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HARDENING FURNACE WITH CONTINUOUSLY OPERATING CHARGING DEVICE

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Fig. 1

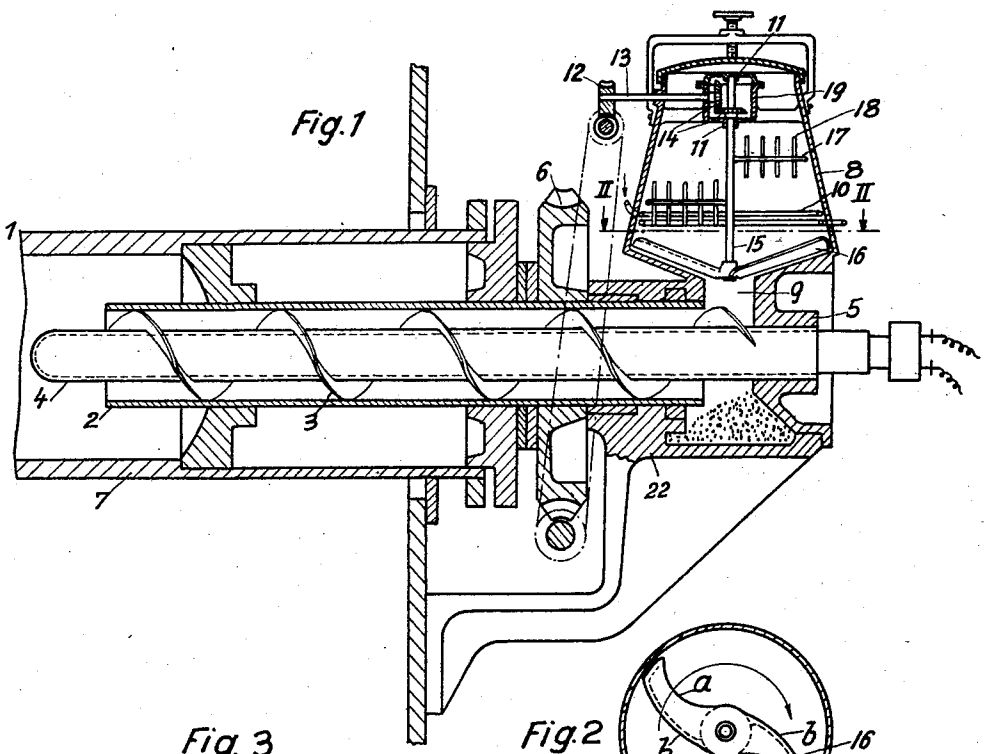


Fig. 3

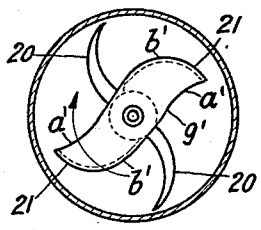


Fig. 2

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HARDENING FURNACE WITH CONTINUOUSLY OPERATING CHARGING DEVICE

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The present invention relates to a hardening furnace, which is especially suited for the hardening of large quantities of products and in which a cementing powder is used of which only relatively small amounts are introduced into the furnace. The essential part of this powder will gasify and the developed hot gases under pressure will effect the hardening action.

In such furnaces it is advantageous to add the cementing powder slowly and by degrees into the hardening space so that the hardening gas is developed gradually, and in most cases it is necessary to replenish the cementing powder in the furnace several times during the hardening process. The slow addition of the powder must occur without opening the drum, because it is of utmost importance that the hot gas under its elevated pressure does not escape, and that the pressure or temperature of the same is not lowered. It is further necessary that the powder charging device operate accurately, so that the amount of powder necessary for the treatment of a furnace charge is added to the furnace in portions of exactly the same weight and at regular time intervals. Above all great care must be taken to prevent the powder feeding device from becoming clogged. The cementing powder is frequently moist and during the gasification steam is often formed, which penetrates into the powder storing tank, whereby the percentage of moisture in the same is increased. Thereby the powder in the tank will be converted into a cloddy mass, which will block up the tank and the discharge conduit therefor.

According to the present invention the above mentioned drawbacks are eliminated by means of a powder tank of special form which cooperates with suitable feeding devices.

The invention is shown by way of example in the accompanying drawings in which

Fig. 1 is a sectional view of a preferred embodiment of the invention.

Figs. 2 and 3 show details of two modifications of the scraper.

