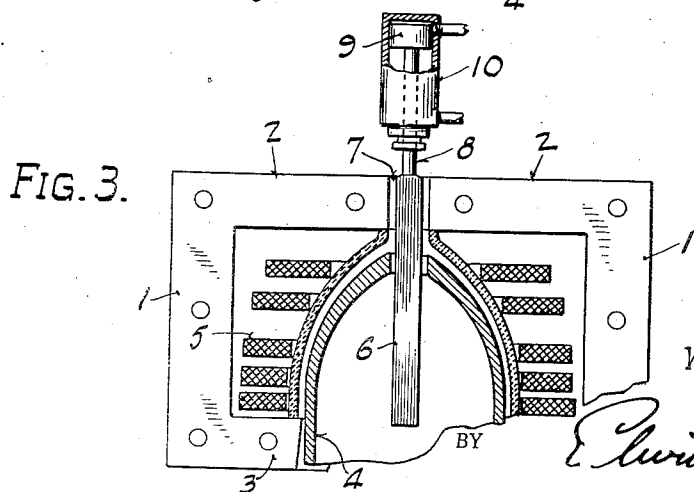
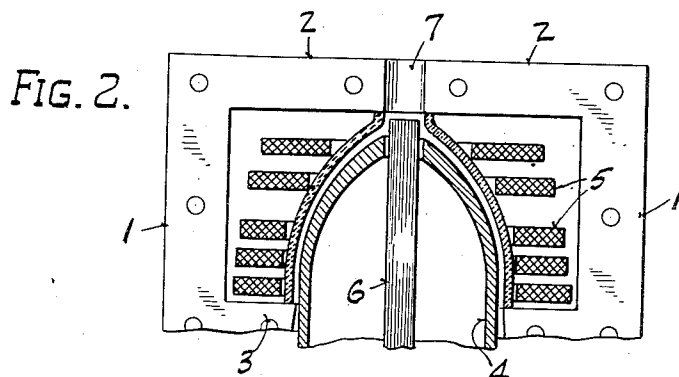
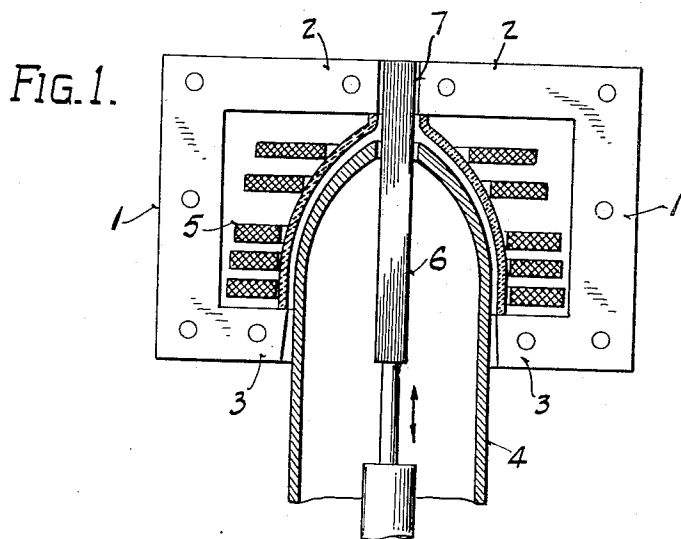


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INDUCTION HEATING
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2,371,066



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INDUCTION HEATING

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2 Claims. (Cl. 219—13)

This invention relates to induction heating and constitutes an improvement upon the low cycle induction heating described in the application of Edward Bennett, Serial No. 451,282, filed July 17, 1942, for Induction furnace, and assigned to the same assignee as the present invention.

In the application referred to there was described a low cycle induction furnace for heating the upper ends of tubes in the manufacture of bomb casings. The problem therein described lay in obtaining a uniform rate of heating for the different sections of the nose of such a bomb casing after initial forming operations had made different sections of different diameter. Professor Bennett set forth a solution to this problem by describing a furnace construction in which a section of high reluctance was provided in the core structure immediately above the upper end of the tube to force a greater proportion of leakage flux away from the axial path through the upper small end of the tube and compel it to cut across through the tube wall at points below the end of the tube. He additionally located the energizing coils for the furnace at a distance remote from the upper end of the blank being heated.

There are times when it is desired to vary the effect of the high reluctance section of the core structure so as to adapt the furnace to the heating of different sized blanks or to heating the same blank in between different successive forming operations.

