(No Model.)

H. LEMP.

ELECTRIC WELDING TRANSFORMER.

No. 440,640. Patented Nov. 18, 1890.

Fig. 2.

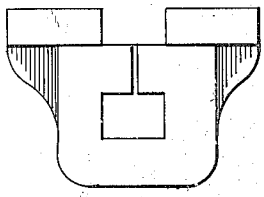


Fig. 1.

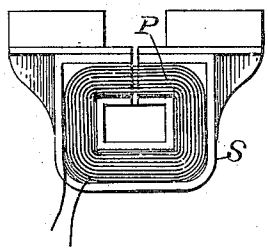


Fig. 3.

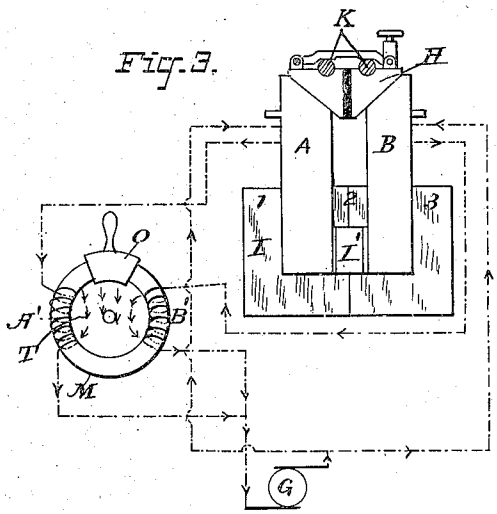


Fig. 5.

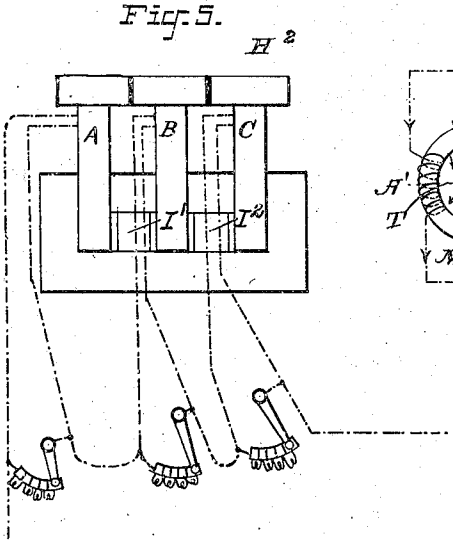
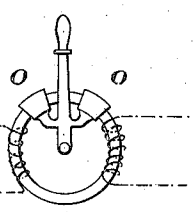


Fig. 4.



ATTEST:
J. A. Hurdle
Thos. H. Capel.

INVENTOR:
Hermann Lemp
By H. L. Townsend
Attorney

UNITED STATES PATENT OFFICE.

HERMANN LEMP, OF LYNN, MASSACHUSETTS, ASSIGNOR TO THE THOMSON ELECTRIC WELDING COMPANY, OF MAINE.

ELECTRIC WELDING TRANSFORMER.

SPECIFICATION forming part of Letters Patent No. 440,640, dated November 18, 1890.

Application filed April 16, 1890. Serial No. 348,153. (No model.)

To all whom it may concern:

Be it known that I, HERMANN LEMP, a citizen of the United States, and a resident of Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Electric Welding Transformers, of which the following is a specification.

My invention relates, generally, to electric metal-working apparatus of the class in which electric currents of large volume but low electro-motive force are passed through the work for the purpose of heating the same and reducing it to the desired condition of plasticity, as in electric welding, forging, soldering, riveting, and other operations.

My invention is, however, designed more particularly for use in electric welding, soldering, forging, and such class of work in which the areas of material to be heated at once are large or extended or subdivided, and which, owing to want of uniformity of contact or conducting capacity at different parts of the work, are liable to heat unevenly.

My invention consists, essentially, in securing uniform heating at different parts of the work by supplying the different parts of the work from different sources of energy and regulating the different sources independently of one another.

My invention consists, further, in a novel construction of compound transformer forming the source of heating-currents, as hereinafter described, and especially adapted for supplying currents of regulable amount to the different sides or parts of the work.

My invention consists, also, in means for regulating the current-flow to different parts of the primary of said transformer.

My invention consists, also, in the construction of the clamping or holding devices for the work, whereby two separate joints to be welded may be more readily furnished with separate currents in parallel.

In a transformer constructed in accordance with my invention I obtain the practical advantages of two separate transformers by winding or applying two separate sets of primary and secondary to the same iron core, and combining with such core a magnetic bridge-piece passing across from one side to the other thereof and adapted to form a path for the magnetic energy of the core when the current of a primary is varied, as hereinafter more particularly described.

