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ELECTRIC RESISTANCE FURNACE ADAPTED FOR HEATING BY NITROGENIZATION

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2 Sheets-Sheet 1

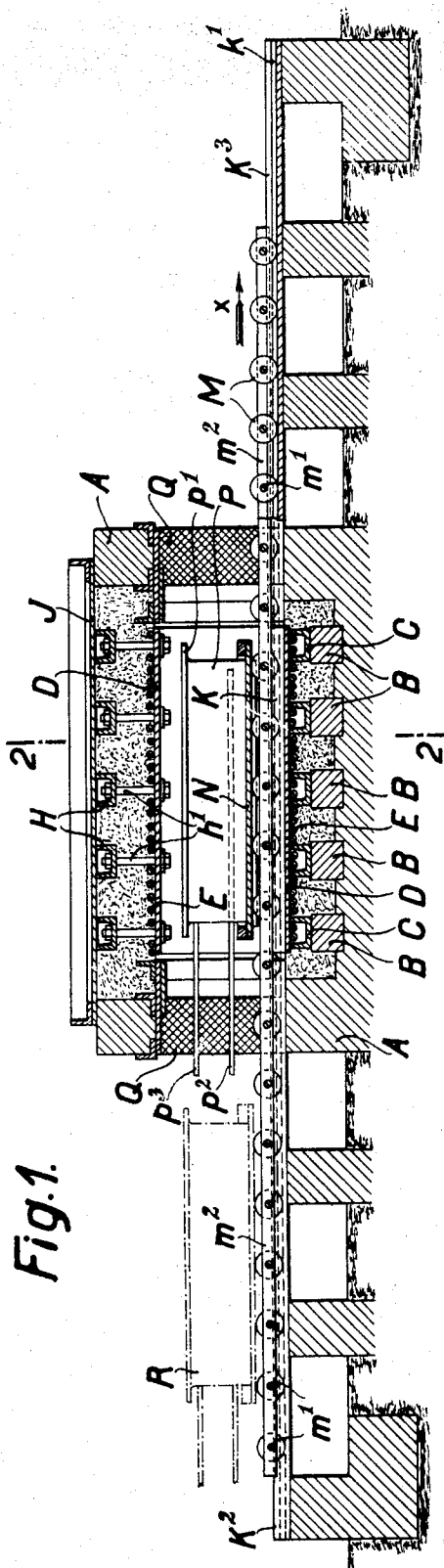


Fig. 1.

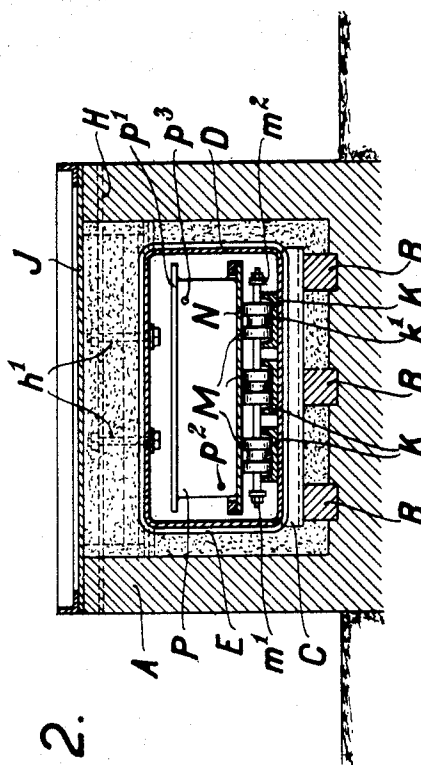


Fig. 2.

