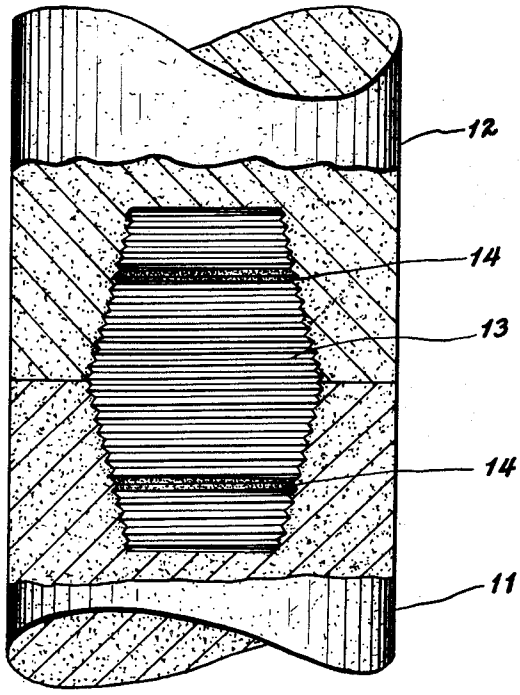
Oct. 15, 1957 H. W. ABBOTT 2,810,117

ELECTRODE CONNECTING NIPPLE

Filed July 7, 1955

FIG. 1



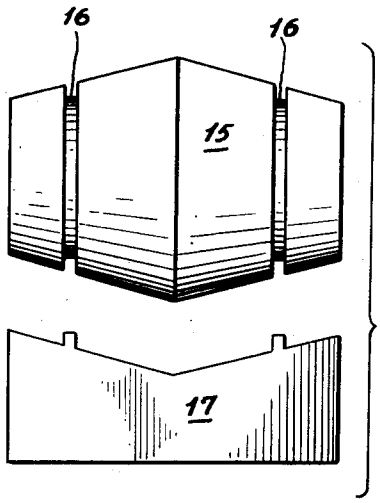
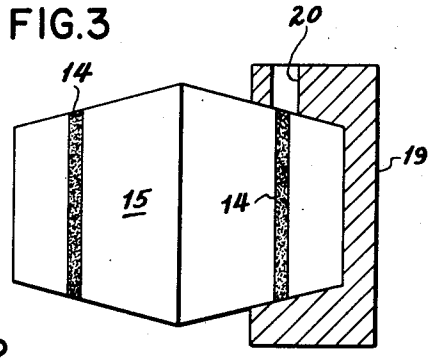


FIG. 2

FIG. 3



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ELECTRODE CONNECTING NIPPLE

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4 Claims. (Cl. 339—268)

This invention relates to connecting members, more commonly known as niples, for joining carbon or graphite electrodes in end to end relation. Such electrodes are used in electric arc furnaces for conducting electric current from a holder through the electrode and an arc at the inner end of the electrode to metal within the furnace. Such electrodes may carry several thousand amperes of electric current and may range from little more than an inch up to several feet in diameter. The electrode is gradually consumed in the operation of the furnace and this requires a more or less continuous feeding of the electrode into the furnace. In order to eliminate shutdown of the furnace for the purpose of changing electrodes it is customary to drill and tap the ends of the electrodes so that they may be joined or connected end to end by threaded nipples, preferably made of material having substantially the same or similar composition to that of the electrodes. As the electrode is gradually consumed at its inner end it will be fed into the furnace and from time to time a new section of electrode will be joined to the outer end of the electrode. In order to reduce the electrical resistance across the connection the adjacent ends of the electrodes should meet in a close-fitting face to face relation and this relationship should be continuously maintained while the furnace is in operation. A tight mechanical joint is desired also to minimize the danger of breakage of the electrodes and the nipple under the severe conditions of temperature and vibration to which the electrode is likely to be subjected in service.

In order to insure a permanently tight connection between joined sections of electrode under operating conditions it has heretofore been suggested to apply to the engaging surfaces, or to portions thereof, a pitch or other bonding or cementing material which will carbonize under the high operating temperatures. This is intended to bond and hold the electrode sections firmly together. These electrode connections of the prior art have not proved to be wholly satisfactory.