Other features of construction will be more particularly hereinafter described, and then specified in the claims.

The transformer devised by me is especially adapted for use in the process of electric welding as applied to the formation of two separate joints or welds simultaneously in parallel, as in a chain-link. In this class of work it is difficult to make both sides heat at the same rate and reach the welding-point at the same time, owing to the difference in the intimacy of contact between the two proposed joints.

In the accompanying drawings, Figure 1 is a side elevation of a portion of a transformer in which my invention is embodied. Fig. 2 is a side elevation of the same part from the opposite side. Fig. 3 is an edge view of a transformer embodying my invention and connected up to the devices hereinafter described and claimed for varying or regulating the action. Fig. 4 illustrates a modification in the regulating device. Fig. 5 illustrates the extension of the idea to three separate sets of primary and secondary conductors.

In Fig. 3 I have shown two secondary conductors A B, each having a primary winding. Each secondary is preferably constructed, as illustrated in Fig. 1, from a casting of copper, forming a solid copper bar having a groove in its side, in which lies the primary conductor P. The copper bar is slit at one side, and at opposite sides of the slit the supports for the work to be heated are formed. The two secondary bars A B, each having its usual winding, are placed back to back, as indicated in Fig. 3, but with a space between them, and are provided with an iron core I, made, as usual, of laminated iron. This core passes through both of the secondaries, as shown, so that there is in effect but one core-piece for both sets of primary and secondary conductors. The coils of the primary are connected into circuit, so that they will act in the same direction or tend to magnetize the iron core in the same way. In other words, instead of producing a consequent pole at any point, they act conjointly to produce a magnetic

circuit having no consequent pole. Between the two sides of the core I is placed a bridge-piece of iron I′, connecting the two sides of the core and adapted to form a path for the magnetism across from one side to the other in case of disturbance of the equality of magnetic potential at opposite sides of the core. The inner side of each secondary bar or conductor S, at its upper and inner side, is beveled, as shown, and the bars receive within them the V-shaped conductor-slide H, which carries the work to be heated and is provided with suitable devices for clamping the work in place. In the present instance it is shown as clamping the two sides of one end of a chain-link K. The slide H fits upon the upper side of the two secondary bars and is preferably divided longitudinally, so that the two sides furnished, respectively, with energy from the sources A B will be insulated from one another.

In order to independently regulate the energy from each source A B according to the requirements of different parts of the work, I propose to regulate the current flowing in the primary circuits of the secondaries S, for which purpose I employ an apparatus constructed as follows and placed in the connection from the source G, which is typical of any source of alternating currents and which supplies the primaries in multiple. The regulating device operates after the manner of a reactive coil or counter-electro-motive-force generator, and is composed of an iron ring M, preferably laminated and having two coils A′ B′ wound upon it at different parts and connected into the circuits of the two primary coils.

O indicates a conducting band or circle of copper which encircles the core M, and preferably consists of a copper casting. By varying the relation of this closed conductor to the reactive coils the reactive power of the latter upon the currents flowing through them may be made to vary, as now well understood in the art, the reaction being less when the conductor O is over the coil A′ or B′, and gradually increasing as it is moved away from coincidence with such coil.

I preferably provide, in addition to the conductor O, an iron armature T, which fills the space within the core and coils A′ B′, and is preferably mounted on a center, so as to adapt it to form a support for the conductor O, which, by means of a suitable handle, may be then moved to any desired position on the core and coils. The iron armature T will obviously form an armature for the coils in whatever position the conductor O may be placed. The coils A′ B′ are so wound or connected that the lines of force generated by each in the core will tend to take paths (shown by the arrows) through the armature T. With this construction it is obvious that as the conductor O is moved toward one coil A′ or B′ and away from the other the action of both coils will be simultaneously varied. It is obvious, likewise, that instead of a single conductor O two conductors might be employed, as indicated in Fig. 4—one for each coil. The two conductors would obviously act in the same way as the one conductor, Fig. 3.

The half-link K or other device the two sides or parts of which are to be heated equally is placed in position on the clamp or clamp-slide, as shown in Fig. 3, so that each side or part will be supplied with current from a separate part of the apparatus. The coils of the two secondaries being so wound and connected as to act in the same direction, the iron core will be magnetized with a difference of magnetic potential between 1 and 2 the same as between 2 and 3, and the lines of magnetism will pass from 1 to 3 directly and circulate through such core as a closed iron circuit, very few, if any, going through the iron bridge I′. Currents of equal potential will now be induced in the two sources of energy A B, and will feed equal current to the two parts of the work, it being supposed that the regulating devices are in proper position to permit current to flow in equal amount through the two primaries. If, now, for any reason the side of the work fed from A should heat faster than that fed from B, the reactive device would be adjusted by moving the conductor O toward the reactive coil B′, thereby decreasing the reactive effect of that coil and increasing that of A′, so as to increase the current in the primary of B and decrease the current in the primary of A. The magnetic potential at the point 2 is thereby raised as compared with point 3, and extra lines of magnetism will take a short path through the iron bridge and back to their source, thus permitting the side of the apparatus B to work freely in setting up greater electrical energy under the influence of the alternating current.

