Aug. 11, 1931. W. E. MOORE 1,818,239

ELECTRIC FURNACE

Filed Sept. 25, 1929 2 Sheets-Sheet 1

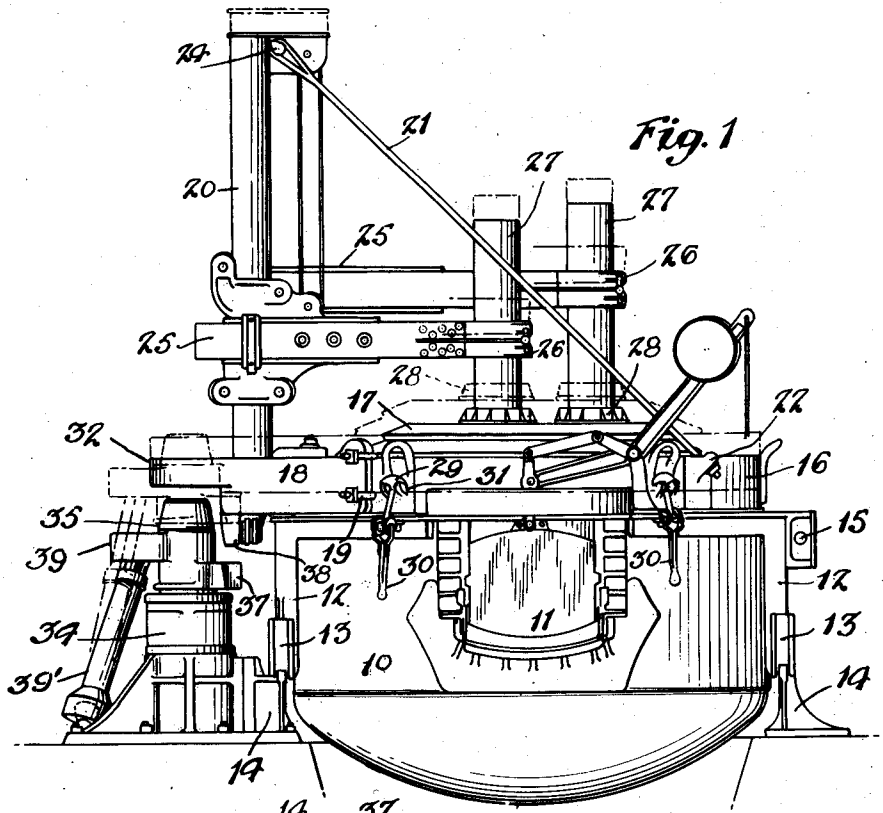


Fig. 1

Fig. 4

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Fig. 2

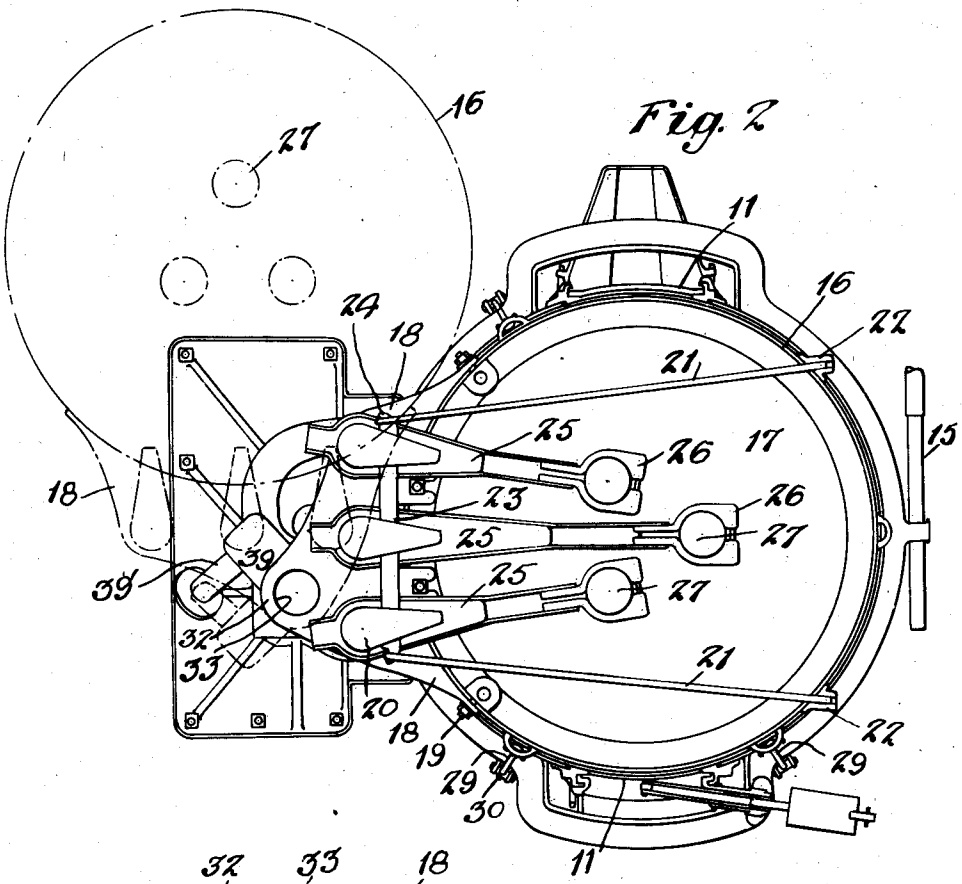
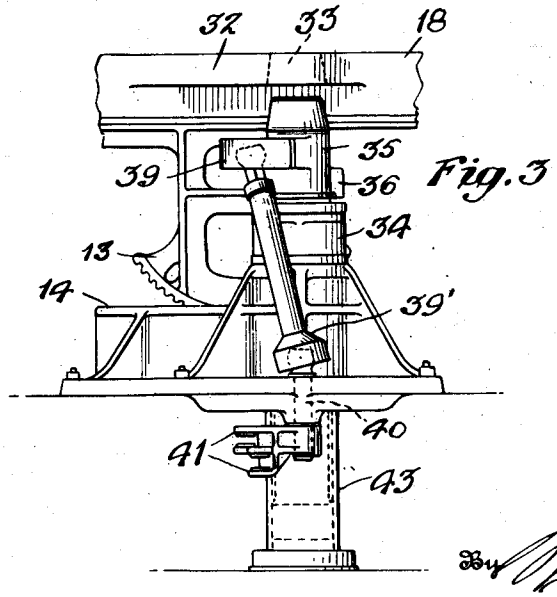


Fig. 3



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UNITED STATES PATENT OFFICE

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ELECTRIC FURNACE

Application filed September 25, 1929. Serial No. 395,058.

My present invention relates to improvements in electric furnaces and more particularly to an improved furnace roof and operating means therefor.

Heretofore it has been customary to charge electric furnaces through a side door after the furnace has been tapped, as by tilting. This method not only involves loss of time, heat and power, but causes considerable difficulty in the charging of heavy scrap, which must be broken into small pieces, and the charging of light scrap, as the side door, being near the metal line, does not permit of the furnace being filled up to the roof with such light scrap. It has consequently been customary to charge such furnaces with light scrap as fully as possible and then melt down the scrap, cut off the power and recharge one or more times, involving consequent loss of time and power.

Several methods have been attempted for charging the furnace through the top, such as the "pull-back" method, in which the entire roof is hinged at one side of the furnace on a horizontal axis in line with and below the electrode guide columns. This method is objectionable in that it tilts the roof refractories through such an angle that both the refractories and the electrodes are loosened, strained and broken. It is also difficult, with the "pull-back" method, to make a tight top seal at the roof joint, as the tilting hinge is arranged low on the furnace shell and the roof has a sliding action when the pull-back motion is started.

In some furnaces the roof has been arranged to lift off by means of a crane and be transported to one side of the furnace while the furnace is charged through the top. This method, however, involves considerable delay, and necessitates the application of separate guide columns that do not tilt with the furnace.

An important object of my invention, therefore, is to provide a furnace which may be readily charged through its roof without the disadvantages heretofore experienced in the art.

Other objects and advantages of my invention will be apparent during the course of the following description.

In the accompanying drawings which form a part of this specification and wherein like characters of reference denote like or corresponding parts throughout the same,

Figure 1 is a front elevation of my improved furnace,

Figure 2 is a top plan view thereof,

Figure 3 is an elevation of the roof operating mechanism, parts being broken away, and,

Figure 4 is a top plan view thereof.

In the drawings wherein for the purpose of illustration is shown a preferred embodiment of my invention the numeral 10 designates the furnace shell provided with the usual side doors 11 and having trunnion frames 12 at its sides which are provided with rockers 13 supported upon horizontal supports 14. Tilting of the furnace is effected by means of the shaft 15. The furnace so far described is similar to that shown and described in my prior Patents 1,444,980 and 1,532,599 and need not be described in detail.

