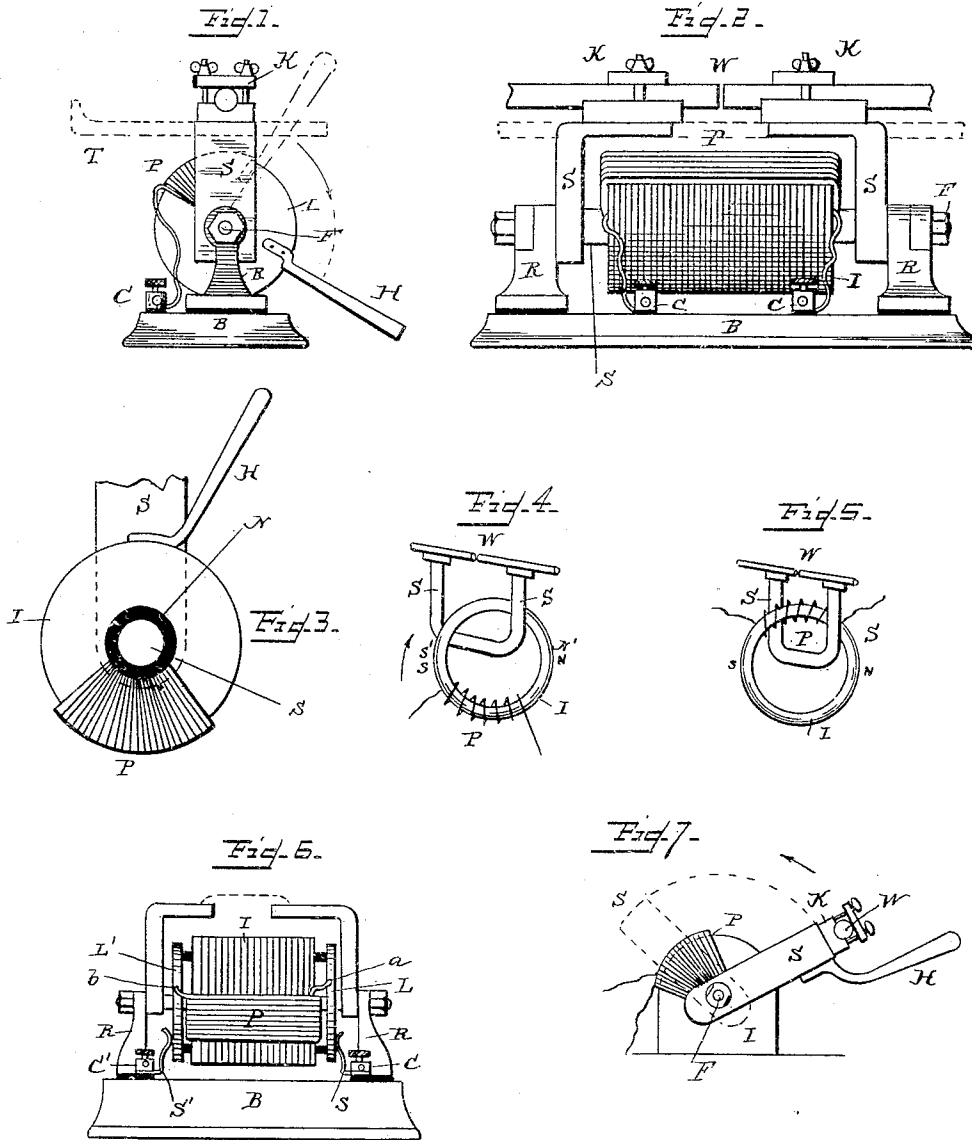


(No Model.)

E. THOMSON.
ADJUSTABLE TRANSFORMER.

No. 461,526.

Patented Oct. 20, 1891.



Witnesses
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UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF LYNN, MASSACHUSETTS.

ADJUSTABLE TRANSFORMER.

SPECIFICATION forming part of Letters Patent No. 461,526, dated October 20, 1891.

Application filed April 17, 1889. Serial No. 307,616. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, and a resident of Lynn, in the county of Essex and State of Massachusetts, have invented a certain new and useful Adjustable Transformer for Electric Welding, Metal-Working, and other Operations, of which the following is a specification.

My invention relates to the construction of induction-coils or transformers generally, but applies more especially to transformers used for electric welding, soldering, forging, or other operations in which currents of large volume are required.

The object of the invention is to obtain simplicity, compactness, and capacity for regulation of the current in the secondary.

The invention also consists in a novel construction of transformer and connected parts especially adapted to metal-working operations.

My invention consists in the novel features of construction hereinafter described, and more particularly specified in the claims.

In the accompanying drawings, Figure 1 is an end view of an apparatus embodying my invention. Fig. 2 is a side view of the same. Fig. 3 illustrates the relation of primary and secondary coils. Figs. 4 and 5 illustrate the action upon which the regulation is founded. Fig. 6 shows in side elevation a modified construction. Fig. 7 illustrates a modification in which the conductor of large gage ordinarily forming the secondary is moved for the purpose of varying the current.

Referring to Figs. 1 and 2, I I indicate a laminated iron core of general, circular, or endless form, preferably built from thin iron disks stamped out of sheet metal and fastened together in any suitable manner.