It is obvious that my invention is not limited to any particular number of different electric sources independently controll as described, nor to any particular construction of transformer secondary.

The same plan of providing a single core for two sets of primary and secondary conductors and furnishing a magnetic bridge-piece I′ for operation, as just described, might obviously be extended to any number of primaries and secondaries having the same iron core. Thus, as indicated in Fig. 5, I have shown three secondaries A B C, arranged in parallel and supporting or connected to a clamp rest or support H^2, which might be used for holding or supporting a sheet of metal the edge of which is to be united to the edge of another piece held at the opposite side of the slit in the secondary. The support H^2 might be subdivided by insulation, applied so as to divide the support longitudinally in the same manner as indicated in Fig. 3. The magnetic bridge-piece which operates in conjunction with B and C in the same manner that

the bridge-piece I′ acts in connection with A and B is indicated at I^2.

It is obvious that the construction of compound transformer for use in connection with means for regulating the current in each part of the primary would be useful in any case where it is desired to regulate the energy furnished from different parts or sections of the secondary conductors wound on the common core.

It is obviously not necessary that the reactive devices should be constructed so that the reaction in one branch or primary circuit will be diminished when that of the other is increased, and vice versa; but it would be possible in conjunction with the transformer, constructed as described, to vary the reaction of each device in each primary independently of the others or to vary the current in such primaries in any other desired manner. Thus, for instance, as shown in Fig. 5, each primary might have a variable shunt independent of the other. I prefer, however, to employ an arrangement such as shown in Fig. 3 for varying the reaction. Whatever the nature of the devices for varying the current-flow in the several primaries or sections of primary, they are simply to be manipulated so as to vary the energy of the different sources, and thereby control the heating at the different portions of the work.

What I claim as my invention is—

1. The combination, in a transformer, of the two or more secondary bars or conductors and primaries therefor, an iron core common to said secondaries and primaries, and an iron bridge-piece connecting the sides of the core, as and for the purpose described.

2. The combination, with a compound transformer comprising two or more secondaries and corresponding primaries therefor applied at different parts of a common iron core and having magnetic bridges from one side to the other of the core, of means for regulating the current-flow in the primaries independently of one another.

3. The combination, with the divided work-holder, of the independent sources of electricity supplying heating-current thereto, and means for increasing the energy of one source while simultaneously decreasing the energy of the other source.

4. The combination, in an electric metal-working apparatus, of two or more sources of energy supplying different parts of the work in parallel, and means for regulating the energy of the several sources independently of one another.

5. The combination, with the two primaries having secondaries connected to different portions of the same work in parallel, of two reactive coils in the circuit, respectively, of said coils and wound on the same core, and a regulating closed circuit of copper applied to said coils and core, as and for the purpose described.

6. The combination, with two or more sets of primary and secondary conductors wound on the same core, which is provided with magnetic bridges from one side to the other thereof, of a source of alternating-current supply and reactive devices connected to the circuits of said primaries, whereby the current flowing in a primary coil may have its strength increased or diminished at pleasure.

7. The combination, with the two reactive coils in different circuits, of a common iron core upon different portions of which said coils are wound, an armature, and one or more closed conducting bands or circuits adjustable with relation to the coils, so as to increase the self-induction of one and simultaneously decrease the self-induction of the other.

8. In an electric metal-working apparatus, the combination, with the work, of different sources of energy supplying the different parts or portions thereof in parallel, and means for varying the energy of said sources so as to control the relative heating of the several parts of the work.

9. In an electric metal-working apparatus, a work-holder made in two or more parts insulated from one another and connected, respectively, with separate regulable sources of electric energy.

10. In an electric metal-working apparatus, the combination, with a divided clamp or work-holder, of secondary bars or conductors in contact, respectively, with the divisions of the holder.

11. The combination, in an electric metal-working apparatus, of a clamp-slide or base divided into sections insulated from one another on a longitudinal line, and two secondary bars with which the sides of the clamp-slide engage, respectively.

12. The combination, with the separate parallel secondary bars or conductors having a bevel at their inner sides, of a V-shaped clamp-slide bearing on said secondaries at their beveled portion, as and for the purpose described.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 14th day of April, A. D. 1890.

HERMANN LEMP.

Witnesses:
JOHN W. GIBBONEY,
ELIHU THOMSON.