The object of the present invention is to provide a furnace which will be capable of ready adjustment to the needs of the blank.

Another object is to provide a furnace in which the high reluctance of the section of the flux path referred to can be varied at will either during or between heating operations.

According to the invention the central core leg is spaced at its upper end from the upper horizontal core structure and is made vertically movable to enable the gap to be increased or decreased at will.

An embodiment of the invention is illustrated in the accompanying drawing in which:

Figure 1 is a vertical central section through furnace;

Fig. 2 is a similar section of the upper portion of the furnace showing the central core in a different position to provide a larger gap between its upper end and the outer core structure; and

Fig. 3 is a section similar to Fig. 2 showing a

modified construction of support for the central core leg.

The furnace comprises in general an outer core structure constituting the vertical legs 1 with radial upper horizontal branches 2 closing together at the top, and similar branches 3 extending to a position adjacent to the tubular blank 4 at the bottom. Coils 5 are disposed within the core structure and encircle the blank 4 when it is inserted into the furnace.

A central core leg 6 of low reluctance is supported axially of the blank 4 to provide a flux path between the inner ends of the branches 2 of the outer core structure and the inner ends of the branches 3. The flux passing vertically through the core 6 through the part of the blank to be heated is effective in inducing heating currents in the blank.

Where substantially all of the magnetic flux passes through all sections of the blank being heated the rate of heating in any given section will depend upon the resistance of that section to the flow of the induced heating currents circumferentially of the blank. Since the diameter of the blank is less at its upper end the current generated there will be greater and the heating rate will be proportional to the IR^2 values at the end as compared to those in the larger diameter sections of the blank.

In the Bennett application above referred to it was pointed out that by providing a gap in the core structure at the upper end of the furnace, it was possible to force a sufficient proportion of flux to take a different path cutting through the blank wall at points below the upper end and thereby obtain a more nearly equal rate of heating of the different sections of the blank.

In carrying out the present invention, the central core leg 6 is made vertically movable and preferably extends through an opening 7 at the center of the branches 2 of the outer core structure. The core leg 6 may be supported on an elevator from the bottom, adapted to raise the leg into the blank 4 and to an adjusted position with respect to the upper branches 2 of the outer core structure so as to provide a variable air gap at the upper end of the blank 4.

In Fig. 1 the core leg 6 is illustrated as extending upwardly through the outer core structure and providing only a minimum gap between its circumference and the edges of the core 2. In Fig. 2 the leg 6 is shown as having its upper end substantially below the branches 2 of the outer core structure, thereby providing a large air gap

for diverting the magnetic flux from the end of the blank 4.

In Fig. 3 the central core leg 6 is suspended by a rod 8 extending upwardly to a piston 9 in a suitable hydraulic cylinder 10 for raising and lowering the core leg.

The adjustment of the air gap between the upper end of the core leg 6 and the branches 2 of the outer core structure is dependent upon the shape of the blank being heated. Where suitable temperature reading means are provided for the different sections of the blank, it is possible to adjust the height of the central core leg 6 during the heating of a given blank so as to obtain uniform temperature readings for the upper and lower sections being heated. Where successive blanks of similar shape are being heated, a predetermined adjustment of the height of the core leg 6 may be made that is suitable for all of the heating operations, or a given cycle of adjustment may be made for the core leg 6 during each of the heating operations.

Various embodiments of the invention may be employed within the scope of the accompanying claims.

The invention is claimed as follows:

1. In a low cycle induction furnace of the class described, a substantially fixed outer core

structure with an energizing coil therefor, a separate inner core structure adapted to be disposed axially of a tubular article being heated and to co-operate with the outer core structure in providing a substantially closed flux path for the furnace, and means for moving the inner core structure longitudinally and for holding the same at a selected position relative to said outer core structure to provide a variable gap in the magnetic circuit between one end thereof and the outer core structure during the heating cycle of the furnace.

2. In a low cycle induction furnace for heating the end of a tubular blank having a partially formed nose in the manufacture of bomb casings and the like, an outer core structure having an opening at one end for insertion of the blank, an inner core structure disposed axially of the blank to provide with the outer core structure a substantially closed flux path for the furnace, and means to move said core structures relatively in an axial direction and hold the same in a selected relative position providing a variable gap in the flux path between an end of said inner core structure and the corresponding end of the outer core structure to divert flux from passing through the smaller end of the blank being heated.

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