G. E. COX.

FLEXIBLE CONNECTION FOR ELECTRIC FURNACES.

APPLICATION FILED SEPT. 10, 1918.

1,292,716.

Patented Jan. 28, 1919.

2 SHEETS—SHEET 1.

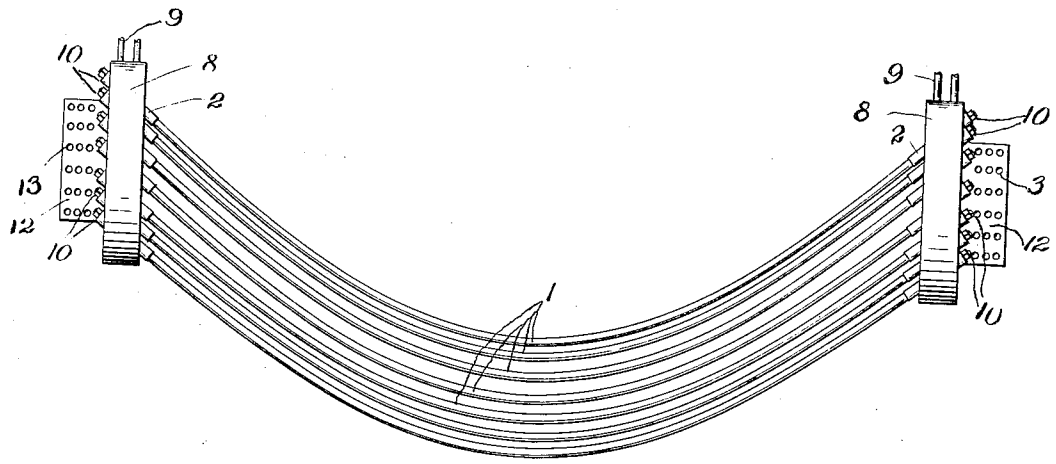
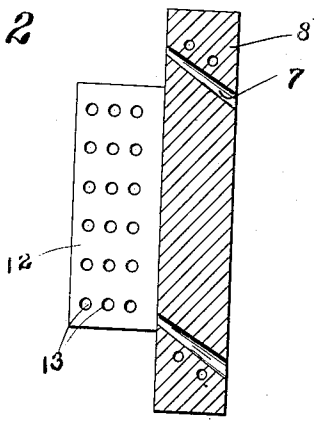


Fig. 1

Fig. 2



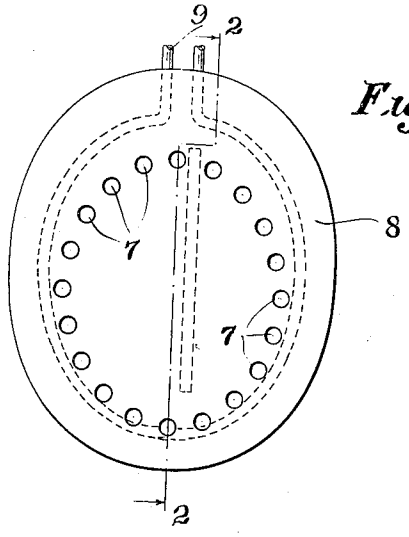


Fig. 3

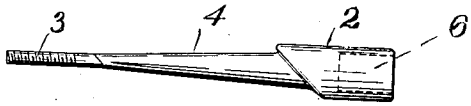


Fig. 4

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2 SHEETS—SHEET 2.

Fig. 5.

