No. 785,832. PATENTED MAR. 28, 1905.

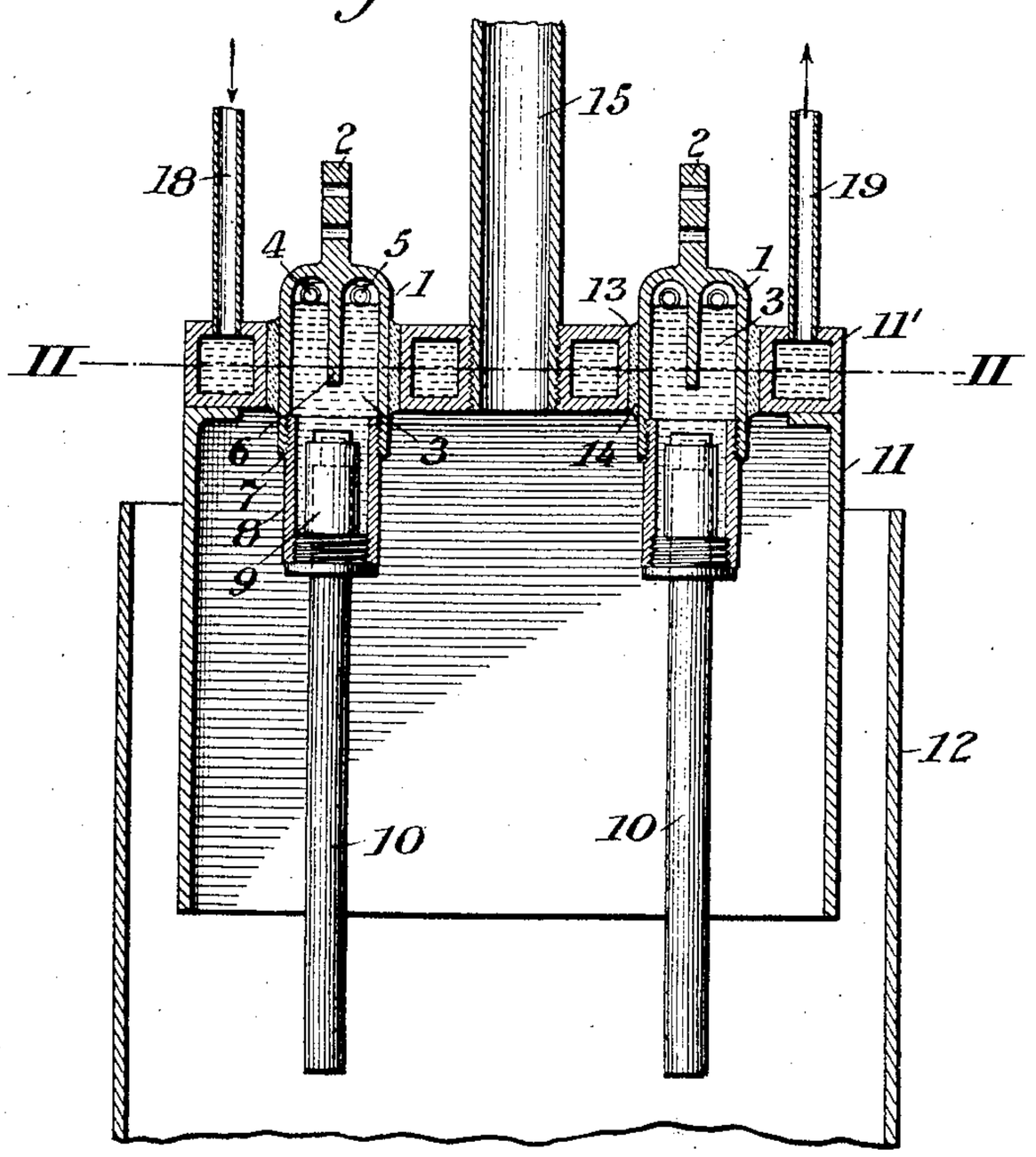
E. F. PRICE, G. E. COX & J. G. MARSHALL.

ELECTRODE FOR ELECTRIC FURNACES.

APPLICATION FILED OCT. 19, 1903.

2 SHEETS—SHEET 1.

Fig. 1.



