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HIGH-FREQUENCY INDUCTOR

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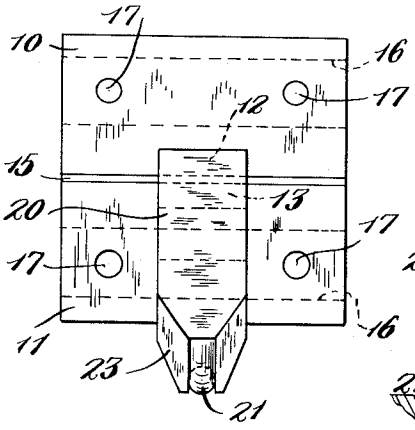


FIG. 2

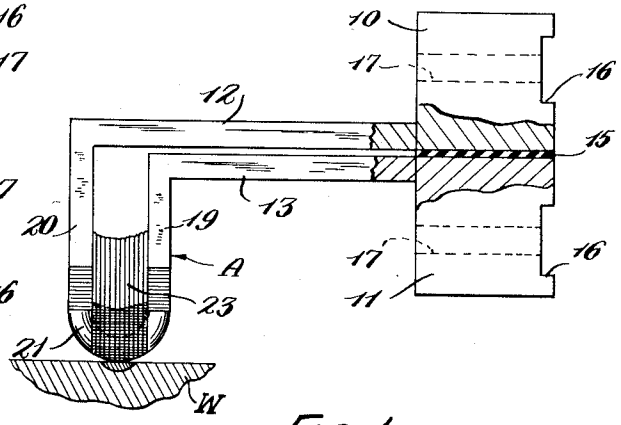


FIG. 1

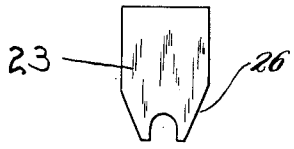


FIG. 3

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HIGH-FREQUENCY INDUCTOR

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1 Claim. (Cl. 219—47)

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This invention pertains to the art of high-frequency induction heating and, more particularly, to a high-frequency inductor capable of heating extremely limited areas. Heretofore, the heating of extremely limited areas employing high-frequency induction heating has been extremely difficult to obtain. Ordinarily, the areas have been circular in shape and there has been less actual heat in the center of the area than there has been on the outside.

The present invention contemplates an inductor construction capable of heating a limited area of a shape which is not necessarily circular and wherein the maximum amount of heat is produced at the center of the area rather than at the edges.

In accordance with the present invention, an inductor is provided which is generally U or hairpin shaped with the curve of the U adapted to be adjacent the workpiece to be heated and of limited cross-sectional area. The legs of the U extend in spaced parallel relationship away from the area to be heated and normally have a much wider cross-sectional area than the curved part. A stack of magnetic laminations having their plane parallel to the planes of the legs are disposed between the legs and extend down to overlap the curved part of the U.

An object of the invention is the provision of a new and improved inductor which is capable of heating limited areas on workpieces and which is simple in construction, electrically efficient and easy to manufacture.

Another object of the invention is the provision of an inductor for heating limited areas of workpieces which comprises a generally U-shaped inductor including a curved portion of limited cross-sectional area adapted to be disposed in close spaced relationship to the area to be heated and a pair of spaced parallel legs of greater cross-sectional area extending away from the workpiece and magnetic laminations disposed between the legs and overlapping the curved portion adjacent the work.

The invention may be embodied in a number of different constructions and arrangements; but, for the purposes of illustrating the invention, a preferred embodiment will be described in this specification and illustrated in the attached drawing which is a part hereof, and wherein:

Figure 1 is a side elevational view of a high-frequency inductor embodying the present invention in heat-inducing relationship with a workpiece to be heated.

Figure 2 is an end elevational view of Figure 1.

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Figure 3 is a detailed view of one of the laminations employed.

Referring now to the drawings wherein the preferred embodiment is shown for the purposes of illustration only and not for the purposes of limitation, Figure 1 shows a high-frequency inductor comprising a pair of terminal blocks 10, 11 which are adapted to be attached to the terminal blocks not shown of a power source such as an impedance-matching transformer. A pair of fish-tail leads 12, 13 are connected at their ends to the terminal blocks 10, 11 respectively and extend away therefrom in spaced parallel relationship and at their other ends are connected to the active heat-inducing portion of the inductor designated generally as A.