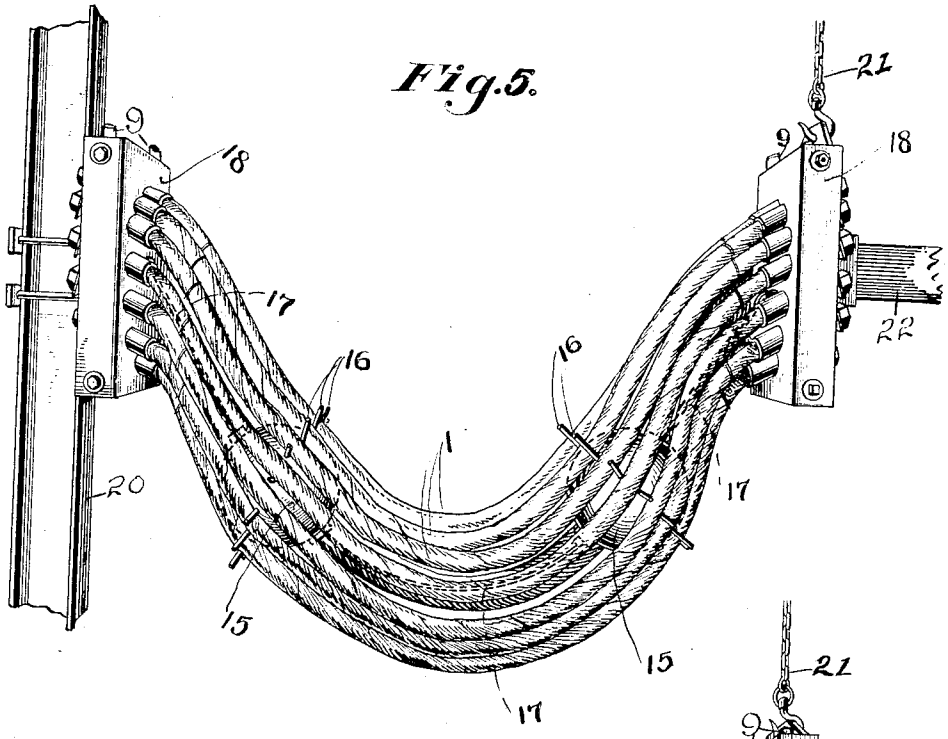
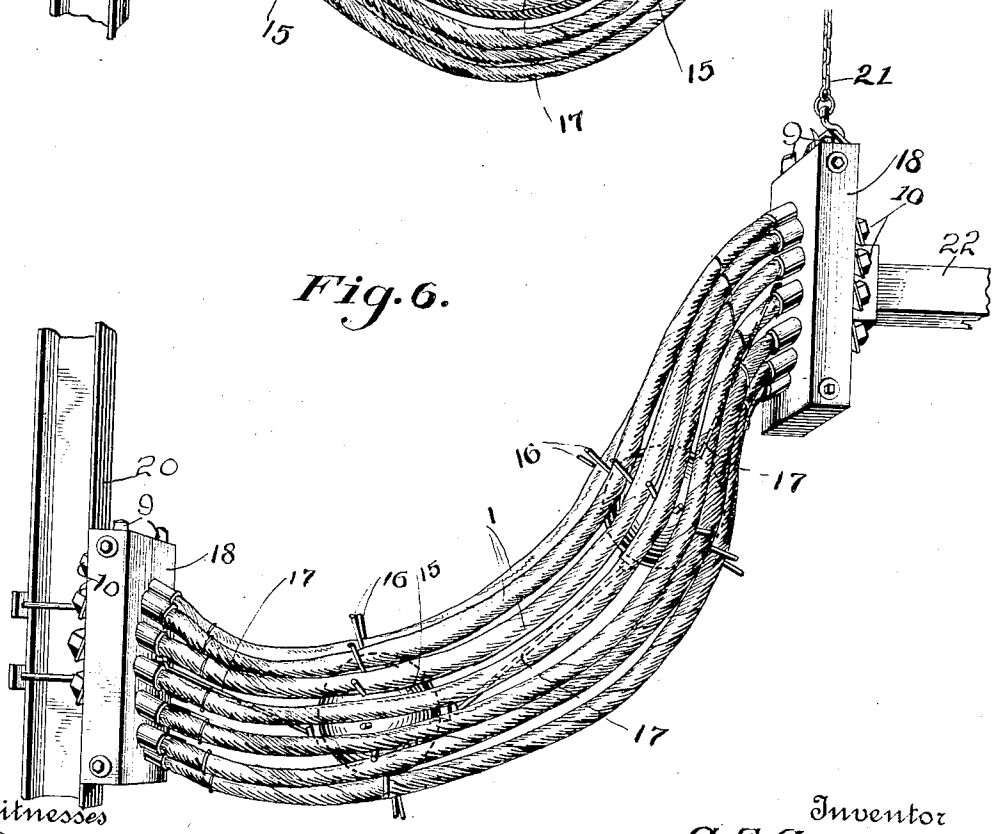


Fig. 6.



Witnesses

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UNITED STATES PATENT OFFICE.

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FLEXIBLE CONNECTION FOR ELECTRIC FURNACES.

1,292,716. Specification of Letters Patent. Patented Jan. 28, 1919.

Application filed September 10, 1918. Serial No. 253,454.