P is a coil of wire used ordinarily in metal-working operations as the primary, and wound, as indicated, upon the ring or disk-core I I, preferably in a notch in the same, so that the coil will not extend beyond the boundaries of the circular or cylindrical outer and inner surfaces of the core. The coil is connected by flexible conductors with proper binding-posts, one of which is shown at C.

The secondary or coarse-wire conductor (indicated at S) passes through the center of the

core I I, and its axis is practically coincident with said center. The laterally-extending portions of the said conductor terminate in separate metal supports carrying the usual metal-holding clamps K K, which hold the metal or metals W to be welded or operated upon.

It is a work-table, which is supported by the secondary S, as shown.

The secondary S, which is supported on the uprights R R, carried on a suitable base B, but insulated from one another thereon, supports in turn the core I I and primary P, the core I being rotatable on said secondary as on a spindle or axis. A handle H, attached to the core, affords a ready means of rotating the same, so as to vary the relative position of the primary and secondary. The construction is a convenient and preferable one; but it is evident that the same variation of one coil wound on the circular core with relation to the conductor or coil passing through and coincident with the central axis of the circular core might be obtained by otherwise mounting the core or coil, or both, so as to permit the adjustment to take place around a geometrical axis coincident with the center of the core and the axis of the portion of conductor S passing through said center. A cylindrical layer of insulation N is preferably interposed, as shown in Fig. 3, between the axial conductor S and the core and coil I P, rotatable on S.

Figs. 4 and 5 illustrate how an adjustment of the apparatus operates to control a welding or other current when the coils are constructed in the manner above described and an alternating current flows through the coil P. Assuming, in Fig. 4, that the secondary circuit S is open at W, an alternating current passed through the coil P will produce merely a reactive effect, and the coil P will act only as a "kicking-coil," so called. If, however, the circuit is closed at W and a current is passed through the coil P in such manner as to establish north and south polarity at *n s*, respectively, the current induced in the secondary coil S S will flow in such direction as to produce north and south polarity at the points *n' s'*, respectively. A reversal of the polarity *n s* will of course be instantly followed by a corresponding reversal of the polarity

$n' s'$, and the action is always such that little current will flow in the coil P when placed in the position shown with respect to the secondary coil S. In other words, the two windings P and S on the iron core I are so related in the position, Fig. 4, as to produce consequent magnetic poles of approximately-equal strength at $n n'$ and $s s'$, and a small current relatively can therefore flow in either of the coils P S. If now the primary coil P, with its iron core I, be rotated about the fulcrum F, so as to occupy the position indicated in Fig. 5, the secondary coil S no longer operates to oppose the primary P, as in Fig. 4, but both coils are now so related that a maximum secondary electro-motive force exists and a large current goes through S, provided, of course, that its circuit is completed through W. It is apparent that a gradation between these minimum and maximum effects of the two coils in producing a welding-current may be obtained by rotating the primary P to intermediate positions to those shown in the figures.

In Fig. 6 I have shown a device that may be used for making electrical connection with the coil P without interfering with the adjustment of the same. L L' are conducting rings or plates carried by core I I, but insulated therefrom, and in connection, respectively, with the two terminals of the coil P. Upon these plates bear the fixed springs S S', connected, respectively, with the binding-posts C C'. The circuit of the coil P in any position of the same is in this case established through binding-post C, spring-contact S, plate L, terminal a , coil P, terminal b , plate L', spring-contact S', and the other binding-post C'.

Although it is preferable to make the conductor P the movable conductor, this is not essential to the perfect operation of the apparatus, since, as indicated in Fig. 7, the iron core I may be stationary, and the secondary conductor S, with its clamps, may be rotated on the center passing through the core I. In this instance the horizontal portion of the conductor S might turn on its own axis, being for that purpose allowed to turn in its supports R R, the core I being held against rotation or being mounted on a separate support; or, if desired, the laterally-extending portions of the conductor S might turn upon the horizontal axial portion, although this

would not be so good a construction, as it would involve a joint between the horizontal and laterally-extending portions of the conductor.

What I claim as my invention is—

1. In an electric metal-working apparatus, the combination, substantially as described, with the same endless or circular iron core of a primary, of a secondary conductor passing through the core and consisting of a bar or single turn of copper having arms or extensions brought into close proximity and terminating in suitable metal-holding clamps, said primary and secondary being adjustable with relation to one another, so as to occupy different positions with respect to one another on the circumferential axis of the core, as and for the purpose described.

2. The combination, in a metal working or heating apparatus, of a circular iron core, a coil or conductor wound on the same, and a second conductor coincident with the central axis of the core and having lateral extensions terminating in work-holders, one or the other of said conductors being movable around an axis coincident with the center of the circular core and the axis of the portion of conductor passing through the center.

3. In a transformer for electric metal-working, an endless iron core carrying a primary, in combination with a secondary consisting of a bar passing through the central opening of the core and having its axis substantially coincident with the center of said opening.

4. In a transformer, the combination, with an iron core having a central opening and provided with a coil P wound upon it, of a conductor S passing through said opening and supporting said core and coil, as and for the purpose described.

5. In a transformer, an iron core of endless form having a coil P wound around one side of the core, and a supporting axis or spindle consisting of a conductor S, which passes through the center of the core and is provided with lateral extensions, as and for the purpose described.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 1st day of April, A. D. 1889.

ELIHU THOMSON.

Witnesses:

J. W. GIBBONEY,
J. R. JOHNSON.