III *Fig. 2.*

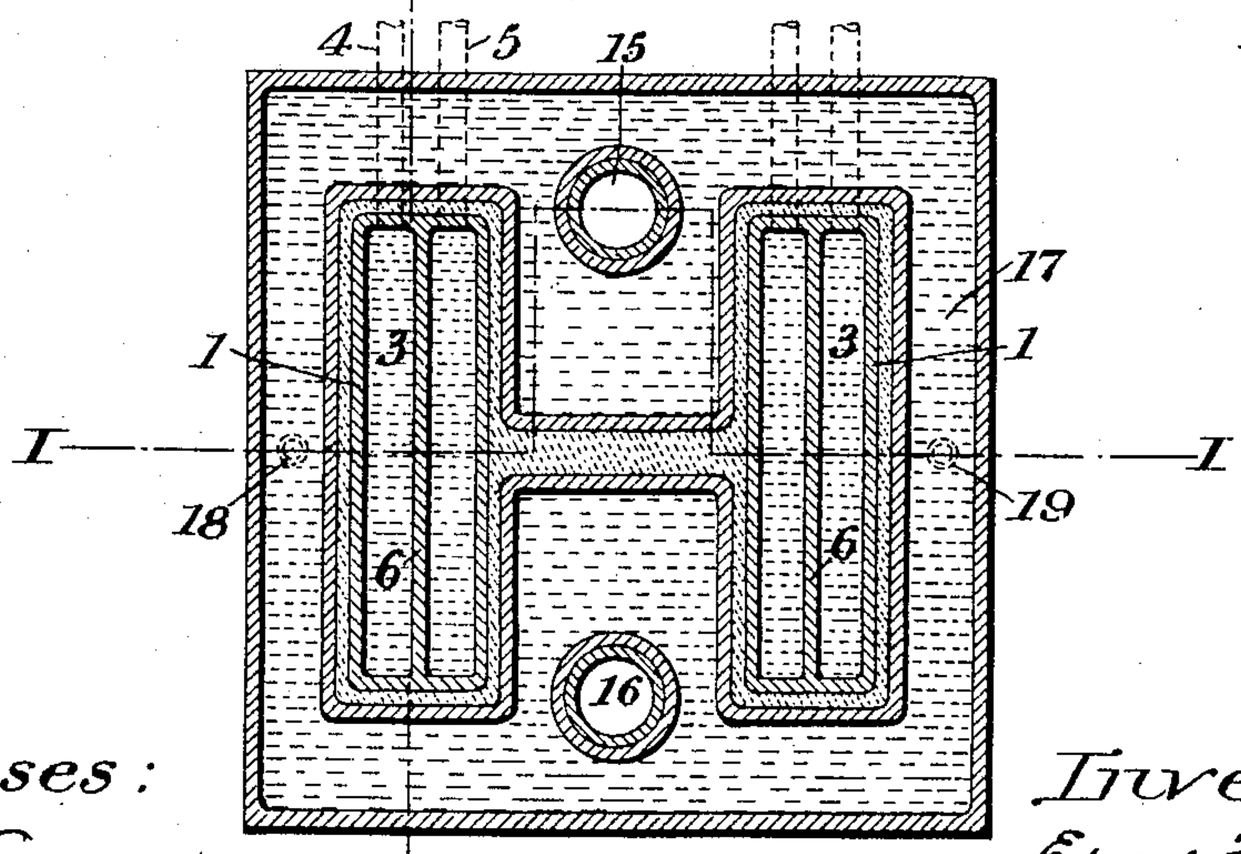


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Fig. 3.

