

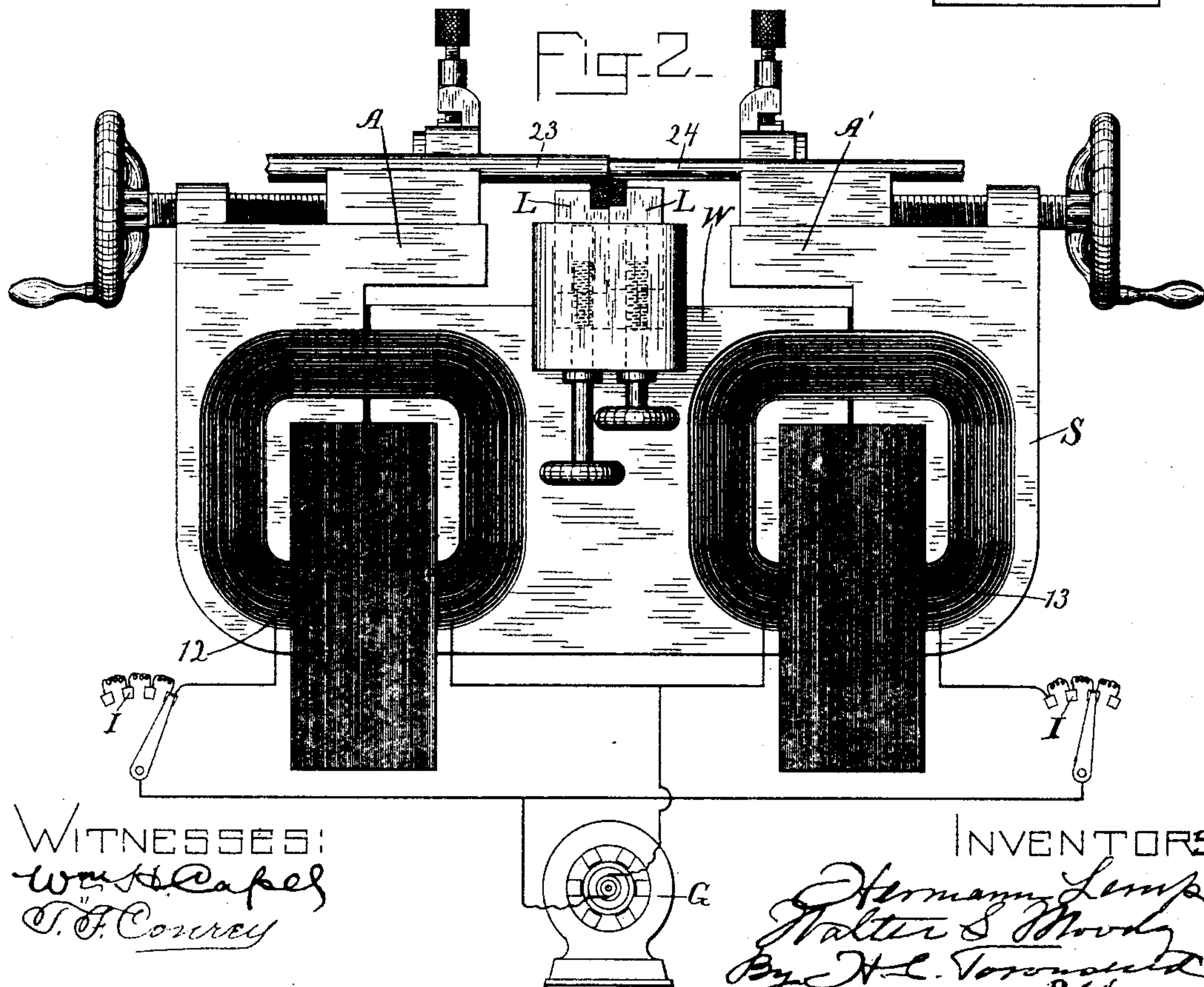