To all whom it may concern:

Be it known that I, GEORGE E. COX, a citizen 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 Flexible Connections for Electric Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to flexible connections for electric furnaces and has for its object to improve and render more efficient the connections heretofore proposed.

With these and other objects in view the invention consists in the novel details of construction and combinations of parts more fully hereinafter described and particularly pointed out in the claims.

Referring to the accompanying drawings forming a part of this specification in which like numerals designate like parts in all the views—

Figure 1 is a diagrammatic elevational view of a flexible connection made in accordance with this invention;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 3, looking in the direction of the arrows;

Fig. 3 is a front elevational view of the parts shown in Fig. 2;

Fig. 4 is a view of one of the contact lugs detached from its cable;

Fig. 5 is a view in perspective of the parts shown in Fig. 1, but employing a somewhat modified form of construction; and—

Fig. 6 is a view of the parts shown in Fig. 5, after one of the contact members has been elevated.

In order that the precise invention may be the more clearly understood it is said:

It is well known in electric furnaces that it is a common practice to lead the current into the hot zone through a carbon electrode because this material withstands the high temperature, or the electric arc, more satisfactorily than any other available material. But most electric furnace reactions are accompanied by a more or less greater consumption of the carbon electrode, due to mechanical disintegration, oxidation, or other chemical reactions taking place in the furnace. It is, therefore, necessary to arrange a progressive feeding of the electrode into the furnace as the carbon is consumed, and at the same time maintain electrical connection between the carbon and the source of energy. This involves the use of some sort of a flexible conductor for carrying this electrical energy.

When furnaces were small, the design and construction of these electrical conductors offered no serious problem, but at the present time furnaces of 25,000 horse power are in operation, necessitating the carrying of currents as high as 75,000 amperes into each electrode. Since the carrying capacity of our available electrical conductors is not unlimited, these larger furnaces have in the past often involved difficult engineering problems in building a flexible conductor of such size as to carry the enormous electric currents involved. But flexible cables are now made capable of carrying these enormous currents and the present invention is directed to the problem of joining said cables with the source of power and with the electrodes.

In the drawings, 1 represents suitable flexible conductors or cables of any convenient number and size. To each end of each conductor there is suitably connected as by welding, brazing, etc., a terminal contact lug 2, provided with the screw threaded end 3, and the tapered shank portion 4. The end of the cable 1 is conveniently received into the socket 6 with which said lug is provided, and the tapered shank 4 is received in a tapered inclined hole 7, with which the contact member or terminal 8 is provided. There are two contact members 8, one for each end of the flexible cables 1, and each contact member which is preferably oval in form is provided with a plurality of holes 7 elliptically or otherwise disposed, and is further provided with a cooling means such as the fluid conveying pipes 9.

After the tapered shanks 4 are introduced into the tapered holes 7, they are forced well home so as to insure a good metallic contact, and are secured in place as by the nuts 10. Each of the contact or terminal members 8, are, or may be, further provided with cable connecting projections or brackets 12, having the holes 13 or other means to facilitate the connections of the electrical leads

thereto. Said brackets 12 may be formed integrally with said terminals 8, or otherwise electrically joined thereto.

It will be observed that each of the holes 7 may be disposed in a direction at right angles to the face of its contact member 8, or at any other inclination, but in large installations, I prefer to incline said holes to such faces at such an angle that their axes prolonged will be tangent to the catenary curve that the cables naturally assume when in their mid positions, so that the pull of said cables will be along said tangent, and thus will not tend to cause said shanks 4 to press more on one side of their respective holes 7 than on another. Further, the pull of each cable being thus in a direction along the axes of its lugs 2, there will be a minimum tendency to rupture the joint between said cable and lugs as well as a minimum tendency for said joints to heat up. The cables 1, of course, can be arranged in any desired relation to each other, but I prefer to arrange them on their terminals 8 in a curve as shown and also to have them of substantially equal length.

In order that the cables may be maintained equally spaced during the up and down movements of the electrode, spacers 15, (see Figs. 5 and 6) made of wood, fiber, or metal or other similar material may be used, but in the case of large conductors, I have found it very advantageous to make these spacers in the form of aluminum spheres or spheroids with suitable projections 16 from their surface to maintain the individual cables in proper position. These spaces, if desired, may be held in place by the wires 17.

In the somewhat modified form of the invention shown in Figs. 5 and 6, the construction is the same as in the preceding figures, except I have shown the contact members 18 as of a rectangular instead of an oval form.

