July 18, 1950 E. BÜHRER 2,515,693

METHOD OF FILLING ANNEALING POTS

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Fig. 1

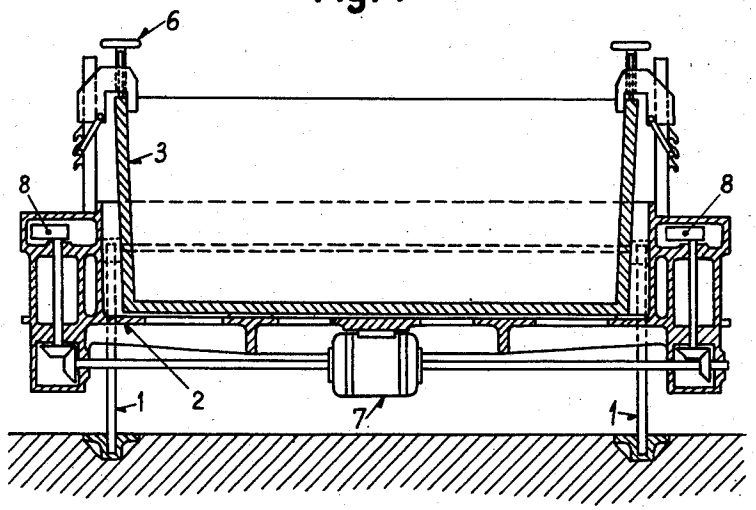
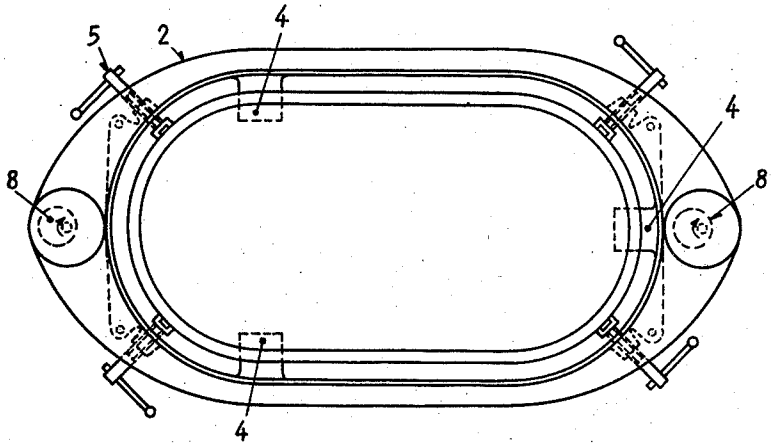