The roof arch ring 16, holding the movable refractory roof 17 is detachably connected to the spectacle casting 18 by means of suitable bolts or other securing means 19. The spectacle casting 18 carries the electrode guide columns 20 and may be quickly detached from the roof ring 16 for repairs. The roof ring 16 is further supported by means of guide rods 21 which are latched into suitable slot blocks 22 on the exterior face of the ring 16. A suitable cross bar or rod 23, having hook-like ends 24 which pivotally engage the upper ends of the rods 21, is carried by the upper ends of the guide columns 20. Electrode arms 25 are slidable vertically on the guide columns 20 and have suitable clamps 26 which engage the electrodes 27. The construction and operation of these electrode arms and clamps are clearly described in my prior patents referred to above. The electrodes are three in number and arranged in a polyphase circuit, and suitable flexible cables may be provided (not shown) of the type disclosed in my prior patents referred to. Water jackets 28 surround the electrodes and these jack-

ets may be connected with flexible water supply pipes (not shown).

The roof arch ring 16 is connected to the furnace shell by means of quick-acting T-head bolts 29 secured to the shell and operated by eccentric levers 30. The T-headed bolts engage suitable fork lugs on the arch ring 16.

The spectacle casting 18 is provided with a horizontal extension 32 of less thickness than the casting itself and provided with a vertically arranged frusto-conical opening 33. It will be seen that the entire roof assembly, including the arch ring 16, the spectacle casting 18, guide columns 20 and electrodes 27 are independent of the furnace and are secured thereto by the quick detachable bolts 29.

A vertically arranged hydraulic ram is arranged beneath the spectacle casting 18 independently thereof and comprises a casing 34 mounted adjacent the support 14 and a plunger 35 which extends above the top of the casing 34 in line with the opening 33, the upper end of the plunger being frusto-conical in shape and adapted to be received in the opening 33 when the plunger is raised. The furnace side of the plunger is provided with a buttress stop 36 having a central projection 37 adapted to fit between the arms of a downwardly projecting buttress fork 38 on the casting 18 when the plunger is raised. The opposite side of the plunger is provided with an arm or projection 39 in which the end of one section of a telescoping toggle shaft 39′ is pivotally secured. A shaft 40 extends up through the floor and through the casing support and terminates in an enlarged end which is pivotally received in the enlarged lower end of the toggle shaft 39′. The lower end of the shaft 40 is provided with a casting having two crank arms 41 to which are pivotally secured the connecting rods of two single action fluid pressure cylinders 42 of any suitable construction. The cylinders 42 and the hydraulic ram may be controlled by any suitable valve mechanism (not shown).

The rockers 13 are geared to the supports 14 and the ram casing is secured to or formed integrally with one of the supports 14. The ram and toggle connections are independent of the furnace and roof and the entire furnace and roof structure may be tilted without interference from the ram which is mounted on the floor.

In operation when it is desired to remove the roof for charging or for any reason, fluid pressure is admitted to the ram cylinder 43 and the plunger rises, its conical end entering the opening 33 and the buttress extension 36 moving up between the arms of the fork 38. Further upward movement of the plunger 35 raises the entire roof assembly into the position shown in dotted lines in Figure 1, the bolts 29 having been previously unfastened. Pressure is then admitted to one of the cylinders 42 and motion is transmitted through the crank arm 41, shaft 40 and toggle shaft 39′ to the projection 39 on the plunger, to rotate the plunger and with it, the entire roof assembly, which assumes the position shown in dotted lines in Figure 2. When the charging is completed the roof is swung back over the furnace shell by means of the other cylinder 42 and when in the position shown in dotted lines in Figure 1 is lowered onto the furnace shell by the ram and the fasteners 29 are secured. The plunger is now completely disengaged from the roof and spectacle casting and the furnace and roof may be tilted in the usual way.

It will be seen that the roof partakes of two movements, one a short vertical movement caused by the ram plunger and the other a swinging movement caused by the cylinders 42 and toggle shaft 39′. The vertical movement breaks the seal between the roof and furnace shell and allows the roof and electrodes to clear the shell. The swinging movement gives access to the top of the furnace shell. The electrodes can be adjusted vertically at will. The cylinders and ram may be controlled by automatic valves if desired but it is necessary that the roof be raised vertically before the swinging movement is started.

It is obvious that electric or other power may be used in place of the hydraulic power described.

While I have shown and described the preferred embodiment of my invention it is to be understood that various changes may be resorted to without departing from the spirit of my invention or the scope of the subjoined claims.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

1. An electric furnace comprising a tilting shell, a roof detachably secured thereto, and means arranged independently of said tilting shell and roof for swinging the roof away from the furnace shell.