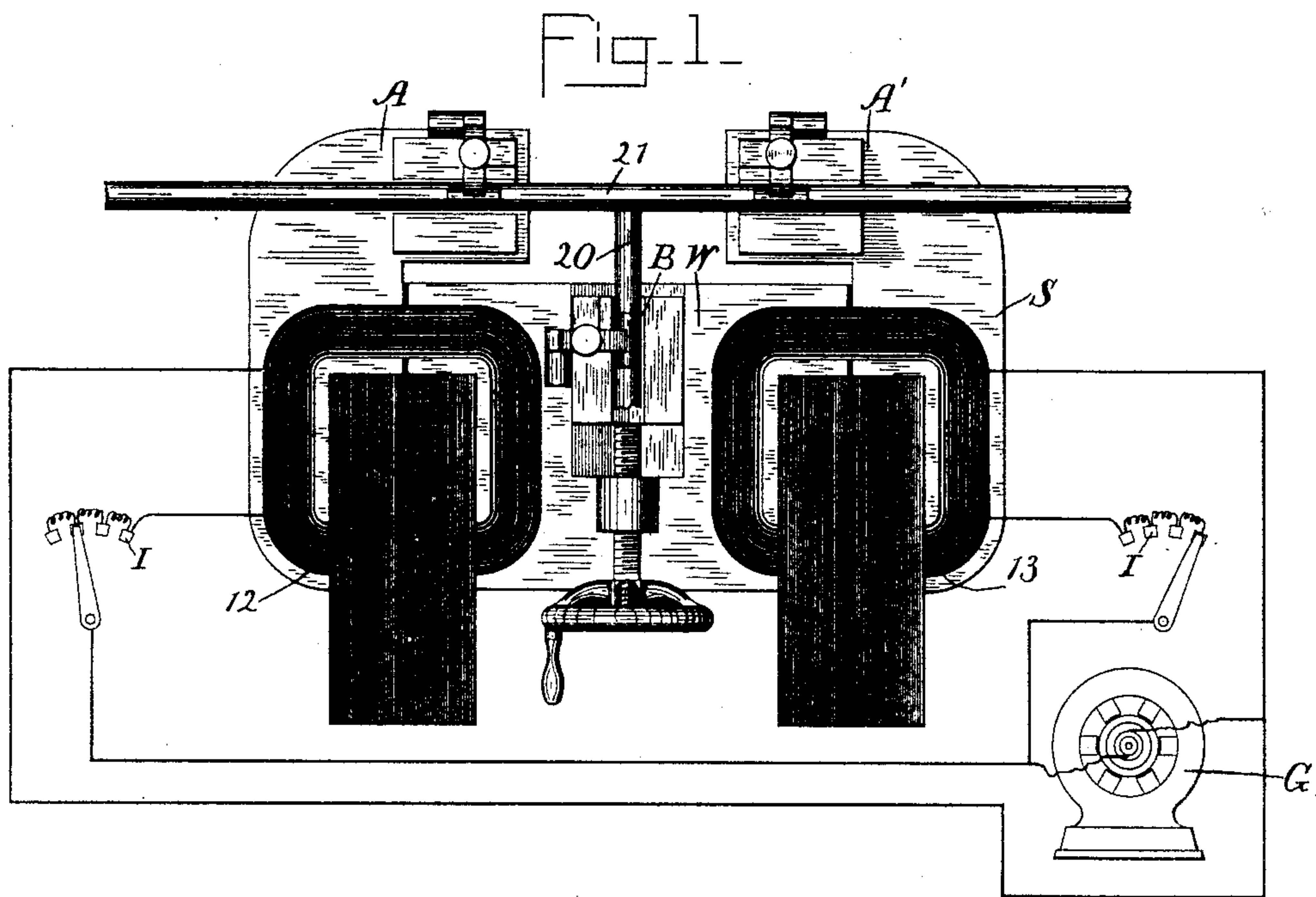
(No Model.)

