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UNITED STATES PATENT OFFICE.

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ELECTRODE-JOINT COMPOUND.

No Drawing. Original application filed November 8, 1920, Serial No. 421,944. Divided and this application filed April 17, 1922. Serial No. 553,976.

To all whom it may concern:

Be it known that I, BETHUNE G. KLUGH, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electrode-Joint Compounds, of which the following is a specification.

This invention relates to an improved joint compound for use in joining the sections of electrodes as placed in service in an electric furnace, and has for its object to improve such joints so as to give greater mechanical strength and electrical conductivity to electrodes at the joints with resulting increased length of service and greater economy in the electrode consumption of electric furnace operation.

The methods heretofore employed in making up the electrode joints, consist in either depending upon the contact made by the faced ends of the electrodes when screwed together by the connecting pin, or of coating the threads and faced ends with a "paste" made up of wholly or partly graphitized carbon, with some aqueous binder consisting either of water alone or of a solution of molasses or other syrup of like nature.

It is, however, well known to those experienced in the use of electrodes in electric furnace practice, that with the various sizes of the materials entering carbon electrodes, it is practically impossible to always machine threads and faces involved in the joining of electrodes that will give such an accurate and continuous contact throughout the joint as will even approximate in mechanical strength and electrical conductivity a joint obtained by the use of some joint compound. Furthermore, the section of the electrode that is in the furnace is essentially at a high temperature from conducted heat and when a paste of conductive carbon with any aqueous syrup solution binder is applied to the upper end of such electrode while in service, the said binder material hardens and becomes immobile immediately thus defeating the object of the paste as a medium for spreading over the surface and completely filling all voids in the joint.

There appears further in the melting of phosphatic materials in the electric furnace to be some reaction of the gaseous and liquid materials in the charge upon any joint compound of a binder of aqueous sugar solutions to the extent of the joint being attacked on all of its contact surface, resulting in broken electrical contact and resultant heating from resistance with often ruptures said electrode at said joint.

My invention has for its object to produce an electrode joint superior to any heretofore attained and it is based upon the following steps, to-wit:—

1st: I select a paste of such character as to be softened by the heat at the joint, when made with an electrode in service, and which will not therefore harden before it can flow into and completely fill all voids in the joint. Preferably the paste is composed of comminuted electrically conductive carbon and a bituminous binder thinly liquid in temperatures from 175° to 200° C.

2nd: I avoid any tendency of paste or generated gases being trapped in the inner end of the screw sockets and preventing the positive surface contact between the electrode ends, by the provision of vents leading from the inner ends of the screw seats and adapted to both vent the air or generated gases and to permit any excess paste in the screw joint to extrude. This feature is of great importance in that it avoids air pockets, prevents any tendency of trapped paste in the seat to hold the electrode ends out of contact, and enables a thick paste to be employed with the assurance that it will fill all voids in joint.

3rd: I bake the joint before it assumes load bearing and current conducting functions.

In compounding and applying my improved paste for electrode joints, I first make up a paste consisting of either amosphous graphite or carbon largely graphitized, and ground so that about fifty per cent by weight thereof will pass a 200 mesh sieve and all will pass a 100 mesh sieve. I then mix with said carbon about twenty per cent of its weight of a mixture of tar and pitch practically free from napthalene. The said mixture of tar and pitch should be in ratio of about one-third tar to two-thirds pitch, and the tar must have been previously dehydrated, which dehydration can be performed by heating two hours at 150° centegrade.

The tar and pitch mixture above described is heated to a freely liquid state and the aforesaid carbon thoroughly and intimately mixed, said mixing being conducted with the whole mass heated to between 175° and 200° C.

The paste above described works very successfully in the hereinafter described procedure, but I have further found that the joint made therewith is further improved by the addition of finely divided metal, preferably clean cast iron borings of not over 20 mesh size in proportion to about 15 per cent of the weight of the carbon, to the mixture and mixing all the constituents together at the temperature of 175° to 200° C.

This paste is applied to the electrode ends while hot, the temperature of such ends being maintained between 200° and 300° C. so that the paste above described will retain its plastic condition when applied and will remain so until the two sections of the electrodes to be joined are screwed together on the threaded pin to the full tension and face contact desired for the joint.

I have found that when the above described procedure is carried out joints are made that have almost the electrical conductivity of the body of the electrode sections, and no attacking of the joints in the smelting of phosphatic materials is evident. This has been proven by long comparative tests in the same furnace and under similar conditions with the result that the troubles with defective joints made up in accordance with my present method were practically nil as against almost continuous trouble from joints made up with pastes of carbon and aqueous solution binders as in the standard practice heretofore prevailing in the art.

While I have described the mixture and method used in very specific detail as to exact proportions and temperatures, which I have found to give the best results, it is obvious that the purpose of my invention is to produce a paste that will soften when heated and therefore can be spread freely so as to fill all voids in the joint and that will be of such character that when baked it will provide and maintain electrical conductivity and mechanical strength such as will approximate conditions obtaining in the body of the electrode section. It is therefore further obvious that with varying characteristics of available constituents for such a paste, those skilled in the art may depart somewhat from the details I have described and still remain within the spirit of my present invention, I, therefore, do not wish to be confined to the exact proportions and details herein described.

My present invention is a division of my application, Serial No. 421,944, filed on November 8th, 1920.

Though I have described with great particularity the details of the embodiment of the invention herein shown, it is not to be construed that I am limited thereto as changes in arrangement and substitution of equivalents may be made by those skilled in the art without departing from the invention as defined in the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. An electrode joint compound, composed of carbonaceous material, and a binder intimately mixed and of a character to become softened and brought into contact with a hot electrode in service to insure the necessary fluidity to completely fill all voids in the joint between the hot electrode section and the section to be joined thereto.

2. An electrode joint compound, composed of comminuted carbonaceous material mixed with a bituminous binder which becomes softened and brought into contact with a hot electrode in service to insure the necessary fluidity to completely fill all voids in the joint between the hot electrode section and the section to be joined thereto.

3. An electrode joint compound, composed of comminuted carbonaceous material mixed with a binder of pitch and dehydrated tar thinly liquid at 175° C. to 200° C.

4. An electrode joint compound, composed of comminuted graphitized carbon intimately mixed with pitch and tar, said pitch and tar mixture being fluid at temperatures ranging between 170 degrees to 200 degrees C., and said resulting mixture of all constituents being of such proportions that its physical state is that of a stiff paste at a temperature of 175 degrees C.

5. An electrode joint compound, composed of comminuted graphitized carbon, metal, and a bituminous binder.

In testimony whereof I affix my signature.

BETHUNE G. KLUGH.

Witness:

NOMIE WELSH.