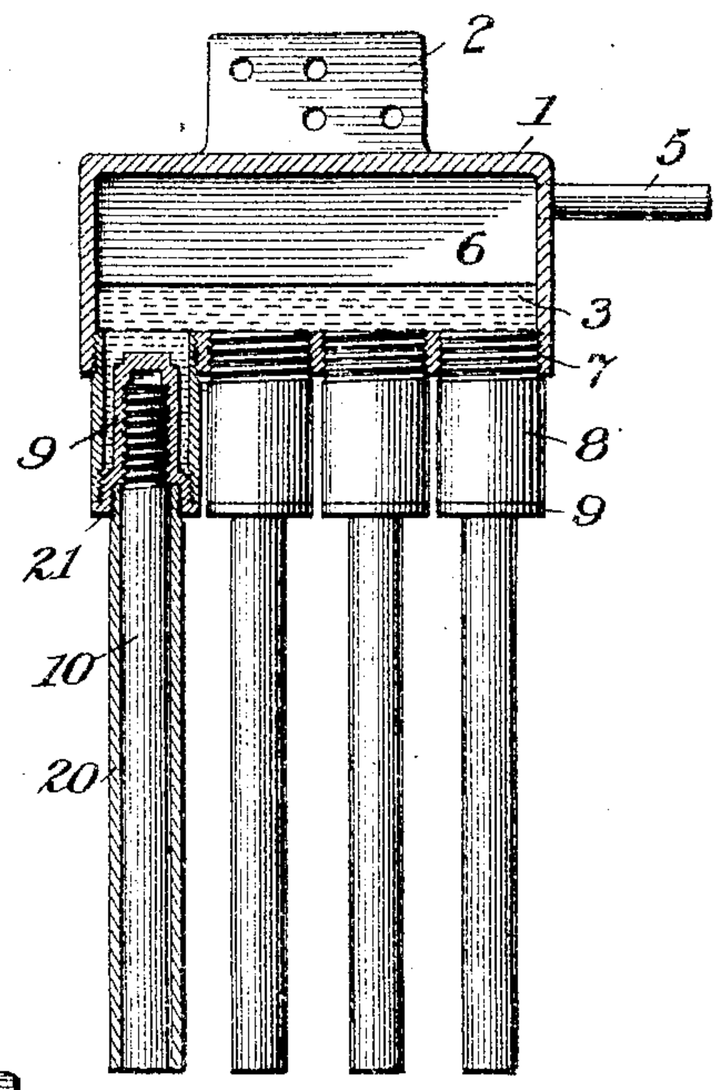


Fig. 4.

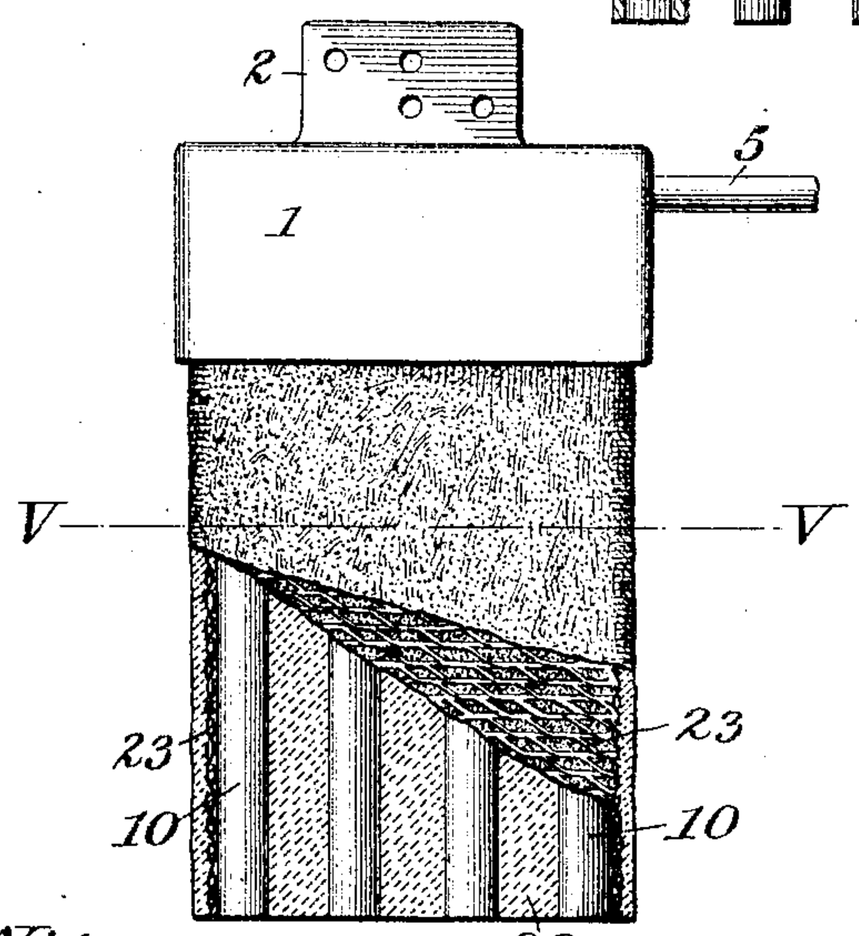
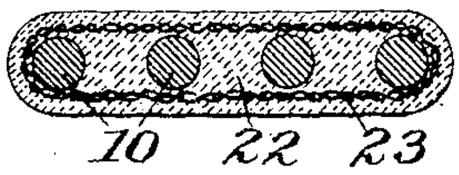


Fig. 5.