2 Sheets—Sheet 1.

H. LEMP & W. S. MOODY.
PROCESS OF ELECTRIC METAL WORKING.

No. 516,312.

Patented Mar. 13, 1894.



WITNESSES:
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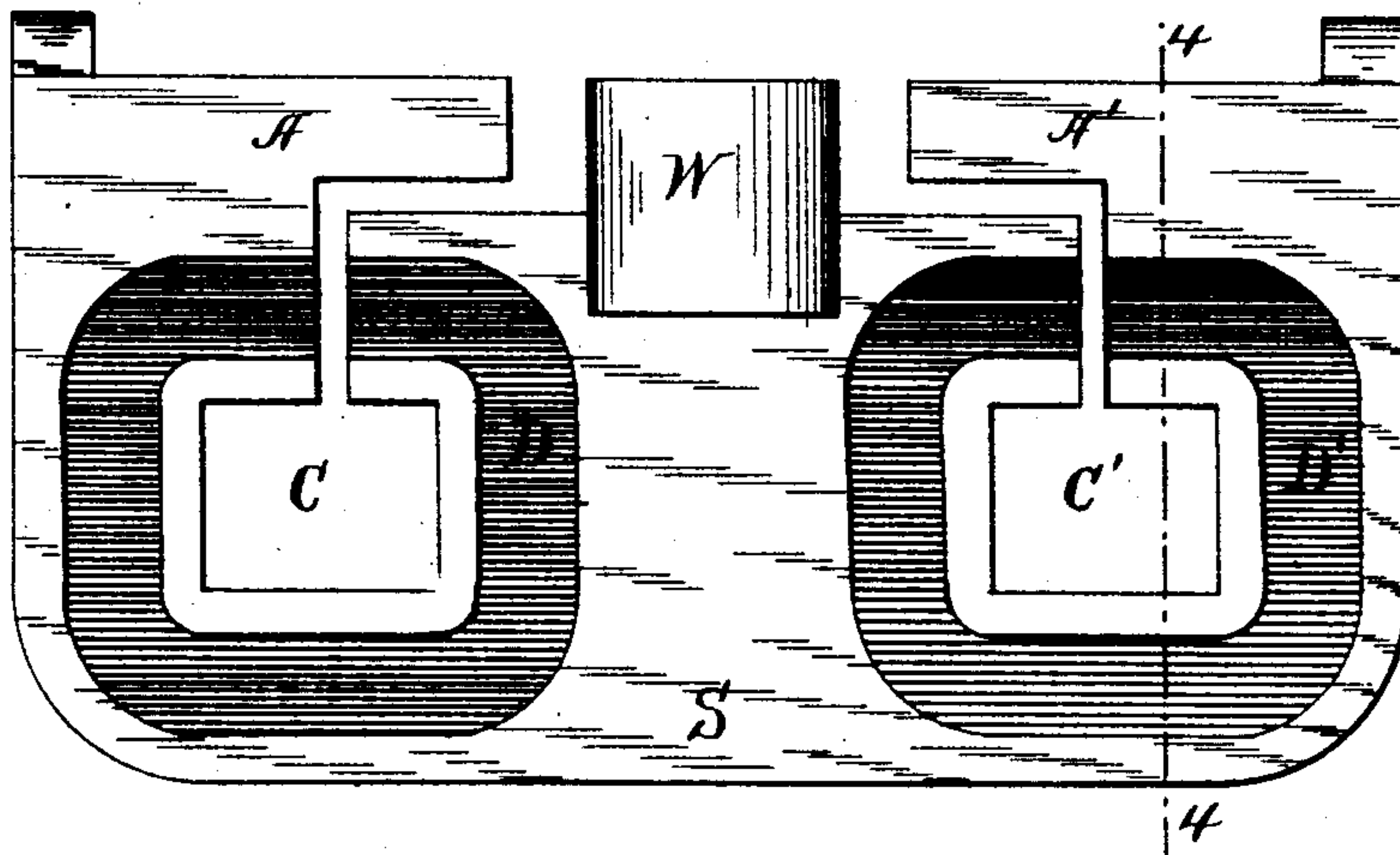


Fig. 3.

