May 26, 1942. W. C. SPECK ET AL 2,284,346

APPARATUS FOR STRAIGHTENING METAL CASTINGS OR PREVENTING DISTORTION OF SAME DURING COOLING

Filed Nov. 5, 1938 3 Sheets-Sheet 1

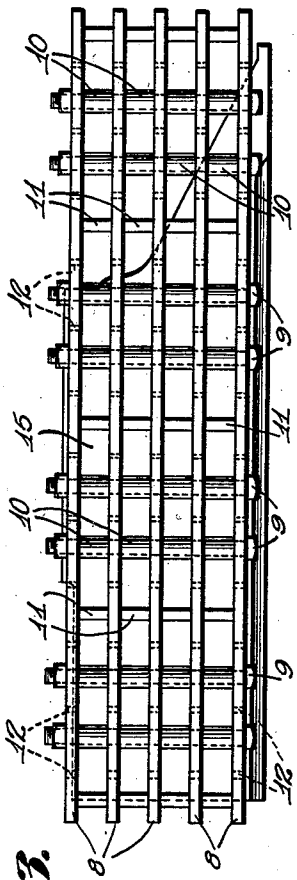


Fig. 3.

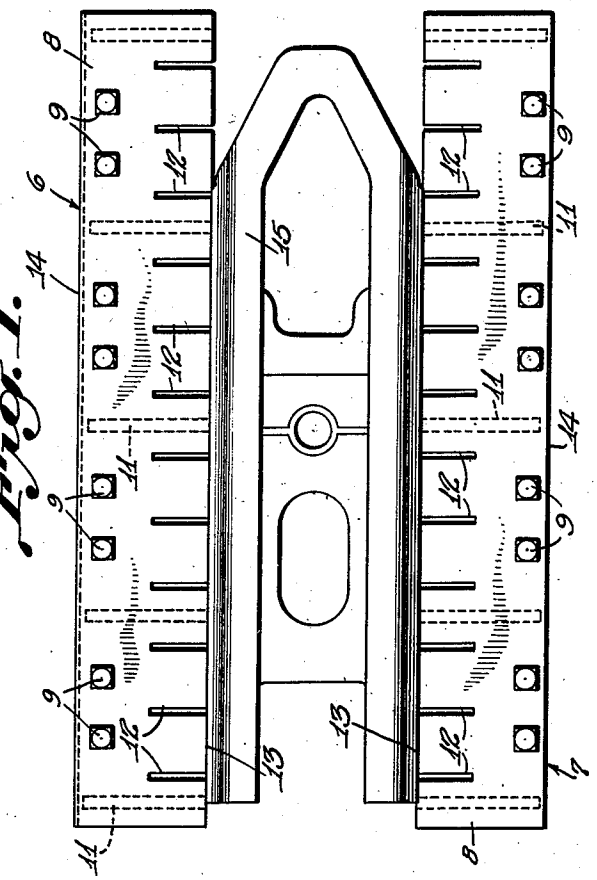


Fig. 1.

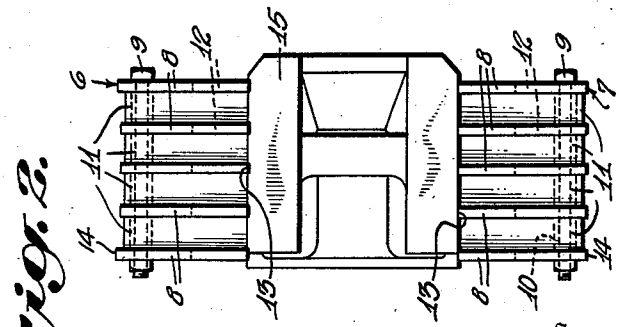


Fig. 2.