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UNITED STATES PATENT OFFICE.

EDGAR F. PRICE, GEORGE E. COX, AND JAMES G. MARSHALL, OF NIAGARA FALLS, NEW YORK, ASSIGNORS TO UNION CARBIDE COMPANY, OF NIAGARA FALLS, NEW YORK, A CORPORATION OF VIRGINIA.

ELECTRODE FOR ELECTRIC FURNACES.

SPECIFICATION forming part of Letters Patent No. 785,832, dated March 28, 1905.

Application filed October 19, 1903. Serial No. 177,607.

To all whom it may concern:

Be it known that we, EDGAR F. PRICE, GEORGE E. COX, and JAMES G. MARSHALL, citizens of the United States, residing at Niagara Falls, in the county of Niagara and State of New York, have invented certain new and useful Improvements in Electrodes for Electric Furnaces, of which the following is a specification.

This invention especially relates to the electrodes which are used in electric furnaces for the production of calcium carbid. These electrodes usually consist of a series of carbon rods secured at their upper ends in an iron head which constitutes the terminal of the electrode. It has been found advantageous to use artificial graphite rods in these carbid-furnaces in place of the usual carbon rods on account of the high electrical conductivity, uniform composition, and durability of the graphite. This graphite, however, presents the disadvantage that it unduly transmits heat from the zone of reaction upward to the metallic holder.

One of the features of this invention is an electrode-holder having a water-chamber and sockets for each of the graphite rods which are movably secured in the holder and project into the water-chamber, the water serving to reduce the temperature of the metal parts. This water-cooled holder is preferably employed in connection with a hood having a water-cooled top, the top having openings in which the holders are adjustably arranged.

The high specific electrical conductivity of graphite permits the use of electrode-rods of materially smaller cross-section than that of the ordinary carbon rods. Graphite rods of a thickness reduced in proportion to the increased current density are, however, mechanically weak and will break if merely substituted for the carbon electrodes of a calcium-carbid furnace. Furthermore, the thin graphite rods are readily oxidized by the atmosphere on account of the high temperature to which they are raised in use. It has therefore been found necessary to mechanically reinforce and strengthen the graphite electrodes and to protect them from oxidation. The preferred means for effecting these results is a filling of refractory cement placed between and around the rods, a support of thin foraminous metal being embedded in the cement. It is sometimes desirable to protect one or more of the front rods of each electrode, which are more exposed to air, by coating the rod with tar and pushing on it a closely-fitting iron sleeve, the upper end of which may be screwed into a socket in the electrode-holder.

The invention will be readily understood by reference to the accompanying drawings, in which—

Figure 1 is a vertical transverse section through a pair of electrodes supported in the hood of a calcium-carbid furnace, the section being taken on the line I I of Fig. 2. Fig. 2 is a horizontal section through the top plate of the hood, taken on the line II II of Fig. 1. Fig. 3 is a vertical longitudinal section through one of the electrode-holders, showing a metal sheath in section upon one of the electrode-rods. Fig. 4 is a side elevation of an electrode, partly in section to show the filling of refractory cement and the support of foraminous metal; and Fig. 5 is a horizontal section through the electrode on the line V V of Fig. 4.

The electrode-holder consists of a head 1, of cast-iron, having a perforated lug 2, which serves as a terminal and support for the electrode. Within the holder is a water-chamber 3, having supply and discharge pipes 4 5. A longitudinal depending baffle 6 extends from the top nearly to the bottom of the water-chamber. A number of threaded openings 7 extend through the lower wall of the head 1, and each of these openings receives a nipple 8. An electrode-socket 9 is threaded into the lower end of each nipple and projects upward within the nipple, leaving an intermediate space for the circulation of water. The upper end of each graphite electrode-rod 10 is threaded and screwed into one of these sockets, making good electrical contact with it. The length of the depending nipples makes it possible to use short electrode-rods, thus de-

creasing the length of the stubs which remain when the rods have been consumed as far as possible and enabling a greater percentage of the length to be utilized. The stubs may also be threaded together and used for the electrode-rods.