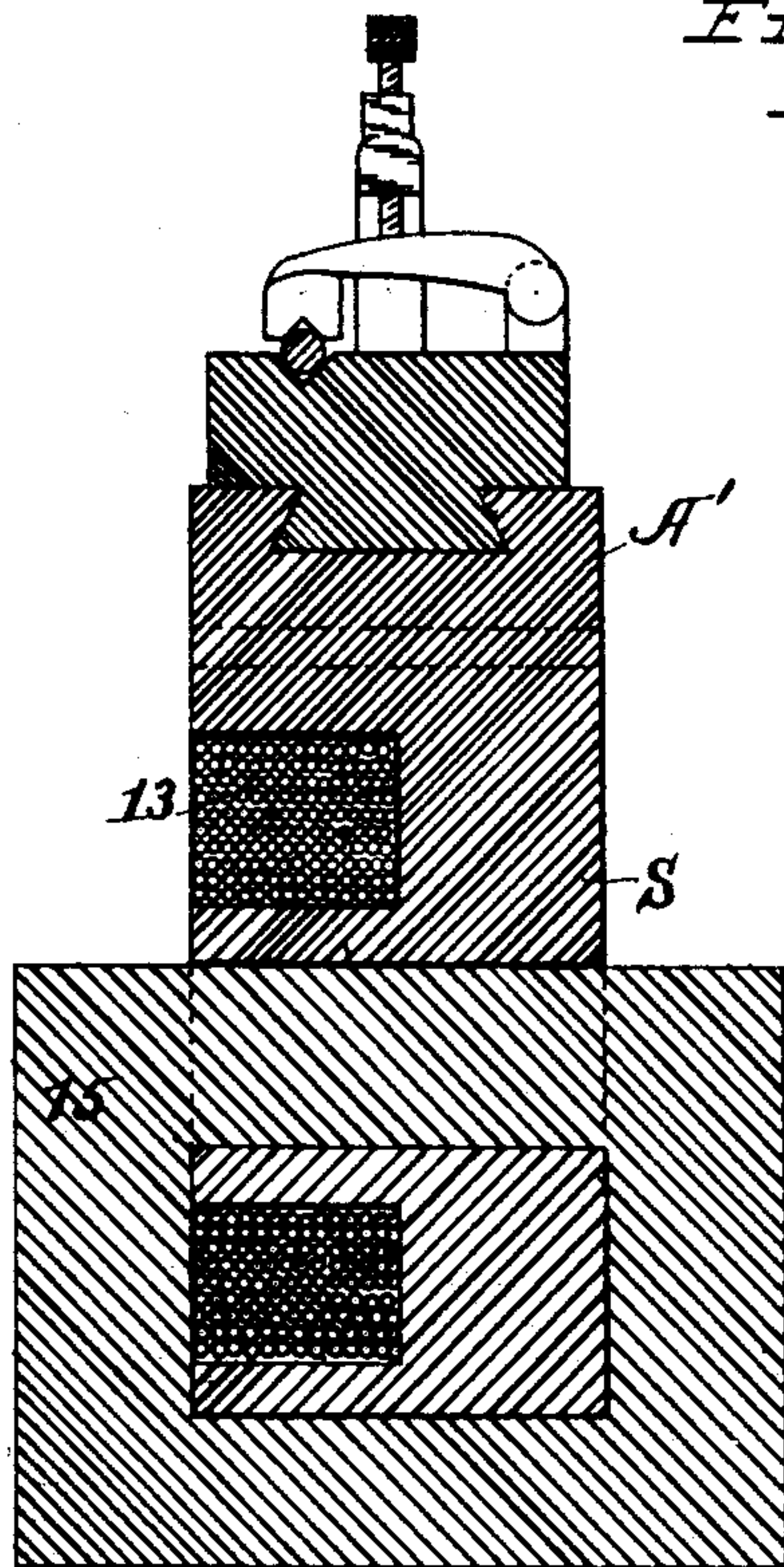


Fig. 4.