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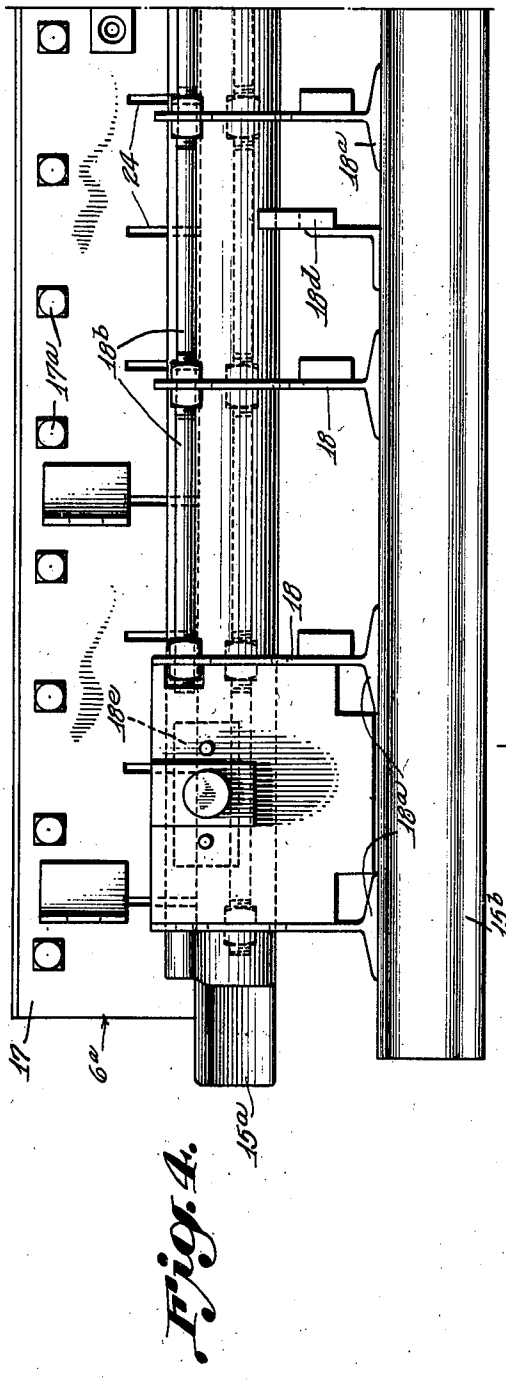



Fig. 4.

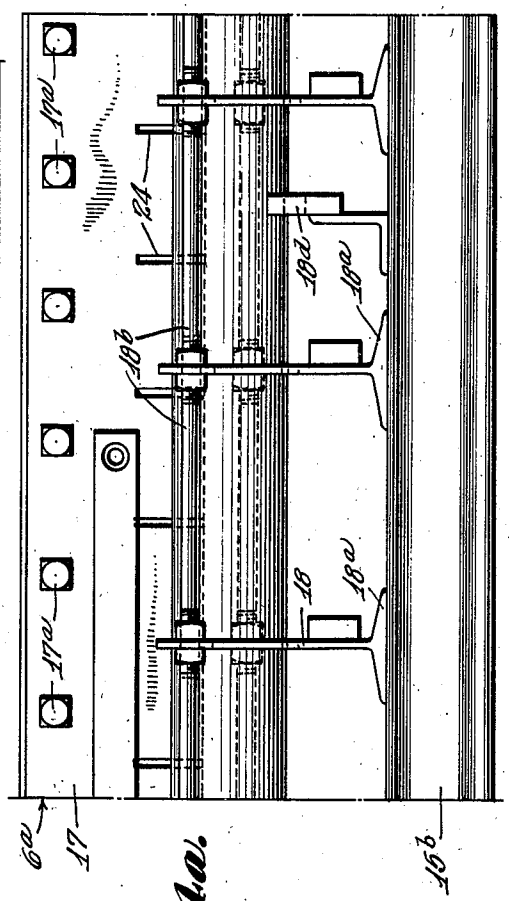



Fig. 4a.

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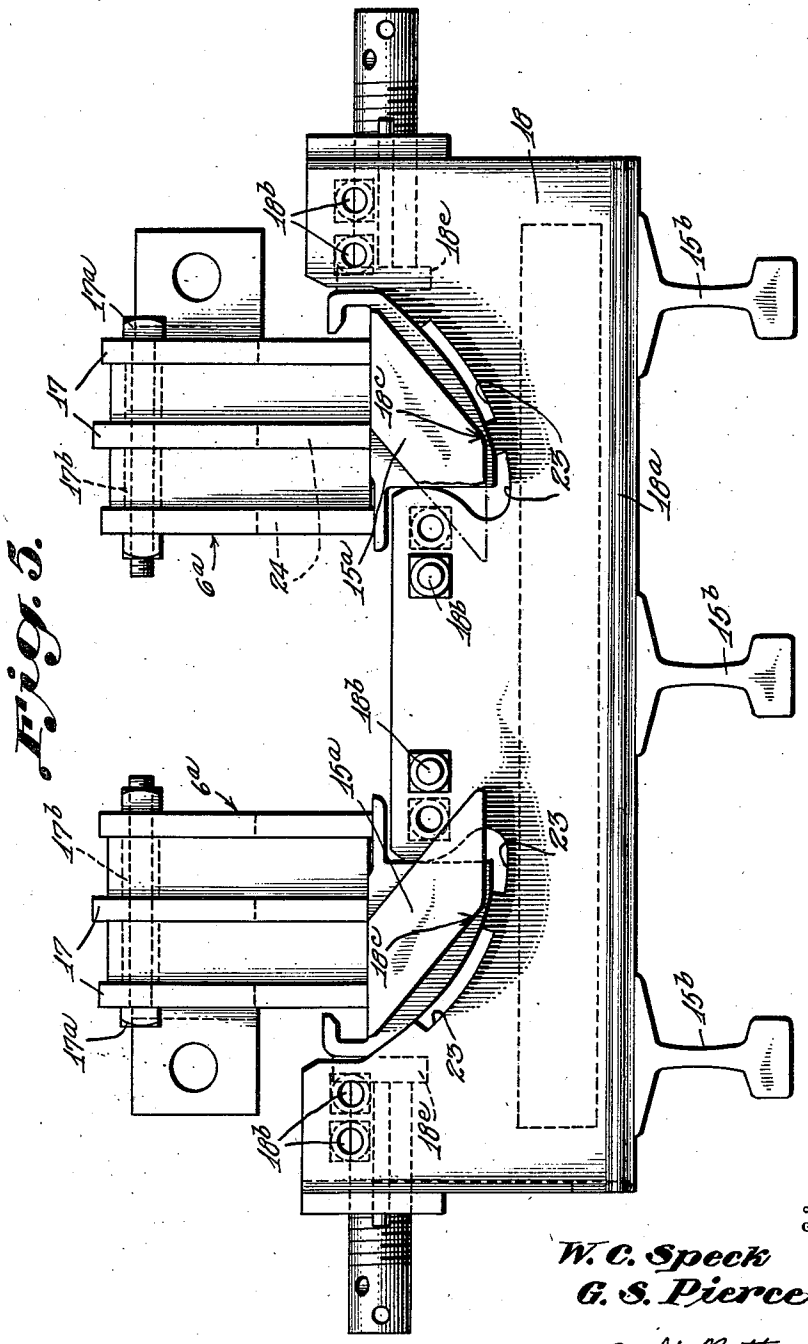
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Fig. 3.