According to Fig. 1 the greater part of the feeding tube 2 for the cementing agent is arranged inside of the hardening drum 1, which is heated in known manner. In the tube 2 and rigidly connected to the same a screw conveyor 3 is located, which loosely surrounds the pyrometer tube 4, so that the tube 2 and the conveyor 3 may be rotated relatively to the pyrometer tube 4. This tube is fastened in the flange-like body 5, preferably by means such as welding. Opposite to the body 5 a bearing 22 is arranged, which supports one end of the tube 2 and in which the tube may be rotated by means such as the worm wheel 6. The cementing powder is stored in a container 8 and is delivered to the conveyor 3 through a channel 9. The velocity of rotation of the conveyor can be controlled and adjusted by means of arrangements known per se and in this way the amount of powder, which is fed at any time into the drum may be regulated. The amount of powder delivered into the drum may also be changed by introducing conveyors of different pitches into the apparatus.

The baking of the powder and clogging up of the feeding device may according to the invention be prevented by means of the simple and efficient device described below.

The powder tanks hitherto used were usually hopper-shaped. According to the present invention the powder container consists of a vertically arranged truncated cone of upwardly decreasing width, so that the walls of the container will offer no resistance to the powder which is dropping downward because of its own weight. In order to facilitate the emptying of the container the bottom of the same is inclined towards the outlet channel 9 which forms a direct continuation of the said bottom. This arrangement will be sufficient to prevent a baking of the powder, provided that the same is in a relatively dry state.

The disintegration of the cementing powder effected by giving the container a special shape, in order to prevent the outlet conduit being blocked, may be further increased by preheating the powder. In this case the heating gases from the fire chamber of the furnace may be utilized, they being passed through a heating coil 10 arranged in the

container 8. Other heating fluids may be passed through the heating coil, for instance hot water or the like.

Instead of the above described heating device or together with the same the following arrangement may be employed:

A shaft 15 is vertically arranged in the powder container and rotates in the bearings 11. The shaft 15 is operated from the same driving arrangement as the worm wheel 6 or directly from this wheel. Also another source of driving force may be employed and in this case the shaft may be rotated from the driving gear 12 by means of the shaft 13 and the bevel gears 14. The gears 14 are surrounded by a protective cover 19. At the lower end of the shaft 15 a scraper 16 is fastened which rotates together with the shaft and feeds the powder through the channel 9 to the conveyor 3. As shown in Fig. 2 the scraper or propeller 16 is bent horizontally in such manner that the points of the same project in the direction of rotation, so that the powder caught by the propeller will be forced towards the middle part of the scraper, that is, towards the conduit 9. The wings of the scraper are further bent vertically in such manner that the front edge *a* when seen in the direction of rotation assumes a raised position, whereas the rear edge *b* is lowered. The propeller 16 will therefore not only guide the powder towards the channel 9, but also press it into the same, whereby the channel cannot be blocked. The scraper may also consist of two different coacting elements and a device of the kind is shown in Fig. 3. According to this figure a member 20 is employed having the form of a double wing the points of which are bent forward in the direction of rotation. This member cooperates with a propeller 21, the wings of which may be relatively short, because the purpose of the same is merely to press the cementing powder through the channel 9. The scraper is arranged directly above the channel 9 and the middle part of the same widened, partly because the stress is greatest in this part and partly in order to cover the channel 9 (see also Fig. 2) to prevent the powder dropping down into the same when the machine is at rest. Through this arrangement a special closing device for the channel 9 is made superfluous.

In case the powder should be very moist a cross rod, or two oppositely located cross rods 17 may be arranged above the scraper or may be employed in its stead. These rods are fastened to the shaft 15 and may be equipped with vertically arranged pins 18, whereby double rakes are formed. Through this device the powder will be thoroughly stirred and the baking of the same will be prevented. The device of Fig. 3 differs somewhat from that of Fig. 2, in that two plates 20 and 21 are provided, arranged approximately 90° apart on the central shaft 15. The plate 21 of the device of Fig. 3 is shown as having rearward or trailing, convex surfaces *b'*, and front or leading concave surfaces *a'*.

We claim:

1. In a hardening furnace with continuously operating charging device, a container for cementing powder having a vertical axis and having the form of a truncated cone, the cross-section of which decreases in upward direction, the container also converging slightly at its bottom, a device for conveying the cementing powder into the furnace, and a comparatively narrow channel connecting the said container with the said conveying device.