ATTEST:

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UNITED STATES PATENT OFFICE.

HERMANN LEMP, OF LYNN, AND WALTER S. MOODY, OF CHELSEA, MASSACHUSETTS, ASSIGNORS TO THE THOMSON ELECTRIC WELDING COMPANY, OF MAINE.

PROCESS OF ELECTRIC METAL-WORKING.

SPECIFICATION forming part of Letters Patent No. 516,312, dated March 13, 1894.

Original application filed October 20, 1890, Serial No. 368,695. Divided and this application filed May 26, 1891. Serial No. 394,214. (No specimens.)

To all whom it may concern:

Be it known that we, HERMANN LEMP, residing at Lynn, in the county of Essex, and WALTER S. MOODY, residing at Chelsea, in the county of Suffolk, State of Massachusetts, citizens of the United States, have invented certain new and useful Improvements in Electric Metal-Working, of which the following is a specification.

Our invention relates to electric metal working operations in which electricity is employed as the heating agent for bringing the material to the temperature required for the electric welding, brazing, forging or other operation, and the general object is to provide for a control of the heating in the parts or portions of the work to be manipulated.

Our invention consists, generally speaking, in heating the work from a divided source of energy, current from which is made to traverse the work from extreme pole to pole thereof as well as to or from a point of division of the source, by suitably modifying the relative potential or electro-motive force of the two sides.

The invention is especially applicable to the formation of welded T or Y joints, as well as to the formation of ordinary butt welded joints between two pieces of metal to be joined end to end, and to other operations.

Our invention consists further in the special construction of apparatus which is adapted to use in practicing our invention and is composed essentially of a transformer the secondary of which consists of a bar or mass of metal having an electrode or terminal intermediate of or common to two or more other terminals of said secondary. By preference we apply the primary coil or coils in such way that the said intermediate or common pole shall constitute electrically speaking a point of division of the secondary heating circuit, its two other terminals or poles being respectively of opposite polarity to one another and constituting the extreme terminals of the source or terminals whose difference of potential is the greatest.

In the accompanying drawings:—Figure 1, is a side elevation of an apparatus that may

be used in practicing our invention and shows also a construction of transformer invented by us. Fig. 2, illustrates a modification of the apparatus and shows the same as applied to forming a butt welded joint between two pieces of metal placed end to end in accordance with our invention. Fig. 3, represents the secondary bar or conductor stripped of its appurtenances; and Fig. 4, represents a cross-section of the apparatus shown in Fig. 2, taken on the plane indicated by line 4, 4, in Fig. 3.

S, indicates the secondary bar or conductor of a transformer having the three terminals A, A' and W, the terminal W, being shown as made at an intermediate portion of the secondary bar or conductor and projecting therefrom toward the space between the terminals or poles A, A'. The pole or terminal W, is common to the poles or terminals A, A', and might obviously be disposed with relation to the terminals A, A', in the manner shown, or in any other manner, according to the shape of the secondary bar or conductor S. This secondary as shown in Figs. 3 and 4, is formed of three vertical portions joined at their lower ends and bearing at their upper ends the terminals A, A' and W. Rectangular openings C, C', are provided for the reception of the usual iron cores 15, and about these openings are formed recesses or channels D, D, for the reception of the primary coils 12, 13. The cores are generally formed of plates of sheet iron cut and put together in any convenient manner. The manner of constructing and applying the coils and cores may be varied without departing from our invention.

