

Nov. 3, 1959

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2,911,510

FURNACES

Filed April 7, 1958

FIG. 1.

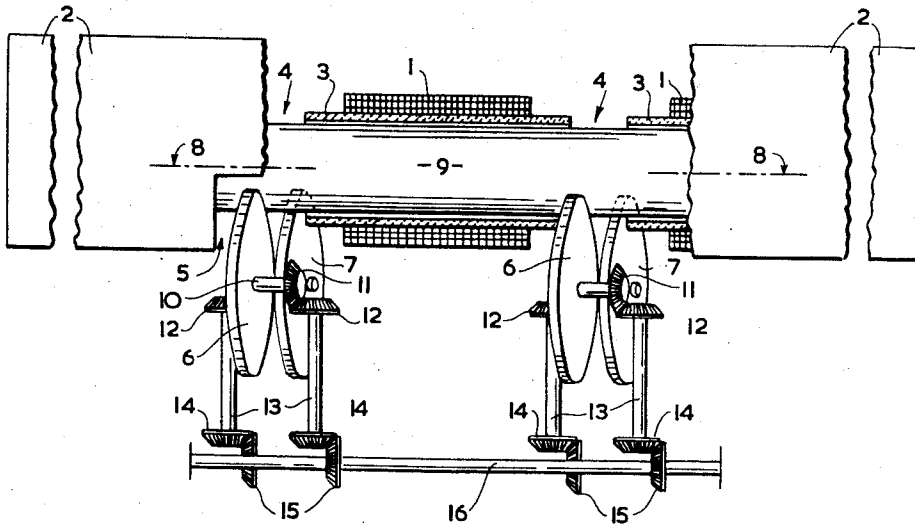
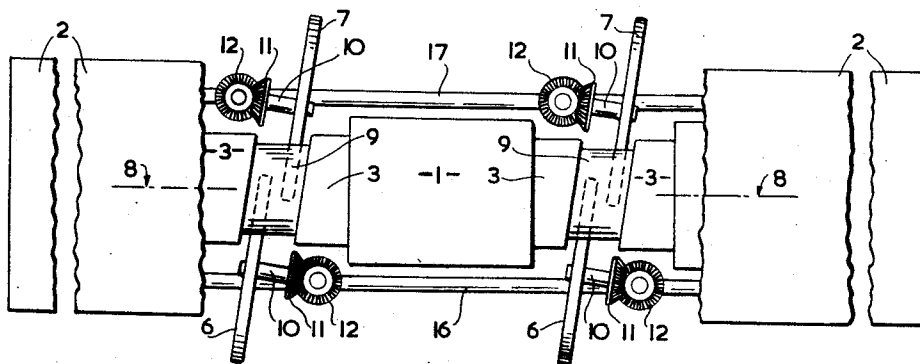


FIG. 2.



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FURNACES

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Application April 7, 1958, Serial No. 726,726

Claims priority, application Great Britain April 11, 1957

9 Claims. (Cl. 219—10.69)

This invention has reference to furnaces of the continuous type, that is of the type wherein the workpieces to be heat-treated are adapted to be fed through the furnace one after the other in a continuous manner; more particularly, the invention is concerned with continuous furnaces for the heat treatment of metal billets and similar elongated workpieces having longitudinal dimensions which are considerably greater than their cross-sectional dimensions.

The principal object of the present invention is to provide a continuous furnace with new or improved mechanism, of simple and economical construction, for feeding elongated workpieces through the furnace.

Another object of the invention is to enable the feeding mechanism to be adjusted so that when it is desired to heat treat a fresh batch of workpieces having uniform cross sectional dimensions which differ from the cross sectional dimensions of the batch of workpieces which were last treated within the furnace, the workpieces of the fresh batch may be fed through the furnace with their longitudinal centre lines in the same common line or axis as that in which two longitudinal centre lines of the previous batch were located during their passage through the furnace.