2. In a hardening furnace with continuously operating charging device, a container for cementing powder having a vertical axis and having the form of a truncated cone, the cross-section of which decreases in upward direction, a device for conveying the cementing powder into the furnace, a comparatively narrow channel opening into the said container and connecting the same with the conveyer device and a bottom in the container inclining towards the entrance to the said channel.

3. In a hardening furnace with continuously operating charging device, a container for cementing powder having a vertical axis and having the form of a truncated cone, the cross-section of which decreases in upward direction, a device for conveying the cementing powder into the furnace, a channel opening into the said container and connecting the same with the conveyor device, a bottom in the container inclining downwardly towards the entrance to the said channel and a heating device arranged on the inside of the said container.

4. In a hardening furnace with continuously operating charging device, a container for cementing powder having a vertical axis and having the form of a truncated cone, the cross-section of which decreases in upward direction, a device for conveying the cementing powder into the furnace, comprising a tube of uniform diameter and a screw conveyor which is rigidly connected to the inner surface of said tube, a channel opening into the said container and connecting the same with the conveyor device, a bottom in the container inclining downwardly towards the entrance to the said channel and means for moving the powder towards the said channel entrance.

5. In a hardening furnace with continuously operating charging device, a container for cementing powder having a vertical axis and having the form of a truncated cone, the cross-section of which decreases in upward direction, a device for conveying the cementing powder into the furnace, comprising a

tube of uniform diameter and a screw conveyor which is rigidly connected to the inner surface of said tube, a channel opening into the said container and connecting the same with the conveyor device, a bottom in the container inclining downwardly towards the entrance to the said channel and means for moving the powder towards the said channel entrance and for forcing it through the said channel.

6. In a hardening furnace with continuously operating charging device, a container for cementing powder having a vertical axis and having the form of a truncated cone, the cross-section of which decreases in upward direction, a device for conveying the cementing powder into the furnace, comprising a tube of uniform diameter and a screw conveyor which is rigidly connected to the inner surface of said tube, a channel opening into the said container and connecting the same with the conveyor device, a bottom in the container inclining downwardly towards the entrance to the said channel, a scraper arranged adjacent the said channel entrance, the wings of said scraper being bent forward in the direction of rotation of the same at their outer ends and having raised front edges and means for rotating said scraper.

7. In a hardening furnace with continuously operating charging device, a container for cementing powder having a vertical axis and having the form of a truncated cone, the cross-section of which decreased in upward direction, a device for conveying the cementing powder into the furnace, comprising a tube of uniform diameter and a screw conveyor which is rigidly connected to the inner surface of said tube, a channel opening into the said container and connecting the same with the conveyor device, a bottom in the container inclining downwardly towards the entrance to the said channel, a scraper arranged adjacent the said channel entrance, a member having the form of a double hook, the outer parts of which project in the direction of rotation of the same, said member being arranged adjacent the said scraper and means for rotating the said scraper and the said member.

8. In a hardening furnace with continuously operating charging device, a container for cementing powder having a vertical axis and having the form of a truncated cone, the cross-section of which decreases in upward direction, a device for conveying the cementing powder into the furnace, comprising a tube of uniform diameter and a screw conveyor which is rigidly connected to the inner surface of said tube, a channel opening into the said container and connecting the same with the conveyor device, a bottom in the container inclining downwardly towards the entrance to the said channel, rotatable members with wings adapted to move the powder towards the said channel entrance and to force it through the same, a widened part on the said rotatable members substantially covering the said channel entrance and means for rotating said members.

9. In a hardening furnace with continuously operating charging device, a container for cementing powder having a vertical axis and having the form of a truncated cone, the cross-section of which decreases in upward direction, a device for conveying the cementing powder into the furnace, comprising a tube of uniform diameter and a screw conveyor which is rigidly connected to the inner surface of said tube, a channel opening into the said container and connecting the same with the conveyor device, a bottom in the container inclining downwardly towards the entrance to the said channel, a rotatable shaft vertically arranged in the said container, rotatable means connected to the end of the shaft adjacent the channel entrance and adapted to move the powder towards the said channel entrance and to force it through the same, means for rotating the said shaft and stirring means projecting from the said shaft and adapted to stir the contents of the same thoroughly during the rotation of the shaft.

In testimony whereof we affix our signatures.

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HEINRICH LINDHORST.