It is an object of the present invention to provide an improved connecting member for joining carbon or graphite electrodes. It is another object of the invention to provide an improved electrode connecting nipple having circumferential reservoirs of bonding material located at the nipple surface. It is still another object of the invention to provide a screw threaded electrode connecting nipple in which circumferential portions of the threaded surface comprise bonding material. Other objects, features and advantages of the invention will become apparent or will be pointed out as the description proceeds.

A preferred embodiment of the invention selected for purposes of illustration and description is shown in the accompanying drawings, in which:

Figure 1 is a vertical section through an electrode joint, fragmentary portions of the joined electrodes above and below the joint being shown in elevation;

Figure 2 is an elevation of a nipple blank showing the

circumferential grooves cut therein to receive bonding material, and also showing a tool such as might be used for cutting the grooves; and

Figure 3 is an elevation of a nipple blank showing the grooves filled with bonding material and showing a form of mold such as might be used for filling the grooves with the bonding material.

Referring to the drawings, Figure 1 shows the upper end of a section of electrode **11** and the lower end of a section of electrode **12** joined by the nipple **13**. The electrodes may be either carbon or graphite and will sometimes be described herein merely as being made of carbonaceous material. At their ends thhe electrodes are provided with axially disposed threaded sockets which receive and engage the externally threaded nipple **13**. In the illustrative embodiment the sockets in the electrodes are frusto-conical cavities and the nipple tapers from its longitudinal midpoint toward each end to match the sockets. It will be understood that this invention is applicable to cylindrical nipples as well. Cylindrical nipples are more commonly used for joining amorphous carbon electrodes, while tapered nipples usually are used for graphite electrodes. The size of the nipple desirably will be proportioned to the electrode size to provide maximum mechanical strength as a whole.

The nipple **13** is a carbonaceous body preferably having a composition substantially the same as, or similar to, that of the electrodes which are to be joined. When the electrodes are screwed tightly together on the nipple, the end faces of the electrodes should fit closely and tightly together. This is important to provide a joint of low electrical resistance, to minimize danger of unscrewing under the vibration to which the electrode will be subjected in service, and to reduce the danger of breakage of the electrodes or the nipple under that same vibration. There will, of course, be the conventional slight clearance between the matching threads of the nipple and the electrode sockets. In order to insure a good surface contact between abutting ends of the electrodes there desirably will be a slight clearance between the end faces of the nipple and the bottoms of the electrode sockets when these parts are assembled.

Various ways have been suggested heretofore for providing electrode connecting nipples, or the electrode sockets, or both with reservoirs to contain material for bonding the electrodes to the nipple and to each other. It is believed that none of the prior constructions conveniently assures a uniformly desirable distribution of the bonding material between the nipple and the walls of the electrode sockets. The construction of the present invention provides the bonding material at the engaging threaded surfaces between the nipple and each electrode socket, and extending entirely around the nipple.

Figure 1 shows two electrodes **11** and **12** connected by a nipple **13** embodying the present invention, this being a view before the joint has been subjected to heat such as will cause the bonding material to melt, flow and carbonize. Located between the longitudinal center of the nipple and each end face thereof are circumferential reservoirs containing bonding material, as indicated at **14**. These reservoirs preferably are formed before the nipple is threaded, but cutting circumferential grooves in the nipple blank and filling these grooves with bonding material.

Figure 2 shows a nipple blank **15** in which the circumferential grooves **16** have been cut. This operation may be performed by placing the nipple blank in a lathe and using a cutting tool similar to that illustrated at **17**. The transverse sectional shape of the grooves **16** should be such as will hold the bonding material firmly and may vary from that illustrated. The dimensions of the grooves should be such as to provide reservoir space for sufficient

bonding material substantially to fill the gaps, or clearance, between the threaded surfaces of the nipple and the sockets. Merely by way of example, and without limitation, dimensions for one particular nipple used for joining 14 inch electrodes will be given. The nipple was about 12¼ inches long, about 6½ inches in diameter at its ends, and about 8⅛ inches in diameter at its center. One groove was cut about 1¾ inches from each end of the nipple and these grooves were approximately ½ inch wide and ⅝ inch deep. Obviously the dimensions of the nipple and the number and dimensions of the grooves may be varied from these figures.