Upon the terminals A and A', are mounted in any suitable manner the necessary work-holders. In the present instance said holders are formed of blocks mounted in a dovetail slide and carrying a common form of screw and lever clamp. At the terminal W, a similar work-holder may be mounted as shown in Fig. 1, or said terminal may be provided with adjustable contacts as L, L, illustrated in Fig. 2. This terminal W, stands as a terminal common to two secondaries whose other terminals are respectively A and A'.

In the formation of T or angle joints it is

preferable to arrange the pole W, as a projection extending in a line intersecting the line joining the terminals A, A', as above described. These several terminals may however
 5 be provided with means for holding the work or passing the heating currents into or through the same according to the nature of the particular metal working operation to be performed.

10 When the secondary bar or conductor is employed as the divided source of energy we wind or apply suitable conductors thereto so that the two terminals A, A', shall constitute respectively the opposite terminals of said
 15 source, while the terminal W, shall be electrically connected to a point of division of the source or circuit of energy. If, however, a greater current is flowing in the primary 13, than in the primary 12, there will not only be
 20 the current through the bar S, from end to end and across from A to A', through the work, but there will be a current from A', through the right hand portion of bar S, to W, and from W, to A', through the right hand
 25 portion of the work. If the heavier current be through primary 12, then the division of the current will be from W, through the left hand portion of bar S to A, and through the corresponding portion of the work to W.

30 As well understood in the art, the current passing to or from the pole W, will depend upon the difference in the potential of the two sides of the secondary bar or source, and if the potential of the said sides is equal, no
 35 currents will pass.

We have, in the present case, shown the two holders or supports connected respectively to the poles or terminals of the divided source, such as the secondary bar S, as constructed specially with reference to the formation of an angle or T joint between a bar
 40 21, and a bar or piece of metal 20, but, as will be well understood, other forms of joint might be constructed, and the nature of the holders or clamps for the work correspondingly modified. Thus, as indicated in Fig. 2, the poles
 45 or terminals A, A', might be provided with means for forcing the parts of the work held in them toward one another, and the pole or
 50 terminal W, have means for making lateral connection with the pieces in the holders A, A'.

To conveniently provide for changing the relative potential of the two sides or portions of the divided source when the same consists
 55 of a secondary S, we prefer to employ two inducing primary circuits applied at opposite sides of the intermediate pole so as to act respectively on the two portions of the secondary and in a manner to cause current to pass
 60 through the secondary as a single circuit and directly from one pole or terminal A, to the other A', through any work held between them.

65 Suitable means are provided for regulating the flow of the current in each primary so as to vary the electro-motive force of a part or

portion of the divided source of energy thus constituted, according to the nature of the metal pieces to be operated upon and the extent of the heating desired at each side or portion of the work. 70

To illustrate our invention we will describe it as applied to the formation of a T joint. At 21, is indicated a bar or piece of metal
 75 placed between the terminals of the secondary S, and heated by the passage of current from one terminal or work holder to the other. In the use of the apparatus described for forming a T joint by welding the piece of
 80 metal 20, to the side of the bar 21, the intermediate pole or projection W, of the secondary is provided with or is in electrical connection with a holder B, of any suitable construction mounted on or in electrical connection with the secondary. Such holder should
 85 be and is preferably provided also with means for forcing the piece 20, against the side of the piece 21. If the two primary currents are equal in the inducing coils the flow of the
 90 secondary current will be through the bar 21, from A to A', entirely. By increasing, however, the effect of one or the other primary by means of the regulating apparatus, a greater
 95 or less amount of current may be made to flow through the intermediate pole which is connected by the piece 20 with the piece 21, and complete its circuit on whichever side of the source is given the higher potential. This
 100 adaptability for determining the side upon which the greater current shall flow is valuable in welding operations, as indicated in Fig. 2, and in other metal working operations. By giving to the one side of the source of
 105 energy a greater potential, it is obvious that current will flow to and through the piece 20, in greater or less amount and the same will become heated at the point of junction to the bar 21,—if the volume of current passed through it be sufficient. After the desired
 110 welding temperature has been effected at the point of union of the bars 20 and 21, by the passage of the currents both through the bar 21 and to and through said bar from the bar 20, the welding may be effected by the proper
 115 pressure.

