

Nov. 20, 1928.

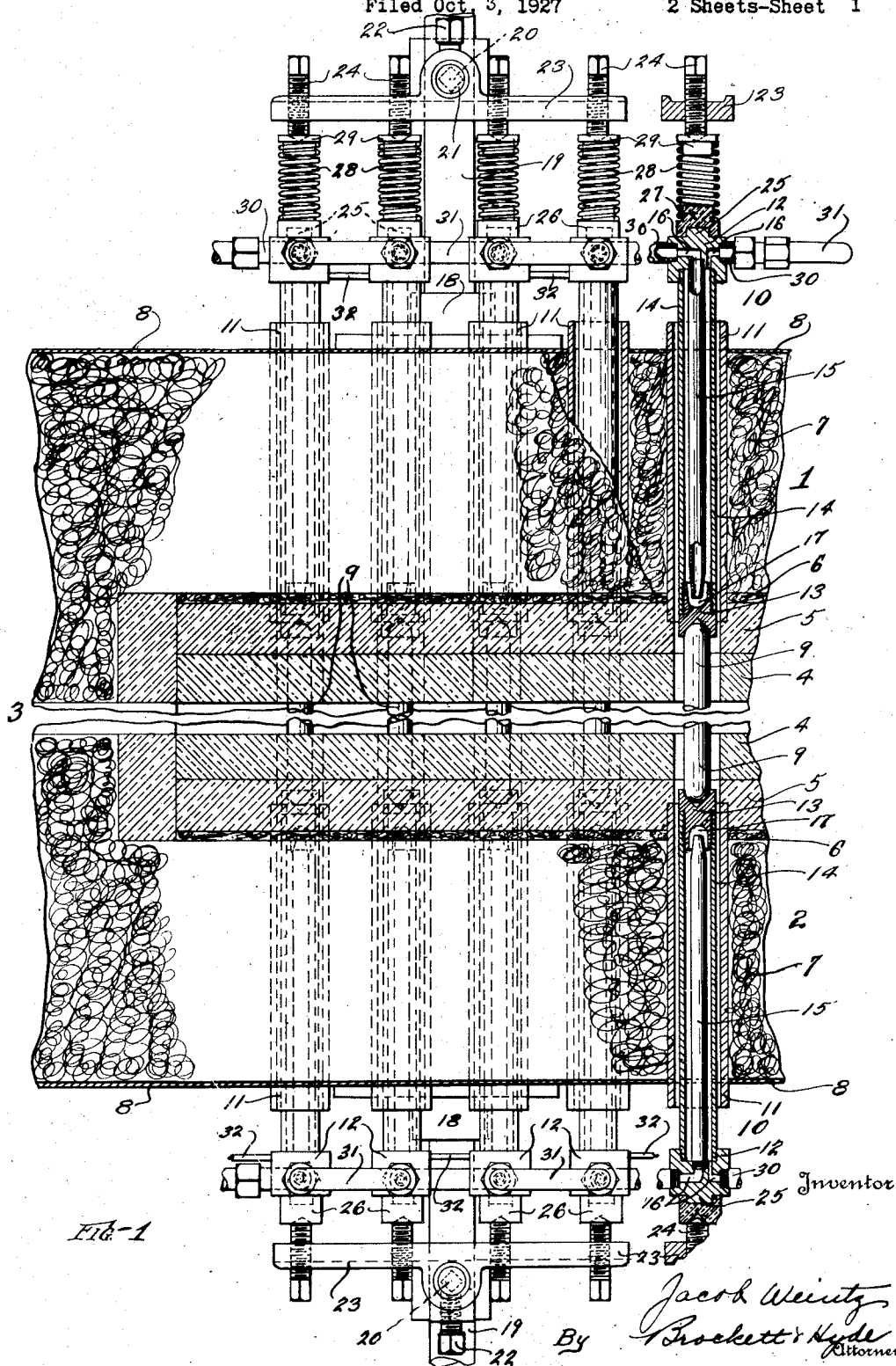
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ELECTRIC FURNACE