The well-known Horry furnace for the production of calcium carbid employs a hood which receives the electrodes and depends into the working chamber of the furnace. One of these hoods 11 is shown in section in Fig. 1 depending into the working chamber 12 of the furnace. A pair of electrodes is shown, the holder of each electrode extending through an opening 13 in the top plate 11′ of the hood. The space between the electrode-holders and the top plate is filled with a luting 14, of refractory cement. A pipe 15 for supplying the furnace charge of lime and coke opens through the top plate at the rear, and a pipe 16 for removing the waste gases leads from the top plate at the front. To assist in removing the heat from the electrode-holders, as well as to reduce the temperature of the hood itself, it has been found desirable to make the top plate 11′ of cast-iron, with an internal water-chamber 17, having a supply-pipe 18 and a discharge-pipe 19.

One or more of the electrode-rods may be inclosed in a closely-fitting iron sheath 20, as shown in Fig. 3. The graphite rod is preferably coated with tar before being pushed into the sleeve. Air is thus entirely excluded from the surface of the rod. The upper end of the sleeve 20 may be threaded into a counterbore 21 in the lower end of the corresponding socket 9. The electrode-rods are mechanically reinforced and strengthened and at the same time protected from oxidation by a body 22 of refractory cement of relatively high resistance, which is filled between and around the rods. This cement may consist of ordinary asbestos or furnace-cement mixed with ground bituminous coal and siloxicon. To strengthen the body of cement and prevent it from scaling off from the rods when heated, a support 23, of thin foraminous metal, such as "expanded iron," is wrapped around the rods and plastered over with the cement.

This invention makes it possible to use graphite electrodes in a calcium-carbid furnace. The greater cost of the graphite is offset by the reduction in the thickness and length of the electrode-rods. The thin rods are efficiently strengthened and protected from oxidation by the reinforcing-body of cement. The water-cooled holders and electrode-sockets prevent the metal parts from burning out, and the long socket-nipples decrease the stub waste of the electrodes. The electrodes and holders will be found useful in electric furnaces for other purposes than the production of calcium carbid.

We claim—

1. An electric furnace having an opening, an electrode having a holder in said opening, means for directly cooling said holder, and means for cooling that portion of the furnace adjacent to said opening and thereby indirectly cooling said holder, as set forth.

2. In an electric furnace, a hood having an opening, an electrode having a holder in said opening, means for directly cooling said holder, and means for cooling that portion of the hood adjacent to said opening and thereby indirectly cooling said holder, as set forth.

3. An electric furnace having an opening, an electrode having a holder passing loosely through said opening, a refractory luting around said holder, means for directly cooling said holder, and means for cooling that portion of the furnace adjacent to said opening and thereby indirectly cooling said holder, as set forth.

4. In an electric furnace having a working chamber, a hood depending into said chamber, an electrode or electrodes within the hood, electrode-holders passing loosely through openings in the top of the hood, means for cooling said holders, and a refractory luting between said holders and the top of the hood, as set forth.

5. In an electric furnace having a working chamber, a hood depending into said chamber, an electrode or electrodes within said hood, each electrode comprising a plurality of graphite rods, a holder receiving said rods and passing through an opening in the top of the hood, and means for cooling said holder, as set forth.

6. In an electric furnace having a working chamber, a hood depending into said chamber and means for cooling the top of said hood; an electrode or electrodes within the hood, electrode-holders passing loosely through openings in the top of the hood, means for cooling said holders, and a refractory luting between said holders and the top of the hood, as set forth.

7. In an electric furnace having a working chamber, a hood depending into said chamber and means for cooling the top of said hood; an electrode or electrodes within said hood, each electrode comprising a plurality of graphite rods, a holder receiving said rods and passing through an opening in the top of the hood, and means for cooling said holder, as set forth.

