, the temperature of application should be such that the pitch or binder is at, or preferably slightly above, its softening point up to its melting point. At this temperature the article appears to be porous and absorbs a considerable quantity of graphite. The amount of graphite to apply to a given surface area is best determined by an examination of the surface as it is being applied. In general, the application is preferably continued until the graphite no longer adheres firmly to the surface of or is absorbed by the article being treated. The above treatment does not substantially change the dimensions of the article. The electrode or other article so treated may be then placed and tightly packed in a heating chamber in contact with carbon articles of like or other shape similarly treated and subjected to heating in the known manner to bring about graphitization of the articles.

In the foregoing manner, carbon articles of any desired shape may be placed or packed in direct and intimate contact in either a horizontal or vertical position in a suitable heating chamber and subjected to a carbonization or graphitization operation without danger of the articles welding or bonding together. In fact, it has been found that a single article treated in accordance with the invention will not bond or stick to the remainder of an untreated charge which in turn becomes strongly bonded or welded together.

I claim:

1. In a method of treating a shaped article

comprising petroleum coke and a pitch binder to prevent said article from bonding to another article of similar composition when the articles are subjected to heating operation in contact with each other at a temperature such that the pitch binder is caused to carbonize, the step which comprises rubbing powdered graphite on the surface of the article while maintaining the temperature of the article at a point between the softening point and the melting point of the pitch binder.

2. In a method of treating a shaped article comprising petroleum coke and a pitch binder having a melting point of approximately 210° F. to prevent said article from bonding and sticking to another article of similar composition when the articles are heated in contact with each other at a temperature such that the pitch binder is caused to carbonize, the step which comprises rubbing powdered graphite onto the surface of the article while maintaining the temperature of the article between about 196° to 210° F.

3. In a method of forming a shaped carbon article, the steps which consist in treating a shaped article comprising carbonaceous matter and a pitch binder by applying powdered graphite to the surface of the article while maintaining the temperature of the article at a point at least slightly above the softening point of the pitch binder, and hereafter subjecting the article to a heating operation at a temperature sufficient to convert carbon forming material present in the article to carbon.

4. In a method of forming a shaped graphite article, the steps which consist in treating a shaped article comprising carbonaceous matter and a pitch binder by rubbing powdered graphite on the surface of the article while maintaining the article at a temperature slightly above the softening point of the pitch binder, and thereafter subjecting the article to a heating operation at a temperature sufficient to bring about graphitization of the article.

5. In a method of treating a shaped article comprised essentially of carbon and a carbon forming binder to prevent said article from bonding and sticking to another article of similar composition when the articles are heated in contact with each other, the step which comprises applying graphite to the surface of the article while maintaining the temperature of the article between the softening point and the melting point of the binder.

6. In a method of treating a shaped article comprised essentially of carbon and a binder capable of being converted substantially completely to carbon to prevent said article from bonding and sticking to another article of similar composition when the articles are subjected to heating operation in contact with each other, the step which comprises applying graphite to the surface of the article while maintaining the temperature of the article at a point such that the graphite adheres firmly to the surface of the article.

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