Any suitable supporting means may be employed for the terminals 8 and 18, and in Figs. 5 and 6, I have by way of example shown a stationary support 20 for the stationary contact member or terminal 18, and a chain 21 for the movable member 18. 22 represents a conductor attached to the movable member 18 which may convey current to the movable electrode, not shown.

It will now be clear that by providing the tapered inclined holes 7 and tapered shanks 4, I am enabled to integrally or otherwise join the cables 1 to the members 2 and produce fixed solid immovable and continuous metal joints between the cables 1 and contact members 8 or 18, and which joints are not disturbed in the least when one of said members such as 18 is lowered to the position shown in Fig. 5, and then raised to the position shown in Fig. 6.

The advantages of this construction over previous forms of flexible connections reside partly in the use of conductors of equal length and of heavier individual cables than previously possible. Said construction avoids the complications incident to the use of a large number of smaller cables for the same current capacity. Further, the tapered lugs which can be ground to fit the sockets enable one to obtain a better metallic contact than has previously been possible with the usual flat surface, and this combined with the water cooled contact terminal heads avoids the serious overheating, so common in large furnace installations. By inclining the connections with the contact heads one is also enabled to use shorter cables than has been previously possible, thereby eliminating expensive materials of construction and reducing the reactance of said circuit.

What I claim is:—

1. In a flexible connection for an electric furnace, the combination of a pair of contact members each provided with a plurality of tapered holes; a plurality of lugs having tapered shanks adapted to fit said holes; means for securing said shanks in close metallic contact throughout their length with said contact members; and flexible conductors permanently joined at each end to said lugs, substantially as described.

2. In a flexible electrical connection, the combination of a pair of contact members provided with inclined tapered holes; a pair of lugs provided with tapered shanks adapted to closely fit said holes; means for securing said lugs in said holes; and a flexible conductor permanently connected at each end to said lugs, substantially as described.

3. In a flexible electrical connection, the combination of a pair of contact members one of which is stationary and the other movable, each of said members being provided with inclined tapered holes; a pair of lugs provided with tapered shanks adapted to closely fit said holes; means for securing said lugs in said holes; means for cooling said contact members; and a flexible conductor permanently connected at each end to said lugs, substantially as described.

4. In a flexible connection for an electric furnace the combination of a fixed contact member provided with inclined tapered holes and with means for joining an electric current lead thereto; a movable contact member also provided with inclined tapered holes and provided with means for joining an electric conductor thereto; lugs having tapered shanks fitting said holes; and cables permanently connected at each end to said lugs, substantially as described.

5. In a flexible connection for an electric furnace the combination of a fixed contact

member provided with inclined tapered holes and with means for joining an electric current lead thereto; a movable contact member also provided with inclined tapered holes and provided with means for joining an electric conductor thereto; means for cooling said fixed and movable contact members; means for raising and lowering said movable member; lugs having tapered shanks fitting said holes; and cables permanently connected at each end to said lugs, substantially as described.

6. In a flexible connection for an electric furnace the combination of a pair of water cooled contact members each having a plurality of inclined tapered holes; a plurality of cables between said contact members in the form of curves; and a plurality of tapered lugs fitting said holes the prolongation of whose axes form tangents with said curves, substantially as described.

7. In a flexible connection for an electric furnace the combination of a pair of contact members provided with a plurality of tapered holes; a plurality of cables disposed between said contact members; spacing means between said cables; and a plurality of lugs joined to said cables having tapered shanks adapted to fit said holes, substantially as described.

8. In a flexible connection for an electric furnace the combination of a pair of contact members provided with a plurality of inclined tapered holes; a plurality of cables disposed in curves between said contact members; spacing means provided with projections located between said cables; and a plurality of lugs joined to said cables having tapered shanks adapted to fit said holes and the axes of which when prolonged will make tangents with said curves, substantially as described.

9. In a flexible connection for an electric furnace the combination of a pair of contact members; a plurality of individual conducting cables electrically joined to said members; and a spherical spacing member of aluminum located between said conductors and adapted to hold the latter apart, substantially as described.

10. In a flexible connection for an electric furnace the combination of a pair of contact members; a plurality of uninsulated cables hanging in curves electrically joined to said members; and an aluminum sphere provided with projections located between said cables to hold the same apart, substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

GEORGE E. COX.

Witnesses:
JAMES W. YOUNG,
JOHN J. ELBERT.