Fig. 2



INVENTOR
ERWIN BÜHRER
By Hakewell & Hirschman
ATTORNEYS

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Fig. 3

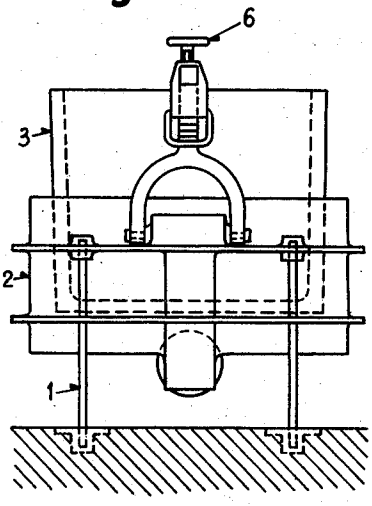


Fig. 4

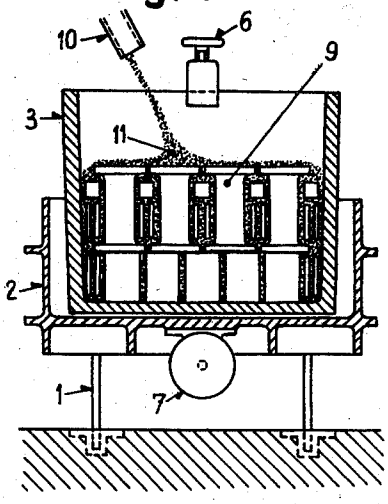
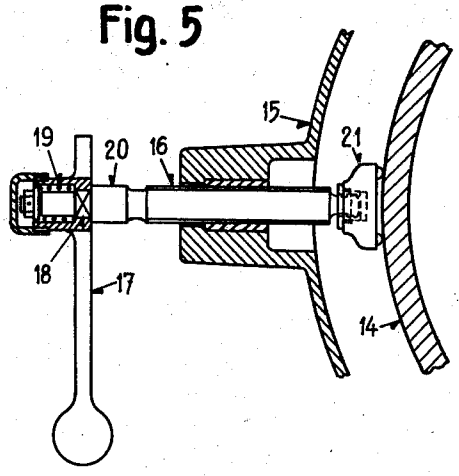


Fig. 5



INVENTOR
ERWIN BÜHRER
BY Lackenbach & Hirschman
ATTORNEYS

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METHOD OF FILLING ANNEALING POTS

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Fig. 6

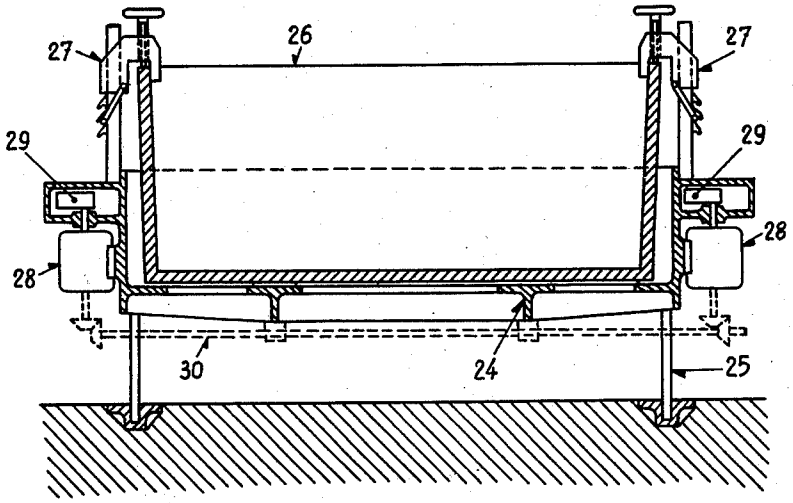
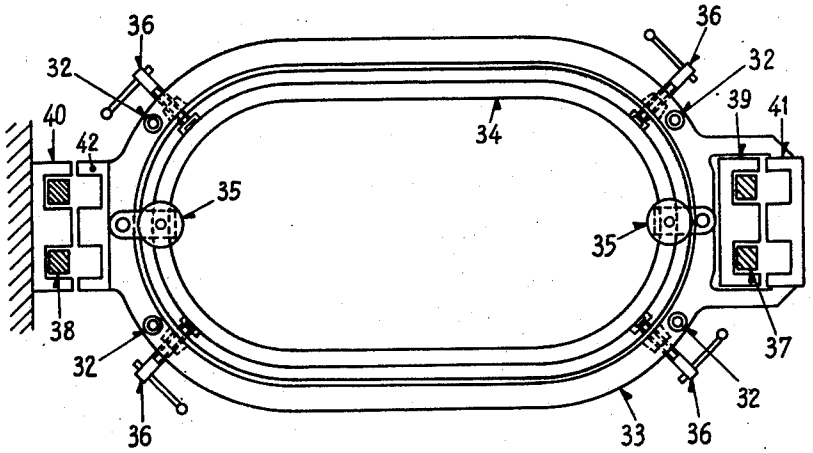


Fig. 7



INVENTOR
ERWIN BÜHRER
By Jackman & Hirschman
ATTORNEYS

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METHOD OF FILLING ANNEALING POTS

Erwin Bührer, Buchtalen, Switzerland, assignor to Société Anonyme des Aciéries ci-devant Georges Fischer, Schaffhausen, a Swiss company

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4 Claims. (Cl. 148—1)

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For the annealing process in the production of malleable iron castings it is usual to embed the hard white iron castings in a packing material in the annealing pot. The ratio between the volume of the metal and the volume of the packing material is on an average 1 to 6. It follows that from the economical point of view the available space in the annealing pot is not used efficiently. Two factors must be borne in mind if a change is desired in the ratio between the volume of the metal and the volume of the packing material.