The adaptability for determining the side upon which the greater current shall flow is valuable not only in the general operation just described, but in the special welding operation indicated in Fig. 2, as well as in others. As will be obvious, when the currents
 120 are passed through the bars 21 and 20, by increasing the potential of one side of the source for the purpose of forming the T joint, or other purpose, more current will pass through
 125 the bar 21 at one end thereof than at the other, the heating at one end being due to the current passing from one terminal A, to the other A', as well as that passing to or from
 130 the point of division of the source. The tendency to overheating at one end or portion of the work we rectify by using the regulating appliances so as alternately to make the po-

tential of each side relatively greater than the potential of the other side of the divided source, thus causing the greater current to flow first in one and then in the other end of the bar 21. There would also be a tendency to the localization of heat at one or the other corner of the bar 20, where it makes abutment with the bar 21, which tendency is corrected by changing the regulating appliances so as to increase the potential first at one side and then at the other side of the divided source. In the present instance the regulation will be effected by adjusting the resistance I, I, so as to cause first one and then the other to be the greater. The piece 20, it will be seen may be considered to be a piece of metal to be joined to 21, or be simply for passing current into the work between the holders A, A'.

In Fig. 2, the transformer is shown as provided with suitable attachments adapting it more particularly for use in welding two bars or pieces 23, 24, together end to end.

The modification of our invention herein illustrated and the special way of effecting the butt weld shown and described is not herein specifically claimed as it forms the subject of claims in an application for patent filed by us of even date herewith, Serial No. 394,215.

In Fig. 2, the intermediate pole or terminal of the secondary S, carries one or more contacts L, which may be moved and placed in electrical connection with the pieces to be welded. When one of said pieces is larger than the other connection is made with the larger piece by means of a contact connected with the pole or projection from the secondary which constitutes a point of division of the source and the potential is increased on that end of the secondary bar which carries the larger piece or that requiring the greater current. Such piece is then heated by the combined action of the currents which flow respectively directly from one terminal of the secondary S, to the other by way of the holders A, A', and the current which flows through said larger piece and into or from the intermediate pole or projection of the secondary. A suitable regulation or adjustment of the flow of current in the primaries may be attained as before.

While we have shown special means for varying the potential at the two sides of the divided source, we do not limit ourselves to such means, but may employ any organization or devices for changing the relative potential according to the nature of the devices employed for generating the currents. It would also be possible, without departing from our invention, to use other means for varying the potential in the various portions of a secondary bar or circuit.

The improvement in metal working consisting in heating the metal at any point by subjecting it to the simultaneous action of currents passed into or through it at an angle

to one another is not herein claimed as it forms the subject of our prior application Serial No. 368,695, filed October 20, 1890, of which the present application constitutes a division. Nor do we claim broadly the method of forming a T or angle joint by passing currents through one piece from end to end and into or from the same by means of the other pieces to be joined to it as this also is claimed broadly in our prior application.

What we claim as our invention is—

1. In an electric metal working apparatus, the combination with a divided source of electrical energy, of opposing terminals, and a terminal from an intermediate point of the source for making connection with the work placed between the opposing terminals.

2. In an electric metal working apparatus, the combination with the source of electrical energy, of opposing terminals, a terminal from an intermediate point of the source for making connection with the work placed between the opposing terminals, and means for varying the current at each side of said intermediate point.

3. In an electric metal working apparatus, the combination with a divided source of energy, of an electrical connection from an intermediate part of the work to an intermediate or divided point of the source, and means for alternately increasing the potential of the two sides of the divided source so as to equalize the heating at the two sides of the intermediate point of connection to the work.