Filed Oct. 3, 1927

2 Sheets-Sheet 1



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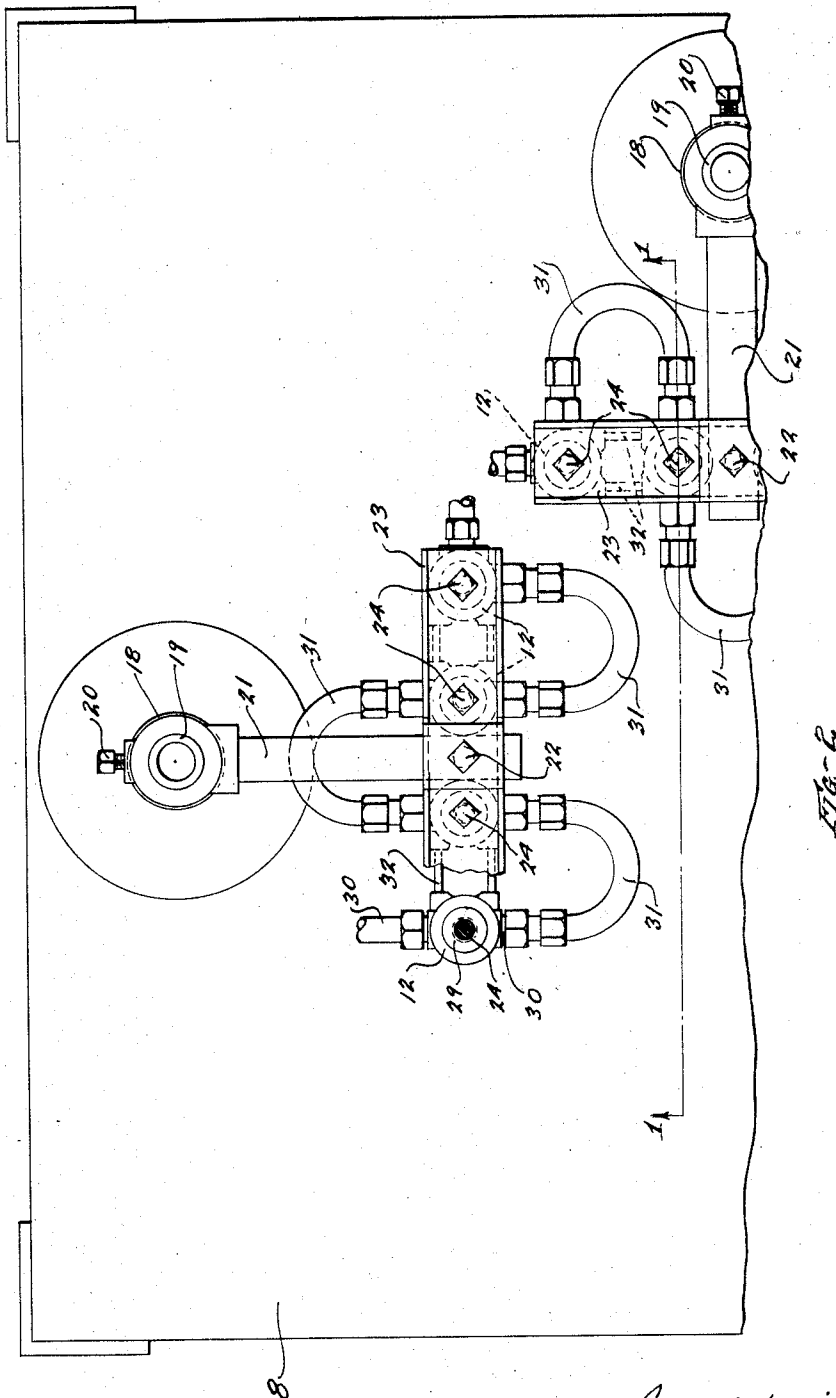
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## UNITED STATES PATENT OFFICE.

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## ELECTRIC FURNACE.

Application filed October 3, 1927. Serial No. 223,800.