After the grooves have been cut in the nipple blank they will be filled with suitable bonding material. This bonding material may be a pitch derived from petroleum, coal tar, or natural asphalts, or a combination of two or more of these pitches. Desirably this bonding material will become liquid at a temperature somewhere between 100° C. and 200° C., begin to carbonize at about 400° C., and become completely carbonized at about 600° C. One bonding material which has been employed is known as Barrett #30 medium pitch, which has a melting point of about 100° C. and benzol insoluble of 30 percent. The bonding material should be capable of being machined at reasonable speeds, and if found too brittle for thread cutting at the desired speed may be made tougher and more resilient by the addition of a small amount of asphalt or other plasticizing material.

The circumferential grooves in the nipple blank may be filled by the use of suitable pouring molds. Figure 3 illustrates, merely by way of example, a cup mold 19 which fits over one end of the nipple blank and is provided with a pour hole 20 through which bonding material may be poured into the circumferential groove in the nipple blank. The mold should be made of material to which the bonding material will not strongly adhere, for example an alloy of aluminum or magnesium. Figure 3 shows the nipple blank with the grooves filled with bonding material 14 and it will be evident that the longitudinal surface of the nipple blank is smoothly continuous and comprises bands of carbonaceous material, from which the blank is made, alternating with bands of the bonding material.

After the circumferential grooves in the nipple blank have been filled with bonding material the blank will be placed in a lathe and threaded in known manner to match the electrode sockets. Since the circumferential grooves cut in the blank have been completely filled with bonding material, the finished nipple will have a continuous threaded surface from end to end, as shown in Figure 1.

In making electrode joints with the nipple of the present invention no special practices or precautions are necessary. The electrodes are provided with threaded sockets in the usual manner and are merely screwed onto the ends of the nipple in the same manner that would be done with a nipple made entirely of carbonaceous material. As this electrode joint is fed gradually into the furnace the temperatures in the joint will increase until the bonding material melts and flows downwardly in the clearance space between the threads of the nipple and the electrode sockets around the entire circumference of the nipple. Upon being subjected to still higher temperatures the bonding material, now well distributed over the nipple surface, and possibly having entered to some extent between the contacting faces of the ends of the electrodes, will be carbonized to form a permanently tight union between the electrodes and the nipple.

The invention herein disclosed may be variously modified and embodied within the scope of the subjoined claims.

I claim:

1. A nipple for joining two carbonaceous electrodes which have axially disposed threaded sockets in the ends thereof, the nipple comprising a carbonaceous body having circumferential grooves therein, the said grooves being filled with bonding material which is solid and capable of being machined at atmospheric temperatures, but which will melt, flow and carbonize under the expected temperatures to which the joined electrodes will be subjected, the longitudinal surface of the nipple, comprising alternating bands of carbonaceous material and bonding material, being continuously threaded from end to end to match the sockets in the electrodes.

2. A nipple for joining two carbonaceous electrodes which have axially disposed threaded sockets in the ends thereof, the nipple comprising an externally threaded carbonaceous member fitting the threaded sockets in the electrodes so as to draw them snugly into end-to-end relation when they are screwed together on the nipple, the said carbonaceous member having a circumferential groove located between the longitudinal center thereof and each of its end faces, these grooves containing bonding material which is solid at atmospheric temperatures but which will melt, flow and carbonize under the expected temperatures to which the joined electrodes will be subjected, so as to bond the joined electrodes together in non-loosening relation.

3. A nipple for joining two carbonaceous electrodes which have axially disposed threaded sockets in the ends thereof, the nipple comprising an externally threaded carbonaceous member fitting the threaded sockets in the electrodes so as to draw them snugly into end-to-end relation when they are screwed together on the nipple, the said carbonaceous body having a plurality of circumferential grooves filled with bonding material which is solid at atmospheric temperatures, but which will melt, flow and carbonize under the expected temperatures to which the joined electrodes will be subjected, so as to bond the joined electrodes together in non-loosening relation.

4. A nipple for joining two carbonaceous electrodes which have axially disposed, threaded, frusto-conical sockets in the ends thereof, the nipple comprising a carbonaceous body tapering downwardly from its longitudinal midpoint toward each end, an annular reservoir in each tapered surface of the nipple filled with bonding material which is solid at atmospheric temperatures, but which will melt, flow and carbonize under the expected temperatures to which the joined electrodes will be subjected, the longitudinal surface of the nipple being continuously threaded from end to end to match the sockets in the electrodes.

References Cited in the file of this patent

UNITED STATES PATENTS

2,482,176	Hamister	Sept. 20, 1949
2,510,230	Johnson	June 6, 1951