4. In an electric metal working apparatus, the combination with a divided source of electric energy, of opposing terminals for holding one piece of the work, and a terminal connected to the point of division of said source and arranged to abut its piece of the work against said other piece.

5. In an electric metal working apparatus, the combination with a divided source of alternating current energy, of opposing terminals for holding one part of the work, a terminal connected to the point of division of said source and arranged to abut its work against part of the work, and means for alternately increasing the potential of the sides or parts of the source, as and for the purpose described.

6. In an electric metal working apparatus, the combination with a secondary bar or conductor provided with opposing terminals for holding one piece of the work, a terminal connected to an intermediate portion of said bar and so constructed as to abut its piece of the work against said other piece, means for inducing at the opposite sides of said intermediate portion alternating electric currents in a direction to reinforce one another, and means for varying the potential of the inducing currents so as to cause the potential in the two sides or parts of the secondary to alternate in strength.

7. In an electric metal working apparatus, the combination with a secondary bar or con-

ductor provided with terminals for holding the metal, means for making electrical connection from an intermediate portion of the metal piece to an intermediate point of the secondary bar or conductor, means for producing alternating inducing currents at opposite sides of the intermediate portion of said secondary bar in a direction to cause alternating currents to flow in the same direction from one terminal of the secondary to the other, and means for alternately increasing the potential of the inducing currents, as and for the purpose described.

8. In a transformer for metal working apparatus, a secondary bar or conductor having an intermediate pole W, common to two or more other terminals or poles of said secondary bar, as and for the purpose described.

9. In an electric metal working or heating apparatus, a transformer having a secondary bar or conductor provided with an intermediate pole or electrode whereby it may constitute a divided source of energy.

10. In an electric metal working or heating apparatus, a transformer having a secondary bar or conductor provided with an intermediate pole or electrode, in combination with primary coils or conductors applied at opposite sides of said intermediate pole or electrode.

11. In an electric metal working apparatus, a transformer having a secondary bar or conductor provided with an intermediate pole or projection directed toward the space between the opposite terminals of said bar or conductor.

12. In an electric metal working apparatus, the combination with a secondary bar or conductor, of an intermediate pole or projection provided with work holding devices, and means for moving the same toward the work included between the terminals of said secondary.

13. In an electric metal working apparatus, the combination with a secondary bar or conductor having an intermediate pole or projection adapted for connection with the work, of primary coils at opposite sides of said pole or projection, means for causing alternating currents to flow in such primary coils in directions to set up currents in the same direction through the said secondary

bar or conductor, and means for varying the current in said primary coils together or independently of one another, as and for the purpose described.

14. The combination substantially as described, with a secondary bar or conductor having an intermediate pole or projection, of primary coils applied to the secondary bar at opposite sides of said projection, and a variable resistance in the circuit of each primary, as and for the purpose described.

15. The combination in an electric metal working apparatus, of a secondary bar or conductor having work holding devices mounted upon its opposite terminals in line with one another, work holding devices mounted at an intermediate portion of said conductor, inducing coils applied to said bar or conductor at opposite sides of such intermediate point, and means for supplying to the same alternating electric currents in proper direction to cause the current to flow through the secondary from one terminal thereof to the other.

16. The combination in an electric metal working apparatus, of a secondary bar or conductor having work holding devices mounted on or connected with its opposite terminals, means for moving the work connected with one terminal toward the other, and one or more electric contacts connected with an intermediate portion of the secondary for passing current into the work laterally.

17. In an electric welding apparatus, the combination with a transformer secondary having work holding devices mounted upon its opposite terminals, of a contact or electrode connected with an intermediate portion of said secondary bar, and primary inducing coils applied at opposite sides of said intermediate portion and supplied with alternating electric currents in directions to cause the current to flow from one terminal of the secondary to the other.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 18th day of May, A. D. 1891.

HERMANN LEMP.
WALTER S. MOODY.

Witnesses:

JOHN W. GIBBONEY,
WARREN B. LEWIS.