The terminal blocks 10, 11 may be of any desired construction. As shown, they are generally rectangular and are in slightly-spaced insulated relationship as at 15. The right-hand side as viewed in Figure 1 has a shallow recess 16 which is adapted to receive a correspondingly shaped mating portion on the terminal blocks of the power source. These blocks are also provided with a plurality of openings 17 through which mounting bolts may extend to mount the terminal blocks on the power source. These terminal blocks may be water cooled if desired.

The fish-tail leads 12, 13 are generally rectangular in cross-sectional shape and, as stated, extend away from the terminal blocks 10, 11 with their sides of greatest dimensions in close spaced parallel relationship. In the embodiment shown in Figure 1, the upper leg 12 is longer than and extends beyond the lower leg 13 to the left. The inducing portion A is generally U or hairpin shaped in side elevational view and includes a pair of spaced parallel legs 19, 20 interconnected at their lower ends by a curved or arcuate portion 21. The legs 19, 20 connect at their upper ends and at right angles to the fish-tail leads 13, 12 respectively. As shown, the legs 19, 20 at their upper ends have a width generally the same as that of the fish-tail leads 12, 13; but, at their lower ends, the legs taper to the cross-sectional width of the U-shaped portion 21. As shown, the U-shaped portion 21 is generally circular in cross section having a diameter approximately one-third the width of the legs 19, 20. This arcuate portion is generally semicircular in the side elevational view. As shown, the lower ends of the legs 19, 20 taper from their maximum width to the diameter of the portion 21 in a length corresponding approximately to two diameters of the portion 21.

Magnetic laminations **23** are disposed between the legs **19** and **20**. The plane of these laminations is parallel to the plane of the legs **19, 20**. On the lower edge thereof, it has a semicircular recess formed to receive the arcuate portion **21** of the inductor. Thus, the laminations **23** at their lower edge overlap the arcuate portion **21**. Further, the outer lower corners of the laminations **23** are beveled or cut away as at **26**.

Separate high-frequency currents are flowed through the inductor; for example, through the terminal block **10**, the fish-tail lead **12**, the leg **20**, the arcuate portion **21**, the leg **19**, the fish-tail lead **13** and the terminal block **11**. These currents set up a high-frequency flux field about the respective conductors. The close spacing of the terminal blocks **10, 11** and the fish-tail leads **12, 13**, however, tend to restrict and limit the flux field about these particular members. The flux field about the arcuate portion **21** tends to thread through the workpiece *w* shown just below to induce heating currents therein in an extremely limited area as shown. This flux is concentrated by the laminations **23**, the lower edge of which it will be noted are relatively narrowed by the cut-away portion **26**. Additionally, the flux about the legs **19** and **20** tends to flow into the laminations **23** and this flux also, to some extent, will show up in the lower edge of the laminations to thread through the workpiece. It is to be noted in this respect that the laminations **23** while cut away at their lower edges are so formed in dimension below the cut-away or tapering portion of the legs **19, 20**.

It has been found in practice that an inductor constructed in accordance with the above disclosure has proven very effective for heating spots of limited areas on metallic workpieces employing ten thousand cycles per second alternating-current electrical energy. The heat in the heated area is normally uniform thereacross and in contradistinction to other inductors for heating small areas, the temperature of the spot is a maximum at the middle.

The invention has been described in connection with a preferred embodiment thereof. It will be appreciated that modifications and alterations in this preferred embodiment will occur to others upon a reading and understanding of this specification. It is my intention to include all such modifications and alterations insofar as they come within the scope of the appended claim.

Having thus described my invention, I claim:

A high-frequency inductor comprising a pair of fish-tail leads adapted to be connected at one end to a high-frequency power source, said leads extending from said power source in close-spaced insulated relationship and a generally U-shaped conductor depending from said leads and including a pair of slightly-spaced legs and a generally arcuate piece interconnecting the lower end of said legs, the upper end of said legs being each connected to one of said fish-tail leads, said arcuate piece having a substantially lesser cross-sectional area than that of said legs, said legs tapering gradually from their greater cross-sectional area to the cross-sectional area of said piece, magnetically-permeable laminations disposed between said legs with their plane perpendicular to the plane of the piece, the lower edge of said laminations being recessed to receive and thereby overlap the sides of said arcuate piece, the lower surface of said arcuate piece forming the only workpiece-facing surface of said inductor.

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