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# UNITED STATES PATENT OFFICE

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## APPARATUS FOR STRAIGHTENING METAL CASTINGS OR PREVENTING DISTORTION OF SAME DURING COOLING

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Application November 5, 1938, Serial No. 239,192

3 Claims. (Cl. 153—48)

The invention relates to means for straightening metal castings and the like and for preventing warping or distortion of such castings while they are being cooled.

In the manufacture of steel castings many are put out-of-line due to pulling the castings out of the mold, warping during annealing or normalizing and otherwise handling the castings while they are hot. This is particularly true of large castings.

Heretofore it has been the practice to straighten such castings cold under presses which put a permanent set at various localized positions throughout the casting to bring it back in line. This method introduces internal strains and initial stresses in the casting which are harmful. To remove these internal strains involves reannealing which, in addition to being costly, would in the majority of cases require restraightening due to warpage in the annealing furnaces and the straightening process mentioned above would again introduce internal strains.

By using our straightening means in the manner hereafter described, the objectional features referred to above are eliminated and the cost of manufacturing castings reduced.

In the annealing or normalizing process, the castings are placed in a furnace designed for that purpose, and are brought to temperatures at which the castings are red hot. They are held at this temperature for a length of time, depending upon the nature of the castings and then removed from the furnace while in the red hot state to cool slowly in relatively still air.

Through the use of our invention, the castings can be removed from the furnace while in a hot state and be placed on a press bed or cradle, and while the castings are thus supported a plunger or especially designed fixture, depending upon the contour of the upper surface of the casting, placed on top of the casing and pressure applied. Thus a casting which is not straight is deformed under pressure while hot to its straightened position.

The casting is then allowed to cool while in the fixture and under pressure as part of the annealing or normalizing process and is, therefore, substantially free from internal strains and initial stresses.

The procedure described above may be applied to structures other than castings, such as steel shapes welded together and the like.

An object of this invention is to provide means for straightening castings or the like which can be applied while the work is in heated condition, and which can be employed without introducing internal strains and initial stresses in the work.

A further object is to provide press or clamping members for deforming castings to their straight condition which will not warp due to being in contact with hot castings or the like.

With the foregoing objects outlined and with other objects in view which will appear as the description proceeds, the invention consists in the novel features hereinafter described in detail, illustrated in the accompanying drawings, and more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is a side elevation of one form of press or straightening element shown engaging or clamping a straight sided casting.

Fig. 2 is an end view of the same.

Fig. 3 is a top plan view.

Figs. 4 and 4*a* are side elevations of another modification of the invention.

Fig. 5 is an end view of the structure shown in Figs. 4 and 4*a*.

In the embodiment of the invention illustrated in Figs. 1 to 3 inclusive, 6 and 7 designate the members of our improved press or straightening apparatus. One of these members is stationary and the other movable toward and away from the same. Assuming that the member 7 is the stationary platen or press bed, the member 6 will be movable upwardly and downwardly toward the member 7. Each member may consist of a series of vertically disposed, spaced, parallel plates 8, joined together near one horizontal edge of the member by bolts 9 passing through spacing sleeves or collars 10. The plates extend longitudinally of the apparatus and they are also spaced by transverse vertical bars 11 preferably arranged at right angles to the plates 8.