This invention relates to electric furnaces of the type employing as heating elements pencils of non-metallic or carboniferous materials and known to the trade as glow bars, the heating elements being adapted to become incandescent and radiate intense heat upon passage of suitable electric current therethrough.

The heating elements are ordinarily of uniform sectional dimension so that they will heat uniformly throughout their length, and are ordinarily supported extending each between a pair of positioning members which may lie within the furnace and which serve as contactors through which the current is led to the heating elements. The contactors are therefore subjected directly to the furnace temperature, or to the heating element temperature at least at the surfaces of contact, with a resulting tendency to oxidize or burn. Where oxidation thus occurs the resistance at the point of contact is increased, and the local over-heating aggravated until a point is reached where sufficient current flow cannot take place to properly heat the heating element which thereupon ceases to function as desired. It is common in a rectangular furnace to arrange a bank of heating elements electrically connected in series, along each side and the rear wall thereof, and to employ a three phase current and pass one phase through each bank. With such arrangement imperfect connection of any heating element will affect the current flow through all heating elements of its bank. Further, the heating elements are fragile and, as manufactured, vary somewhat in length.

The objects of my invention are to provide a means for cooling the contactors whereby oxidation thereof is eliminated; and to provide a means of supporting each bank of heating elements adjacent its wall of the furnace whereby the elements are electrically in series relation, regardless of variations in length thereof, and whereby the same are easily individually removable for replacement.

Further objects and advantages of my invention, together with the exact nature thereof, will appear from the following description taken in connection with the accompanying drawings, in which Fig. 1 is a broken vertical section through a furnace taken generally longitudinally; and Fig. 2 is a plan view of the same portion of the furnace.

In the drawings, 1 and 2 represent generally the top and bottom walls of a furnace, the furnace having an opening on its forward side designated by numeral 3. All of the furnace walls are of generally similar construction, which may comprise a lining 4 of high grade refractory material backed by fire brick 5 about which in succession is a layer of asbestos 6, a thick layer of cheaper heat insulating material 7, and a metallic casing 8. Vertically extending adjacent the side and rear walls of the furnace, and in the spaced relation indicated, are a number of heating elements 9. Each heating element is positioned between a pair of mountings generally designated by the reference numeral 10 extending through tubular liners 11, as of porcelain, in openings through the top and bottom walls respectively of the furnace.

Each heating element mounting comprises a head or base fitting 12 lying outside the furnace and in connection with a contactor or cap fitting 13 within the furnace, by a tubular member or sleeve 14. Each base fitting has a pair of longitudinally aligned cavities formed by a step bore as indicated, each cavity communicating with one of a pair of lateral openings 16. In the larger of the cavities in the base fitting is secured, as by the threaded relation indicated, the sleeve 14 to which reference has been made.

The sleeve extends inwardly through the liner to a connection as by the threads indicated with the cap fitting 13. The inner face of the cap fitting 13 is provided with a deep cavity 17, and the outer face of the cap fitting has a depression to receive as indicated a heating element end, to position the same and make firm contact therewith. In the smaller cavity of the base fitting 12 is secured a tube 15 which extends through the sleeve 14, terminating within the cavity 17, preferably with the nozzle form indicated. By such arrangement, cooling water entering the openings 16 leading to the tube 15 will pass inward through the tube, impinge upon the cap fitting 13 within the cavity 17 thereof, and exhaust outwardly through the annular space between the members 14 and 15, passing out through the opposite openings 16 having communication therewith. The cap

fittings 13 are preferably of copper, having high co-efficients of conductivity both of electricity and of heat, and by the arrangement described a minimum thickness of metal is located between adjacent walls of the cavities 17 and the depressions in which the heating element ends are seated, so that the cap fittings are very efficiently cooled.

The lower heating element mountings 10, Fig. 1, are identical with the upper mountings just described, as indicated in the drawings.

In the furnace shown each of the two sides and the rear wall is provided with a bank of four heating elements. On the furnace casing 8 adjacent the projecting extremities of each bank of heating element mountings is a flanged bracket 18 bearing a column 19. Adjustable on each column as by set screw 20 is a collar having a lateral arm 21. Adjustable on each arm 21 as by set screw 22 is a bus bracket 23 extending in the plane of the adjacent bank of heating elements and bearing a number of set screws 24, one in alignment with each heating element of the corresponding bank.