Still another object of the invention is to enable the feeding mechanism to be adjusted for varying the speed at which the workpieces are fed or progressed within the furnace, without having to vary the speed of any driven component of the said mechanism.

The above and other objects of the invention will be readily understood from the following detailed description and appended claims when read in conjunction with the accompanying diagrammatic drawing which illustrates a typical embodiment of the invention. However, it is to be understood that the invention is not restricted to the particular embodiment illustrated in the drawing wherein:

Figure 1 is an elevation, partly in section, of a continuous electric induction furnace, and

Figure 2 is a plan, also partly in section, of the furnace shown in Figure 1.

The furnace shown in the drawing comprises a number of axially aligned coils 1 which are enclosed in a tunnel-like shell 2. Each coil is disposed around a sleeve 3 of refractory material and the adjacent ends of the several sleeves are spaced apart by any desired and predetermined distance to provide clearances 4 of a common uniform width, between the said adjacent ends.

The underside of the shell 2 is formed with a number of openings 5 equal to the number of inter-sleeve clearances, each of the said openings extends partway round the tunnel and vertically below a corresponding one of the inter-sleeve clearances, and a different pair of discs 6, 7, projecting through each of the said openings, is so disposed that their upper peripheral zones extend into the corresponding clearance. Although, in the drawing, only two pairs of discs 6, 7, are shown, it will be understood that, in practice, such disc pairs will be provided,

at predetermined intervals apart, along the entire length of the furnace.

The discs 6, 7, of each pair are rotatable about axes which are parallel to one another, are located on opposite sides of and equidistantly from the vertical plane passing through the common longitudinal centre line 8 of the sleeves and coils, and are inclined relatively to the said common centre line: also, the axes of each pair of discs are parallel to the axes of the other disc pairs. Since all the disc axes are parallel to one another and each disc is heated in a plane perpendicular to its axis, it follows that the discs of each pair are parallel both to one another and to the discs of all the other pairs.

The axes of each pair of discs are located below the common longitudinal centre line and are spaced apart by a distance less than the disc diameter so that the adjacent peripheral zones of the said discs overlap one another below the said common centre line; furthermore, the said axes are located at such a distance below the common longitudinal centre line that the upper peripheral zones of the discs overlap the lower portions of the adjacent ends of two of the sleeves and project into the clearance between the said ends so that they are adapted to assist in supporting an elongated workpiece such as a cylindrical billet 9 extending across the clearance into one or both of the sleeves, in a position wherein the workpiece is disposed concentrically to the sleeves and is out of contact with the internal surface or surfaces of the sleeve or sleeves into which it extends.

Since the disc axes are inclined to the common longitudinal centre line of the sleeves and coils and are perpendicular to their respective discs, it follows that the discs are also inclined to the said centre line; consequently, by rotating the several disc pairs in the same direction and at the same speed, any workpiece supported upon their upper peripheral zones, is fed through the sleeves at a speed which is dependant upon the speed of rotation of the discs and upon the angle at which the discs are inclined to the common longitudinal centre line of the sleeves and coils.

In order that each workpiece may be supported at all times during its passage through the furnace, upon the upper peripheral zones of at least two pairs of discs so as to minimise the possibility of the said workpiece tilting relatively to the common longitudinal centre line of the sleeves and coils and, consequently, coming into contact with the internal surface of any of the sleeves, the pairs of discs are pitched apart, lengthwise of the furnace, by a distance not more than half the length of any workpiece which is to be heat treated within the furnace.

When it is desired to heat treat a batch of elongated workpieces of the same uniform cross sectional dimensions, the discs of all the several pairs are rotated simultaneously at the same speed and in the same direction and the workpieces are charged one after the other, into one end of the furnace on to the upper peripheral zones of the two pairs of discs adjacent the said end with the result that the workpieces are fed or progressed through the successive sleeves and are discharged from the opposite end of the furnace, in a continuous manner.