Each longitudinal plate is provided with a series of vertical slots 12 which extend from the opposed surfaces 13 of the members toward their opposite surfaces 14.

Due to the slots 12 and the arrangement of the plates, the confronting faces 13 of the straightening members are formed by a multiplicity of spaced edge portions or ribs designed to engage opposite sides of the casting 15 to be straightened or prevented from warping during cooling.

In the annealing or normalizing process, the casting 15 is placed in a furnace designed for that purpose, and brought to temperatures at which the casting is red hot. It is held at such tem-

peratures for a period of time, and then removed from the furnace while in the red hot state to cool slowly in relatively still air. Immediately on removing the casting from the furnace, and while it is hot, it is placed on the press bed 7. While the casting is in this position, the plunger or upper member 6 is placed on top of the casting and pressure applied, which pressure is maintained while the casting cools to substantially atmospheric temperature. Thus a casting, which is not straight, is deformed under pressure while hot into straightened condition or if the hot casting is straight when removed from the furnace, the members 6 and 7 will prevent warping or deformation during cooling. Obviously, the pressure may be either dead weight or fluid pressure, such as hydraulic, air, steam, etc.

As the casting is allowed to cool while clamped in the apparatus, as part of the annealing or normalizing process, it is substantially free from internal strains and initial stresses.

Due to the skeleton form of the members 6, 7 and to the line contact between the members and the casting, the members 6, 7 do not produce any appreciable chilling effect on the structure being straightened and consequently the casting will not warp due to being in contact with relatively cool plates.

The apparatus illustrated in Figs. 4, 4*a* and 5 is designed to accommodate castings 15*a* of an irregular contour. In this form of the invention, the foundation of the press bed may comprise longitudinally extending parallel rails 15*b* which support a series of transverse vertical plates 18 having feet 18*a* resting on the rails. The plates are preferably arranged in parallel relation and are rigidly connected to one another by longitudinally extending bolts 18*b*. Each plate is preferably provided with a plurality of notches 18*c* extending downwardly from the upper edges of the plates, and as the notches of the plates are in alignment, they form a cradle to support a plurality of irregular castings 15*a*. The edges of the notches are recessed or provided with rabbets 23 so as to minimize the extent of the edges actually in contact with the castings.

To aid the plates in supporting the castings during cooling, intermediate notched plates 18*d* of less height than the plates 18 may be arranged transversely on the rails 15*b*.

Where necessary we may employ adjustable jaws 18*e* to engage the outer side edges of the castings to prevent warping during cooling.

The upper or plunger members 6*a* in this modification may be similar to the ones shown in Figs. 1 to 3 inclusive. Each plunger member may consist of a number of longitudinally extending parallel plates 17 connected together by bolts 17*a*, and held in spaced relation by collars 17*b*, surrounding the bolts. The lower end portions of the plate 17 may be slotted or notched transversely as shown at 24 to serve the same purpose as the slots 12. In other words, notches 24 will reduce the metal contact of the member 6*a* to a small percentage of the surface area of the casting with which the member contacts. By spacing the elements of the members and slotting or notching them as illustrated, the clamp allows the upper and lower members to always be in line, whereas apparatus minus this feature will cause warping of the castings and defeat the purpose of our invention.

While we have disclosed suitable embodiments of the invention in such manner that they may be readily understood by those skilled in the art, we are aware that changes may be made in the details disclosed without departing from the spirit of the invention as expressed in the claims.

What we claim and desire to secure by Letters Patent is:

1. In an apparatus of the character described, oppositely disposed pressing members, one of said members being provided with a series of substantially parallel plates, one edge portion of the plates being provided with aligned notches forming a cradle to receive a casting, the notched portion of each plate having lug portions extending into the notch of the plate to minimize the edge formed by the notch.

2. In an apparatus of the character described, a plurality of oppositely disposed pressing members, one of said members comprising longitudinally extending rectangular parallel plates arranged edgewise in reference to the other member, each plate having a multiplicity of spaced narrow slots in its edge portion which faces the other member, spacing elements arranged between said plates at right angles thereto and having edge portions co-planar with said edge portions of the plates, and means rigidly and detachably connecting all of the plates together.

3. In an apparatus of the character described, oppositely disposed first and second pressing members, the first member comprising longitudinally extending parallel plates arranged edgewise in reference to the other member, each plate having a multiplicity of narrow slots in its edge portion which faces the second member, spacing elements arranged between said plates and positioned at right angles thereto, means rigidly connecting all of the plates together, the second member being provided with a series of substantially parallel spaced plates positioned at right angles to the plates of the first member, one edge portion of each plate of the second member being provided with aligned notches forming a cradle to receive a casting, the notched portion of each of the last-mentioned plates having lug portions extending into the notch of the plate to minimize the edge formed by the notch.

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