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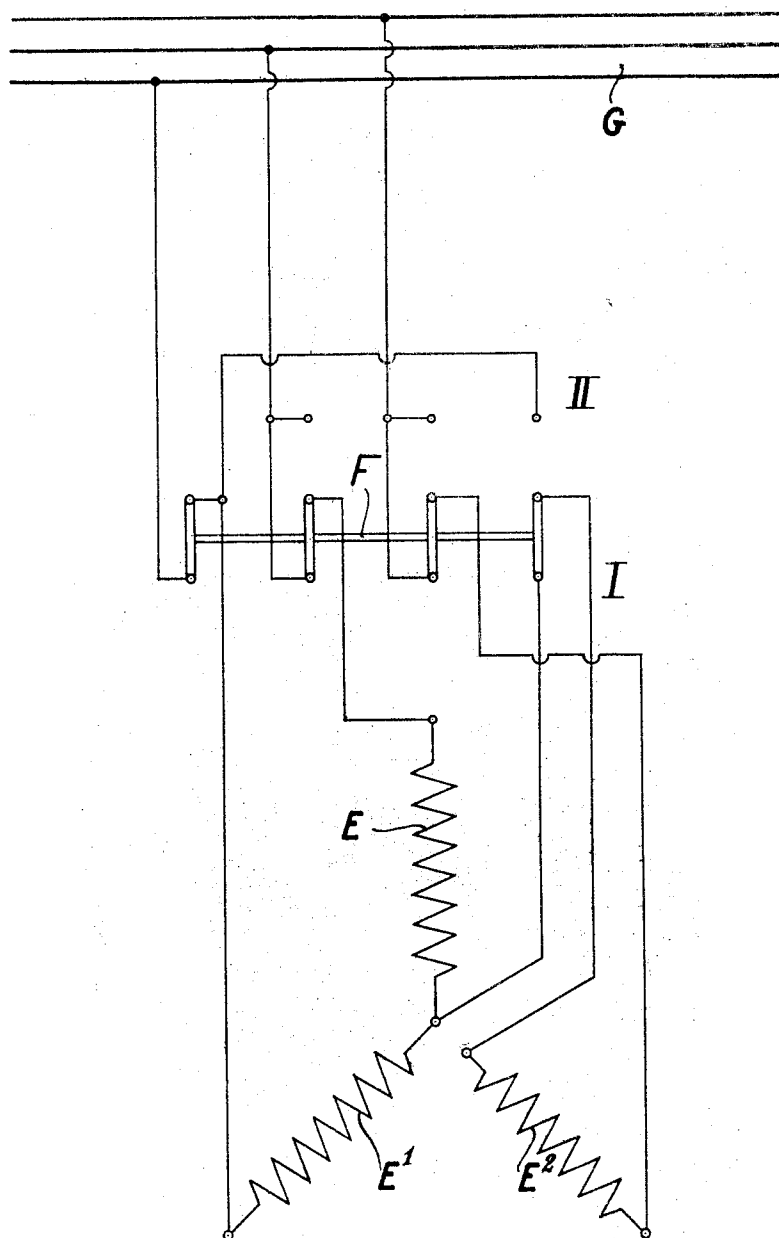
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Fig.3.



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ELECTRIC RESISTANCE FURNACE ADAPTED FOR HEATING BY NITROGENIZATION.

Application filed August 2, 1926, Serial No. 126,650, and in Germany September 4, 1925.

The purpose of the invention is to provide an electrical resistance furnace for hardening by nitrogenization which is characterized by great simplicity of structure, and which can be disassembled to a large extent and attended in a very easy manner.

In order to allow of my invention to be more readily understood, an example of embodiment of the same will now be described in detail with reference to the drawings which accompany and form part of this specification, this embodiment showing a resistance furnace operated by means of three phase current and designed to be used for hardening steel articles by nitrogenization.

In these drawings

Fig. 1 is a longitudinal section through the furnace,

Fig. 2 is a section on line 2—2 of Fig. 1,

Fig. 3 is the corresponding wire diagram.

Referring now first to Figs. 1 and 2, A denotes the brickwork of the furnace into the foundation of which a plurality of pillar blocks B of refractory material are built in. These blocks B form supports for a box D of rectangular cross section which is open at its ends and rests on said blocks B by means of cross carriers C. The box D is made of a heat- and corrosion-proof alloy, for instance a chromium-nickel steel alloy and is provided on its outer surface with insulators (not shown) carrying the heating resistance E which is subdivided so as to form three phase-windings and consists of chromium-nickel-iron wire. The ends of these windings E, E¹, E², Fig. 3, are led out of the furnace through its wall in a suitable manner (not shown) and so connected, by means of a four-pole throw-over switch F, Fig. 3, to a three-phase main G, that in the switch position denoted by I, star connection and in position II series connection of said three phase-windings E, E¹, E² is established.

By means of suitable screw bolts h¹ the box D is suspended from cross carriers H which rest on the side walls of the brickwork. The furnace is covered on the top by an iron cover plate J loosely resting on the brickwork A and after the removal of which the box D together with the carriers H may be removed as a whole. The hollow spaces existing between box D and brickwork A and cover J are filled with kieselguhr, as shown in Fig. 2.