2. An electric furnace comprising a tilting shell, a roof detachably secured thereto, electrode supports carried by said roof, electrodes carried by said supports and extending through said roof, and means arranged independently of said tilting shell and furnace roof for raising the roof and electrode assembly vertically from the shell and swinging the roof and electrode assembly away from said furnace shell.

3. An electric furnace comprising a shell, means to tilt said shell, a roof removably secured to said shell, a plunger arranged independently of said furnace shell and adapted to be raised to engage said furnace roof, means to raise said plunger to raise the roof vertically from said shell, and means to ro-

tate said plunger to swing the roof away from the shell.

4. An electric furnace comprising a shell, a roof removably secured thereto, electrodes and guides therefor carried by said roof, a plunger arranged independently of said shell and roof, means to raise the plunger to engage the roof and move the roof and the associated electrodes and guides vertically from said shell, and means to rotate said plunger to swing the roof and electrode mechanism away from said shell.

5. An electric furnace comprising a shell, means to tilt said shell, a roof removably secured thereto, electrodes and electrode guides carried by said roof independently of the shell, a plunger casing arranged adjacent said shell and independently thereof, a plunger in said casing, means to move the plunger vertically to engage and raise the roof and associated electrode mechanism vertically away from said shell, and means to rotate said plunger to swing the roof and electrode mechanism away from the furnace shell.

6. An electric furnace comprising a shell, means to tilt said shell, a roof detachably secured to said shell, a spectacle casting detachably secured to said roof, electrode guides carried by said casting, electrodes mounted on said guides, a plunger casing arranged adjacent said shell and independently thereof, a plunger in said casing, means on said plunger to engage said spectacle casting when the plunger is raised, means to raise said plunger to raise the spectacle casting and roof vertically away from said shell and means to rotate said plunger to swing said casting and roof away from said shell.

7. An electric furnace comprising a tilting shell, a roof detachably secured to said shell, electrodes mounted on said roof, a hydraulic ram arranged adjacent said shell and independently thereof, and comprising a casing and a plunger, means to move said plunger vertically to engage said roof and move it vertically away from said shell, a lateral projection on said plunger, a shaft journaled adjacent said ram casing, and a telescoping toggle shaft connecting said shaft with the lateral projection on the plunger, whereby rotation of the shaft operates through the toggle shaft to rotate the plunger and swing the furnace roof and electrodes away from the furnace shell.

8. An electric furnace comprising a shell, means to tilt the shell, a roof detachably secured to said shell, a spectacle casting detachably secured to said roof, electrode guide mechanism carried by said casting, electrodes carried thereby, a hydraulic ram arranged adjacent said furnace shell and independently thereof, and comprising a casing and a plunger therein, means on said plunger to removably engage the spectacle casting, whereby upward movement of the plunger raises the casting and roof vertically away from said furnace shell, a lateral projection on said plunger, a shaft, a telescoping toggle shaft connecting the shaft and the lateral projection on the plunger, and means to rotate the shaft when the plunger is in its raised position to rotate the plunger through the toggle shaft for swinging the casting and roof away from the furnace shell.

9. An electric furnace comprising a shell, a roof removably secured thereto, means independent of said furnace for raising the roof vertically from said furnace shell and pivoting it away from the furnace shell, and means for tilting said shell with the roof in position thereon.

10. An electric furnace comprising a tilting shell, a roof detachably secured thereto and capable of being tilted therewith, and means arranged independently of said tilting shell and roof for swinging the roof away from the furnace shell.

11. An electric furnace comprising a tilting shell, a roof detachably secured thereto and capable of being tilted therewith, and means arranged independently of said furnace for raising the roof vertically from said shell and pivoting it away from the furnace shell.

12. An electric furnace comprising a shell, a removable roof therefor, electrodes extending through said roof and supported thereon, electrode cooling jackets carried by said roof in proximity to said electrodes, means independent of said furnace for raising the roof vertically from said furnace shell and swinging it away from the furnace shell, and means for tilting said shell with the roof and electrodes in position thereon.

13. An electric furnace comprising a tilting shell having substantially diametrically opposite doors arranged in the tilting plane of the furnace, a removable roof for said shell, electrodes extending through said roof and supported thereby, said roof and electrodes being capable of being tilted with said shell, and means arranged independently of said furnace shell and roof for swinging the roof and electrodes away from the furnace shell.

In testimony whereof I affix my signature.

WILLIAM E. MOORE.