Each of the base members 12 is provided on its outer surface with a stud 25 on which may be positioned a plug 26 of insulating material. The lower series of fittings 12, i. e. those employed in connection with the mountings 10 projecting through the lower wall of the furnace, are similarly provided each with a plug 26 of insulating material having a depression whereby the same may be seated upon the pointed end of the adjacent set screw 24.

The upper series of plugs 26 are provided with studs 27 adapted to position helical compression springs 28, the opposite ends of which are positioned about similar stud portions and against flange portions of plugs 29. The plugs 29 are provided with depressions similar to those of the lower series of plugs 26 whereby each plug 29 is similarly seated upon one of the upper series of set screws 24.

Each of the openings 16 in the base fittings 12 is provided with a nipple 30 by which connection is had with a length of non-metallic flexible tubing 31. Those lengths of tubing between adjacent fittings 12 are arranged to interconnect the head fittings so that that nipple 30 communicating with the opening 16 leading from the annular space between the members 14 and 15, will lead into the opening 16 in the adjacent head fitting in communication with the tube 15 thereof. The first nipple 30 is arranged for communication with a water supply whereby circulation will be effected through each of the heating element mountings of the series and will overflow out from the last mounting of the series; or in other words, whereby all of the upper mountings are in series as to circulation, and all of the lower mountings similarly arranged.

Extending between and secured with alternate elements of adjacent head fittings 12 are connectors 32 forming electrical leads therebetween whereby electrically each heating element bank comprises four heating elements arranged in series, the circuit including the mountings between which the heating elements are secured.

By the arrangement described, each heating element is firmly positioned between a pair of aligned mountings, one of the mountings being in fixed relation with the other parts of the furnace, the other mounting being yieldably backed by one of the springs 28. Insertion or removal of a complete bank of heating elements may be easily accomplished by moving one of the bus brackets 23 outwards by proper manipulation of the corresponding set screw 20. Such operation, however, is not necessary, as any of the mountings 10 backed by one of the springs 28 may be easily moved against the spring to provide sufficient clearance between the corresponding pairs of cap fittings 13 to allow removal of the heating element therebetween, the adjacent stretch of tubing 31 and of wire 32 being sufficiently flexible to allow such movement.

The springs 28 are of proportions sufficient to accommodate ordinary variations in heating element length; but where abnormal variation is encountered it may be accommodated by manipulation of the corresponding set screws 24 in obvious manner.

What I claim is:

1. In an electric furnace, a heating element mounting, a base fitting secured outside said furnace and adapted for connection with a cooling water system, a contactor fitting adapted to receive and position a heating element end, tubular members secured between said fittings to form a pair of passages for directing flow of said water to and from said contactor fitting, and extending through the furnace wall to position said contactor fitting adjacent the inner surface thereof.

2. A heating element mounting for electric furnaces comprising a base fitting having a pair of cavities and a pair of openings communicating one with each of said cavities and adapted for connection with a cooling water system, a sleeve secured with said fitting with one of said cavities opening into the hollow thereof, a cap closing the opposite end of said sleeve and having a cavity and a surface adapted to contact with a heating element end, and a tube communicating with the other of said base fitting cavities and extending through said hollow and terminating within said cap cavity.

3. In an electric furnace, a bank of heating elements arranged in parallel relation, each extending between a pair of contactors, separate backing means for each set of contactors and secured upon opposite walls of the fur-

nace, and yielding connections between one of said backing means and its set of contactors.

4. In an electric furnace, a bank of heating elements mounted in parallel physical relation, sets of heating element mountings arranged on opposite sides of said furnace to support said heating elements in said ar-

10 rangement, means for electrically connecting said heating elements in series relation, means for cooling each of said mountings and means for connecting the mountings of each set in series relation in a cooling system.

In testimony whereof I hereby affix my signature.

JACOB WEINTZ.