8. An electrode, comprising a series of carbon rods, a holder having an internally-threaded socket for each rod, and means for cooling said holder and sockets, as set forth.

9. An electrode, comprising a series of carbon rods, a holder having an internally-threaded socket for each rod, and a water-chamber in said holder and arranged to cool each socket, as set forth.

10. An electrode, comprising a series of carbon rods, a holder having a socket for each rod, and a baffled water-chamber in said holder and receiving each socket, as set forth.

11. An electrode-holder, sockets for the

electrodes removably secured in said holder, and a water-chamber in said holder and receiving each socket, as set forth.

12. An electrode-holder, having a water-chamber, a nipple or nipples opening into said chamber, and an electrode-socket in each nipple with a space between it and the nipple, as set forth.

13. An electrode-holder, having a water-chamber with a depending baffle, a nipple or nipples opening into said chamber, and an electrode-socket in each nipple with a space between it and the nipple, as set forth.

14. An electrode, comprising a series of carbon rods, a holder for said rods, and a reinforcing-body of refractory cement of relatively high resistance between said rods, as set forth.

15. An electrode, comprising a series of carbon rods, a holder for said rods, and a reinforcing and protecting body of refractory cement of relatively high resistance between and around said rods, as set forth.

16. An electrode, comprising a series of carbon rods, a holder for said rods, a body of refractory cement between and around said rods, and a support of foraminous metal in said cement, as set forth.

17. An electrode, comprising a series of carbon rods, a holder for said rods, means for cooling said holder, and a reinforcing-body of refractory cement of relatively high resistance between said rods, as set forth.

18. An electrode, comprising a series of carbon rods, a holder for said rods, means for cooling said holder, and a reinforcing and protecting body of refractory cement of relatively high resistance between and around said rods, as set forth.

19. An electrode, comprising a series of graphite rods, a holder for said rods, means for cooling said holder, and a reinforcing and protecting body of refractory cement between and around said rods, as set forth.

20. An electrode, comprising a holder having a water-chamber, nipples opening into said chamber, a socket in each nipple with a space between it and the nipple, an electrode-rod depending from each socket, and a body of cement between and around the electrode-rods, as set forth.

21. An electrode, comprising a holder having a water-chamber, nipples opening into said chamber, a socket in each nipple with a space between it and the nipple, a graphite electrode-rod depending from each socket, and a body of cement between and around the electrode-rods, as set forth.

22. An electric furnace having an electrode projecting into the working chamber and comprising one or more carbon rods, a holder for said rods, and a metal sheath closely fitting upon and protecting the projecting portion of one or more of said rods, as set forth.

23. An electrode, comprising one or more carbon rods, a holder for said rods, a metal sheath closely fitting one or more of said rods, and a carbonaceous cement between said rod and sheath, as set forth.

24. An electrode, comprising a plurality of graphite rods, and means for mechanically reinforcing the rods and protecting them from oxidation, as set forth.

25. An electrode, comprising a water-jacketed holder, a plurality of graphite rods, and means for mechanically reinforcing the rods and protecting them from oxidation, as set forth.

26. An electrode, comprising a water-jacketed holder having depending nipples, a graphite rod secured in each nipple, and means for mechanically reinforcing the rods and protecting them from oxidation, as set forth.

27. An electrode, comprising one or more graphite rods, a holder having an internally-threaded socket for each rod, and means for cooling said holder and sockets, as set forth.

28. An electrode, comprising a series of graphite rods, a holder having an internally-threaded socket for each rod, and a water-chamber in said holder and arranged to cool each socket, as set forth.

29. An electrode, comprising a series of graphite rods, and a holder having a separate internally-threaded socket for each rod, as set forth.

30. An electrode, comprising a series of graphite rods, a holder for said rods, and a reinforcing-body of refractory cement between said rods, as set forth.

31. An electrode, comprising a series of graphite rods, a holder for said rods, and a reinforcing and protecting body of refractory cement between and around said rods, as set forth.

32. An electrode, comprising a series of graphite rods, a holder for said rods, a body of refractory cement between and around said rods, and a support of foraminous metal in said cement, as set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

EDGAR F. PRICE.
GEORGE E. COX.
JAMES G. MARSHALL.

Witnesses:
CHARLES E. BILLINGS,
EDW. J. SCHNEIDER.