1. In the case of the production of European malleable iron castings the packing material must supply a quantity of oxygen corresponding to the weight of the castings.

2. The packing material must completely fill up all the empty spaces in and between the castings in order to prevent warpage of the castings at the high annealing temperatures.

The present invention provides a considerable improvement of the volume ratio in favour of the weight of the castings. This improvement is obtained by vibration of the annealing pot during the filling operation, the castings being filled in first and then the packing material. In adding the packing material the pot must be submitted to the vibrations in any case, whereas the castings alone are vibrated only if necessary.

Practically the vibratory movement cannot be produced by knocking or by rocking the annealing pot. Undamped periodic oscillations are best suited for the vibration, as they effect a quick levelling down of the added packing material, the latter filling up all the cavities in and between the castings.

The hard white iron castings are very brittle and must be handled carefully. In order to prevent cracks in the hard iron castings the vibratory movement must not cause the castings to bump against one another. The oscillations must assume the character of an undulatory curve in order to prevent the development of detrimental stresses when the direction of the oscillatory movement is reversed.

For the application of the present invention devices should be used which produce the vibratory movement mechanically as oscillations in a horizontal plane.

The drawings illustrate some practical forms of the said devices.

Fig. 1 shows a longitudinal section of a vibrating device.

Fig. 2 shows a plan view of the said vibrating device.

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Fig. 3 shows a front view of the said vibrating device.

Fig. 4 shows a cross section through the vibrating device.

Fig. 5 shows a clamping fixture for the annealing pot.

Figs. 6 and 7 show alternative vibrating equipments with different driving appliances.

The vibrating apparatus in Fig. 1 is supported on four spring bars 1 and consists of a frame 2 in which the annealing pot 3 is fixed, and of the vibration generating mechanism.

The annealing pot 3 rests on three flat supports 4 within the frame 2; it is fixed both horizontally and vertically by the clamps 5 and 6. The vibratory movement is produced by two synchronized revolving eccentric flywheels 8, both driven by the same motor 7. These synchronized eccentric flywheels 8 impart a circular oscillation in a horizontal plane to the frame 2 and to the annealing pot 3 clamped therein, and further to the contents of the pot 3.

The annealing pot 3 is filled as follows: An empty annealing pot 3 is lowered into position into the frame 2 by means of a crane and all the clamps 5 and 6 are tightened. The white iron castings 9 are then packed into the annealing pot 3 as tightly as possible. When the castings 9 have reached a certain height they are shaken down. It is quite immaterial whether they fill only one half or reach to the top of the annealing pot 3. This causes the smaller castings to run into the spaces between and in the larger castings to the greatest possible extent. Then the packing material 11 is poured into the annealing pot 3 from a hopper, the outlet 10 of which is indicated in Fig. 4. The vibratory movement generated by the eccentric flywheels 8 causes the packing material 11 to fill up the spaces left in and between the white iron castings 9.

As soon as the spaces between the castings have been filled with the packing material, the clamps 5 and 6 are loosened and the annealing pot 3 is lifted out of the frame 2 by means of a crane.

The clamps 5 and 6 must be very strong to be able to transmit the considerable stresses, due to the circular oscillations, from the frame 2 to the annealing pot 3. On account of the elasticity of the frame 2 and of the walls of the annealing pot 3, special attention must be given to the design of the clamps 5 which transmit the stresses horizontally.