The box D is fitted with a track consisting of three U-iron rails K, see Fig. 2, riveted to the floor of the box, and of guide ribs k¹. Similar tracks K² and K³ projecting into box D through the front openings of the furnace form prolongations of track K, k¹ at both ends of the box and are arranged outside the furnace in the manner shown in Fig. 1. A system of loose double rollers M is adapted to run on the rails K, K², K³, said rollers being interconnected by axles m¹ and lateral frame-plates m² so as to form a moving platform. The length of the whole roller system M m¹ m² is about double and a half the length of the furnace.

A receptacle P, designed to receive the articles to be nitrogenized, is resting, within the heating chamber formed by the box D, through the intermediary of a bottom plate N, on the loose rollers M, an eye serving to attach a wire rope or the like being provided on it. The receptacle P is closed in a gas-tight manner by a cover p¹ and is made of a chromium-nickel-steel alloy having a particularly high resistance to heat and chemical influences. The supply of the gas delivering nitrogen to the receptacle P takes place through a pipe p² passing through one of its front walls and reaching nearly up to the other front wall thereof. A pipe p³ passing through the same front wall serves to lead off the gas. A second, similar receptacle R rests outside the furnace on that portion of the moving platform M m¹ m² which rests on the track portion denoted by K².

The heating chamber of the furnace is shut off from the outer space by loose walls Q which have to be removed before the receptacle P is entered.

The operation of the described resistance furnace takes place as follows.

After the furnace, still empty but closed by the loose walls Q, has been heated up by connecting the resistances E E¹ E² to the three-phase main G with the throw over switch F in position I (star connection), the switch F is turned over into position II, in which the phase windings take only so much current as it is sufficient to maintain the temperature attained by the heating-up operation. The receptacle P which has been filled in the meantime with the articles to be hardened and closed in gas-tight man-

ner, is then entered, after removal of the loose walls Q, into the heating chamber of the furnace. When this takes place, the moving platform displaces itself with half the speed of the receptacle P. After the pipes p^2 and p^3 have been connected to a bottle containing the nitrogenous gas, the furnace is closed again by the loose walls Q. The nitrogenous gas is thereupon supplied to the receptacle P heated by means of the resistances E^1 E^2 . During this operation nitrogen penetrates the articles to be hardened and hardens them. During the period of nitrogenization the second receptacle, R, is put on the track portion K^2 and filled with articles to be hardened. As soon as a sufficient quantity of nitrogen has been supplied to the articles contained in receptacle P and receptacle R has been filled, the loose walls Q are removed. The receptacle P is thereupon shifted in the direction of arrow x , Fig. 1. This motion is taken part in by the moving platform with half the speed, and by the receptacle R with the speed of the receptacle P. When the receptacle R has reached the former position of receptacle P, the latter which now is outside the furnace, is brought to a standstill and the loose walls Q are brought into position again. This done, the articles contained in receptacle R are nitrogenized and receptacle P is emptied and refilled with articles to be hardened, so that it enters the furnace at the same time when receptacle R leaves it. From this time the described operations may be repeated as often as desired. Finally the furnace is thrown out of operation by interrupting the current supply.

The fact that the electric heating body D is capable of receiving a shiftable receptacle enables a great number of articles to be treated at the same time and in a very easy manner. In comparison with receptacles running on wheels the arrangement of the receptacle P and R on the described roller system offers the very important advantage

of the pulling in and out of the filled receptacles taking place in a very easy manner.

By making the heating box and the receptacle of a chromium-nickel-steel alloy which has a high resistance to heat and chemical influences (and might be replaced by any other suitable metal or alloy), not only the life of the heating box and of the receptacles is increased, but also a catalytic decomposition caused by the contact with the heated walls of the receptacle, of the gases delivering nitrogen is prevented.

The extension of the gas supply pipe nearly up to the opposite front wall of the receptacle p , p' , enables the entering gases to be heated gradually, so that only gas which is pre-heated up to the treating temperature comes into contact with the articles to be hardened.

The closure of the receptacles by means of a removable cover offers the advantage, in comparison with the front wall closures hitherto used with resistance furnaces, that the articles to be treated may be more easily set in and out and may be carefully embedded.

Without deviating from the spirit of the invention, the furnace might be closed by sliding doors instead of by loose walls. Furthermore, the described furnace is adapted to be used, instead of the described nitrogenization, for the cementation of steel or for any other heat treatment, for instance for heating articles in an inert gas.

I claim:

In an electric resistance furnace adapted for hardening metals by nitrogenization, a roller system, a nitrogenizing receptacle mounted thereon, and a removable electrically heated casing surrounding said nitrogenizing receptacle and the portion of the roller system which lies within the furnace.

The foregoing specification signed at Cologne, Germany, this 10 day of July, 1926.

ADOLF FRY.