June 21, 1932. O. EISENHUT ET AL 1,864,485

ELECTRIC FURNACE INSTALLATION

Filed Jan. 31, 1930

Fig.1

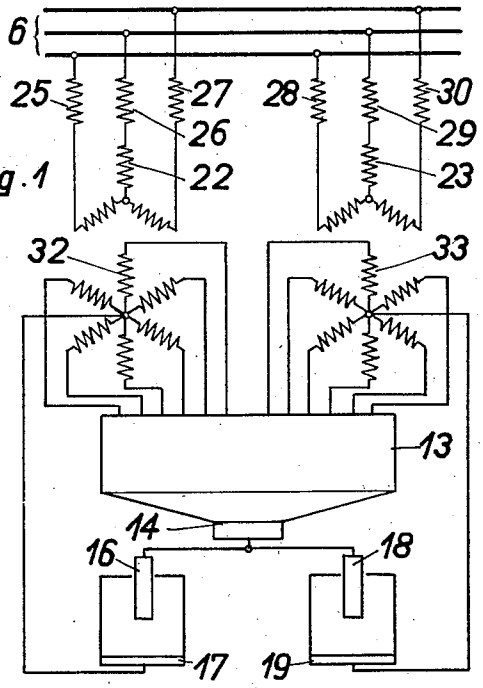


Fig.3

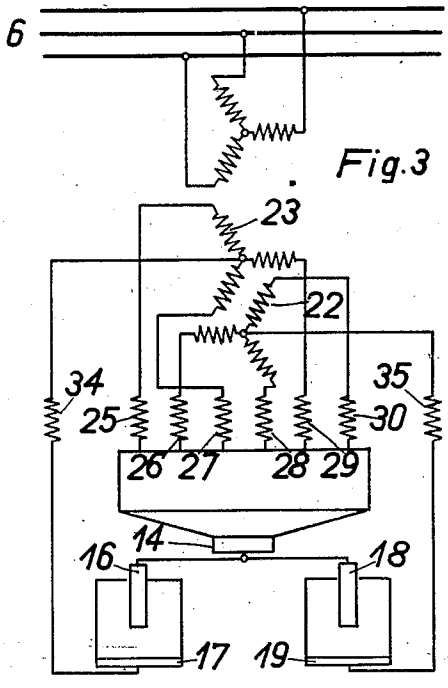
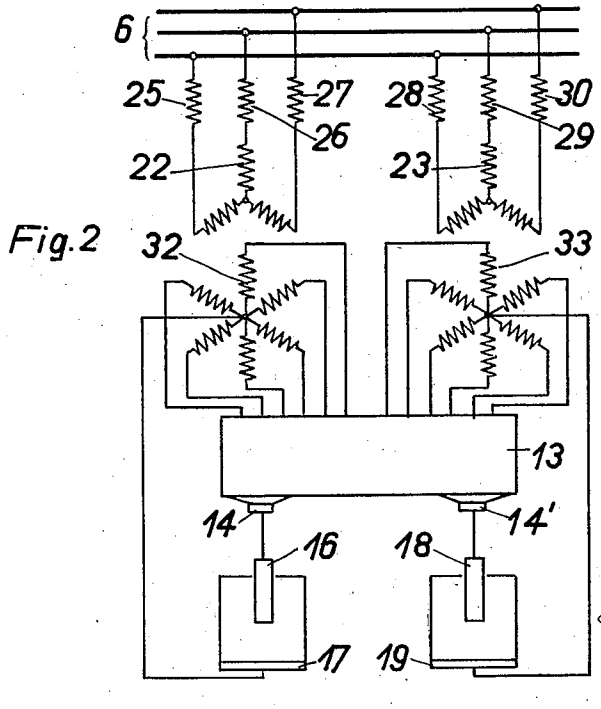


Fig.2



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UNITED STATES PATENT OFFICE

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ELECTRIC FURNACE INSTALLATION

Application filed January 31, 1930, Serial No. 425,006, and in Germany February 4, 1929.

This invention relates to improvements in direct current electric furnace installations, and particularly to such installations as are supplied with current from electric current rectifiers of the metallic vapor type.

Heretofore a single rectifier was connected to supply each furnace unit and, because the furnace units were usually for small loads, to obtain a given load a great number of rectifiers had to be used in connection with a like number of electric furnaces. Such arrangement makes an electric furnace installation uneconomical in operation, and extremely complicated and expensive in construction. A further disadvantage of such arrangement is the fact that the arrangement of a plurality of such furnace and rectifier units requires a great deal of space which is frequently difficult to obtain. It is now, however, possible to construct rectifier units of such size as to be capable of supplying a plurality of furnace units in series at a sufficiently high voltage for heavy loads. It is, however, possible to operate a plurality of furnace units, in parallel, from a single rectifier only by the use of some stabilizing means. A plurality of furnace units may be supplied in parallel from a single current rectifier if the furnace current is supplied over separate current paths provided with stabilizing means such as reactance connected between the transformer supplying the rectifier and the alternating current supply line.