In Fig. 5 the annealing pot is indicated by 14, the frame by 15, while 16 is the spindle of a horizontal clamping screw. An adjustable weight 17

acts as a lever to facilitate clamping, and as a safety device to prevent the clamp from being loosened under the effect of the oscillatory movement. To this end lever 17 fits over the square head of the spindle 16.

The spring 19 pushes the lever 17 against the collar 20 of the spindle 16. On pressing the end 21 of the clamp against the pot 14, and after tightening, the lever 17 must be pushed over the square part 18 in such a way that the weight 22 will have a tendency to tighten the spindle under the effect of the vibratory movement.

There are various methods of producing the vibratory movement and imparting it to the annealing pot. An example of a vibrating device is shown in Fig. 6, in which circular oscillations are generated by two separate eccentric flywheels driven by two synchronized motors. Fig. 6 shows schematically a frame 24, resting on four spring bars 25, into which the annealing pot 26 is placed. Clamping devices to fix the pot 26 in position are indicated at 27. The clamping devices acting horizontally are not shown. Fixed at both ends of the frame 24 are two synchronized motors 28 with two eccentric flywheels 29. The switch gear is arranged in such a way that the two motors are synchronized and can only revolve together. In order to prevent angle displacement in the synchronization both motors can be coupled mechanically by means of the shaft 30.

Fig. 7 illustrates a device in which the vibrating movement is produced by electromagnets. In this case the movements do not take the form of circular oscillations, as in Figs. 1 to 6, but of horizontal pendular oscillations of the ends of the spring bars 32 supporting the frame 33. The annealing pot 34 is set into the frame 33 and fixed in position by the clamps 35 and 36. The stationary parts 39 and 40 of two three-phase alternating current electromagnets 37 and 38 are fixed on a support firmly embedded in foundations. The moving armature parts 41 and 42 of the electromagnets are connected to the frame 33 and transmit the pull of both magnets 37 and 38 to the frame 33 and to the annealing pot 34, and therefore to the contents of the latter.

The shaking down of the white iron castings and the filling of the intermediate spaces with the packing material is obtained with either of the apparatus shown in Figs. 6 and 7 in exactly the same way as in the case of the device shown in Figs. 1 to 5. The use of a vibratory movement gives a mechanical method of packing white iron castings which is much better than a packing by hand. The only way of filling the spaces between and in the castings in such a way that a further displacement of the castings is impossible is to apply a vibratory movement. Experiments have

proved that practically no deformation of the castings occurs when using iron ore as a packing material for annealing. The method of packing used hitherto necessitated additional work for the straightening of the castings warped during annealing, the straightening operation being performed either on hot or on cold castings. With the packing method according to the present invention it is possible to make use of the filling capacity of the pots to the greatest possible extent.

The main object of the present invention is to reduce production costs in general, and particularly the costs of annealing, without affecting the quality of the final product. Several items of the costs in the production of malleable iron castings are favourably influenced, e. g. less heat per weight unit of castings is required for annealing, the costs for annealing pots are lower, the costs of labour are reduced, less work is needed for straightening warped castings, etc. . . . At the same time the total output of the annealing plant is increased.

I claim:

1. A method of filling annealing pots for the purpose of annealing white malleable iron castings in furnaces, comprising placing the hard iron castings into the pot, adding packing material and subjecting the contents of the pot, at least during the filling of the packing material, to a horizontal vibrating movement to cause leveling down of the packing material and to cause the packing material to fill the spaces between, and in, the iron castings.

2. A method of filling annealing pots according to claim 1, wherein the annealing pot is filled in layers.

3. A method of filling annealing pots according to claim 1 in which the pot is first filled completely with castings, the packing material being added afterwards and made to fill any remaining spaces between and in the castings by the application of said horizontal vibratory movement.

4. A method of filling annealing pots according to claim 1 wherein the vibratory movement is constituted of undamped periodic oscillations, the oscillations having the character of an undulatory curve and being in the horizontal direction.

ERWIN BÜHRER.

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