The discs are adjustable simultaneously towards and away from the vertical plane passing through the common longitudinal centre line of the sleeves and coils so as to vary the degree by which their upper peripheral zones overlap the ends of the sleeves thereby breaking the said zones to be so positioned that they support the workpieces being fed through the furnace with the longitudinal centre lines of the said workpieces coinciding with the said common centre line and, when the workpieces are of cylindrical shape, with a uniform annular clearance between their surfaces and the internal surfaces of the sleeves. Moreover, the ability to adjust the discs towards

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and away from the above mentioned vertical plane, also has the advantage that should it be desired to heat treat a batch of workpieces having uniform cross-sectional dimensions which differ from the cross-sectional dimensions of the workpieces of the preceding batch treated in the furnace, the said fresh workpieces may also be fed through the furnace with their longitudinal centre lines coinciding with the common longitudinal centre line of the sleeves and coils.

The discs are also adjustable so as to vary their angular relationship to the common longitudinal centre line of the sleeves and coils thereby enabling the speed at which the workpieces are fed or progressed through the furnace to be increased or decreased without changing the speed of rotation of the said discs; when this angular adjustment is made to any one of the discs, a corresponding adjustment is made to the other disc of the same pair so as to maintain the parallel relationship between the two discs.

To attain the above results, in the furnace shown in the drawing, each disc is fast upon a separate stub axle 10 which is inclined to the vertical plane passing through the common longitudinal centre line 2 of the sleeves 3 and coils 1 is parallel both to the stub axle carrying the other disc of the same disc pair and to the stub axle carrying the corresponding disc of each of the other disc pairs. Each disc is located at the end of its stub-axle which is nearer to the said vertical plane and a bevel gear 11 fast upon the opposite end of the said axle, meshes with a complementary bevel gear 12 fast upon the upper end of a vertical lay shaft 13. A further bevel gear 14 fast upon the lower end of each lay shaft meshes with a complementary bevel gear 15 fast upon a corresponding one of two motor-driven driving shafts, 16, 17, which extend lengthwise of, but below, the tunnel-like shell 2 and are located on opposite sides of, equidistantly from and parallel to the vertical plane passing through the centre line 8, the shaft 16 being adapted to transmit drive to the discs 6, shaft 17 being adapted to transmit drive to the discs 7 and the gears 15 being located at equidistant intervals apart lengthwise of their respective driving shafts.

Since each of the bevel gears 11 are located upon the ends of the inclined stub axles which are further from the vertical plane passing through the centre line 8, the shafts 13, 16, and 17 are not only located below the shell 1 but are also disposed laterally and on opposite sides of the coils 1 so that ample room is available for their installation and they are affected to a minimum by the heat generated within the furnace.

The driving shafts, lay shafts and stub axles are journalled in bearings (not shown) located below and externally of the tunnel and like shell 2, and all the bearings are adapted to be adjustable simultaneously towards or away from the vertical plane passing through the common longitudinal centre line of the sleeves and coils so as to adjust the distance between the axes of the driving shafts 16, 17 and the degree by which the discs of each disc pair overlap the sleeve ends thereby ensuring that the longitudinal centre line of the disc-supported workpieces and the sleeves coincide and that the said workpieces are positioned concentrically of and within the sleeves as they are fed through the furnace. In practice, each batch of workpieces to be heat treated will be of the same uniform dimensions in cross-section so that when once the degree of overlap of the discs has been adjusted to suit the said dimensions further adjustment of the bearings is unnecessary until it is desired to heat treat a fresh batch of workpieces having different cross-sectional dimensions.

In addition, and in order to vary the speed at which the workpieces may be fed through the furnace without having to change the speed at which the shafts, stub axles and discs are rotated, the bearings of the said stub axles are angularly adjustable about the axes of their respective vertical shafts thereby increasing or decreasing

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the angle at which the discs are inclined to the common longitudinal centre line of the sleeves and coils.