It is, therefore, among the objects of the present invention to provide direct current electric furnace installations utilizing a single electric current rectifier for supplying a plurality of electric furnace units.

Another object of the invention is to provide direct current electric furnace installations in which a single electric current rectifier of the metallic vapor type supplies a plurality of electric furnace units connected in parallel.

Objects and advantages, other than those above set forth will be apparent from the following description taken in connection with the drawing in which:

Fig. 1 diagrammatically illustrates an embodiment of the invention in which the electric furnace units are connected, in parallel, with the electric current rectifier supplying the same,

Fig. 2 diagrammatically illustrates an embodiment of the invention in which separate current paths are provided for a plurality of electric furnace units connected to the same electric current rectifier, and,

Fig. 3 diagrammatically illustrates an embodiment of the invention in which a plurality of electric furnace units are connected in parallel to a single rectifier supplying the same and in which stabilizing means are connected directly with the electric furnace unit.

Referring more particularly to the drawing by characters of reference, in the embodiment shown in Fig. 1 of the drawing in which a parallel connection of furnace units to a rectifying system is shown, the reference numeral 6 indicates an alternating current supply line or other suitable source of supply to which the transformer primary windings 22, 23, are connected to the line 6 through the reactances 25, 26, 27 and 28, 29, and 30.

The transformer secondary windings 32, and 33 are connected with the anodes of the electric current rectifier 13. It will be seen from the arrangement of the primary windings 22 and 23 and the secondary windings 32 and 33, that two separate transformers are provided between the line 6 and the rectifier 13 thereby providing current paths operating in parallel. The electrodes 16, 18 of the electric furnaces are connected with the cathode 14 of the rectifier and the electrodes 17 and 19 are connected to the neutral point of the secondary windings 32, 33 respectively, thereby completing the direct current circuit. Due to the separate current paths, uniting only in the cathode of the rectifier, each of the furnace units operates in a very stable manner because of the inductivity of the transformer arranged therewith and of the reactance coils connected between each transformer and the line. Any suitable number of furnaces may be operated in parallel from one rectifier, it being necessary only to provide the proper number of rectifier anodes. Thus, taking n as the number of furnaces and a three-phase rectifier transformer, the recti-

fier then must have $3n$ anodes. If the transformer is arranged for six phase current, then the rectifier must have $6n$ anodes. It will be understood, of course, that the number of transformers and of reactance coils is determined by the number of furnaces.

It may also be desirable to provide two entirely separated current paths for each furnace, as is illustrated in Fig. 2 in which the rectifier 13 is provided with two cathode portions 14, 14′, each of which is connected to one of the electric units.

A stabilizing means may also be connected in the conductors connecting the neutral points of the transformer secondary with one electrode of the furnace unit as illustrated in Fig. 3 in which reactances 34, 35 are connected between the neutral points of the transformer secondary windings 22 and 23 and the furnace electrodes 17 and 19. In this illustration a six-phase transformer is used and the reactances described heretofore as connected between the primary winding of the transformer and the supply line are illustrated as being connected between the secondary winding and the anodes of the rectifier. It will, of course, be understood, that any one of the well known methods of arranging the secondary windings of a transformer and the anodes of a rectifier may be used and that the neutral point of the secondary windings may be connected by means of an absorption reactance coil, for the purpose of further stabilizing the operation of the furnace.

The embodiments of the invention illustrated and described permit the use of a lesser number of rectifiers for the same furnace load with the attendant saving in expensive equipment and space. The installation is thereby materially simplified.

Although but a few embodiments of the invention have been illustrated and described, it will be understood that various other embodiments are possible, and that various changes may be made without departing from the spirit of the invention or the scope of the appended claims.

The invention claimed is:

1. A direct current electric furnace installation comprising a source of alternating current, a plurality of arc furnaces, a single metal vapour rectifier vessel, a transformer, primary windings on said transformer connected to said source, a secondary winding for each of said furnaces, the neutral point of each of said secondary windings being connected to the cathode of its associated furnace, connections between the outer ends of each of said secondary windings to a separate group of anodes in the rectifier vessel and a connection between the anode of each furnace and a cathode in the rectifier.

2. An electric furnace installation as claimed in claim 1, wherein the anodes of the rectifier are in groups, each group coacting with a separate cathode.

In testimony whereof we have hereunto subscribed our names this 18th day of January, A. D. 1930.

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