From the foregoing description, read in conjunction with the accompanying drawing, it will be apparent to those skilled in the art that I have devised a novel, efficient and simple mechanism for feeding cylindrical and similar elongated workpieces through a continuous type of furnace so as to position the said workpieces, when passing through the treatment chamber of the furnace, with their longitudinal centre lines coinciding with the longitudinal centre line of the chamber so that they are prevented from contacting the chamber walls. Whilst the said description describes and the said drawing illustrates a typical and practical embodiment of my invention, it is to be understood that various alterations and modifications may be made without departing from the scope of the following claims: thus, for example, the furnace need not be of the electric induction type but may be adapted to be heated in any known and convenient manner.

I claim:

1. A continuous furnace for the heat treatment of metal billets and similar elongated workpieces, comprising a treatment chamber having openings in its underside, the said openings being spaced apart along the direction of travel of the workpieces through and lengthwise of the chamber, and a number of pairs of discs equal to the number of openings, the discs of each pair being parallel to one another but inclined to the vertical plane passing through the longitudinal centre line of the chamber, and being rotatable about parallel axes located on opposite sides of and equidistantly from the said plane, and the upper peripheral zones of each of the said pairs of discs extending into the chamber through a corresponding one of the openings so that the workpieces are adapted to be supported upon the said zones and to be fed along the chamber by the rotation of the discs.

2. A furnace according to claim 1 wherein the upper peripheral zones of the disc pairs are so located within the chamber that they are adapted to support the workpieces with the longitudinal centre lines of the said workpieces coinciding with the longitudinal centre line of the chamber.

3. A furnace according to claim 1 wherein the axes of the discs are adjustable towards and away from the vertical plane passing through the longitudinal centre line of the chamber.

4. A furnace according to claim 1 wherein the discs are angularly adjustable relatively to the vertical plane passing through the longitudinal centre line of the chamber.

5. A furnace according to claim 1 wherein the chamber comprises a number of co-axial refractory sleeves of which two adjacent ends are spaced apart to provide inter-sleeve clearances of the same uniform dimensions, a separate electric-induction coil is carried around each of the said sleeves and a tunnel-like shell surrounding the said sleeves and coils, the said shell having openings in its underside, each of the said openings being disposed vertically below a corresponding one of the said clearances, the upper peripheral zones of a corresponding one of the disc pairs passing through each of the said openings into the corresponding clearance where they overlap the lower parts of the adjacent sleeve end.

6. A furnace according to claim 5 wherein each disc is fast upon a corresponding stub axle which is inclined to the vertical plane passing through the longitudinal centre line of the chamber, and the said axle is geared to a corresponding one of two driving shafts extending lengthwise and opposite sides of and below the said chamber.

7. A furnace according to claim 6 wherein all the disc-carrying axles on one side of the vertical plane passing through the longitudinal centre line of the chamber are geared to one of the said driving shafts and all the disc-

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carrying axles on the opposite sides of the plane are geared to the other and said driving shafts.

8. A furnace according to claim 7 wherein each driving shaft and the disc-carrying axles geared thereto are adjustable towards and away from the vertical plane passing through the longitudinal centre line of the chamber. 5

9. A furnace according to claim 7 or claim 8 wherein each stub axle is angularly adjustable relatively to the vertical plane passing through the longitudinal centre 10

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line of the chamber so as to vary the angle at which the corresponding disc is inclined to the said plane.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,911,510

November 3, 1959

Frederick A. McNulty

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, lines 1 to 3, for "Frederick A. McNulty, of Bedford, England," read -- Frederick A. McNulty, of Bedford, England, assignor to Salem Engineering Company Limited, of Milford, Derbyshire, England, --; line 12, for "Frederick A. McNulty, his heirs" read -- Salem Engineering Company Limited, its successors --; in the heading to the printed specification, line 3, for "Frederick A. McNulty, Bedford, England" read -- Frederick A. McNulty, Bedford, England, assignor to Salem Engineering Company Limited, Milford, Derbyshire, England --.

Signed and sealed this 14th day of June 1960.

(SEAL)

Attest:

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