June 14, 1932. G. BENEDETTO 1,863,462

TRANSFORMER FOR USE IN ELECTRIC WELDING AND LIKE OPERATIONS

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Fig. 1.

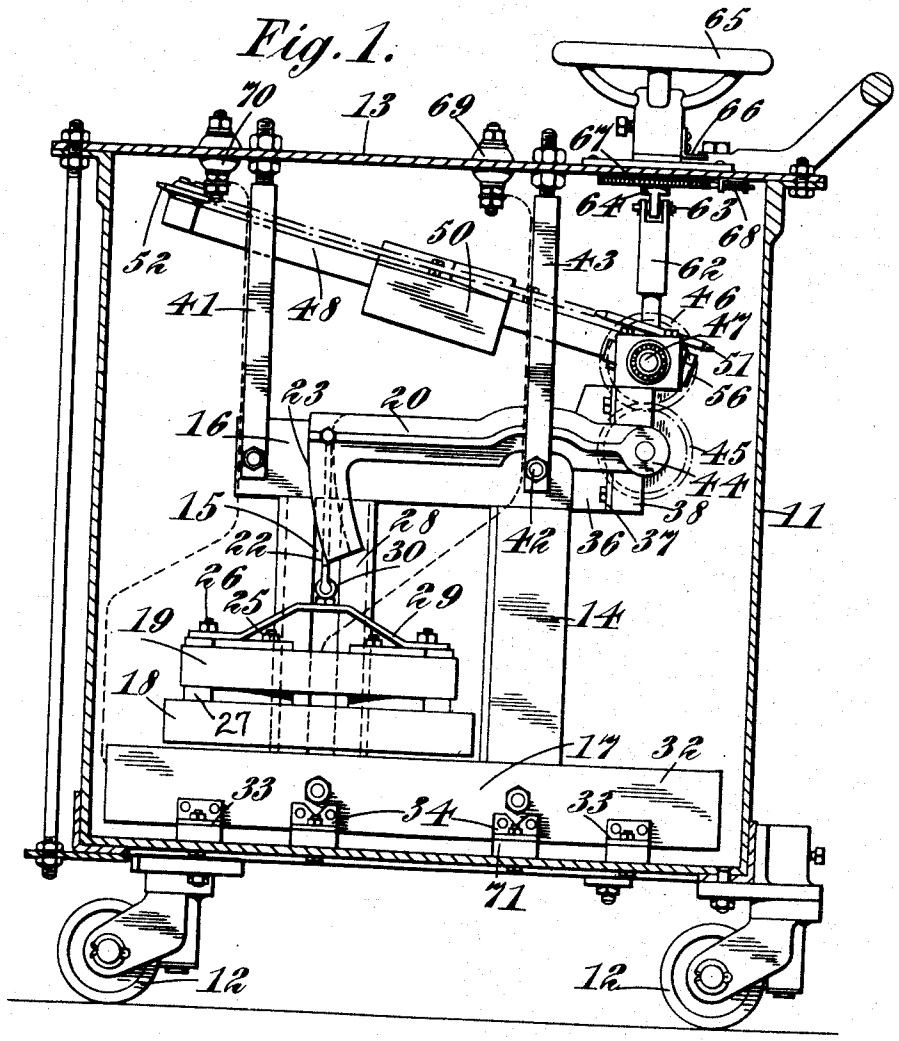

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Fig. 2.

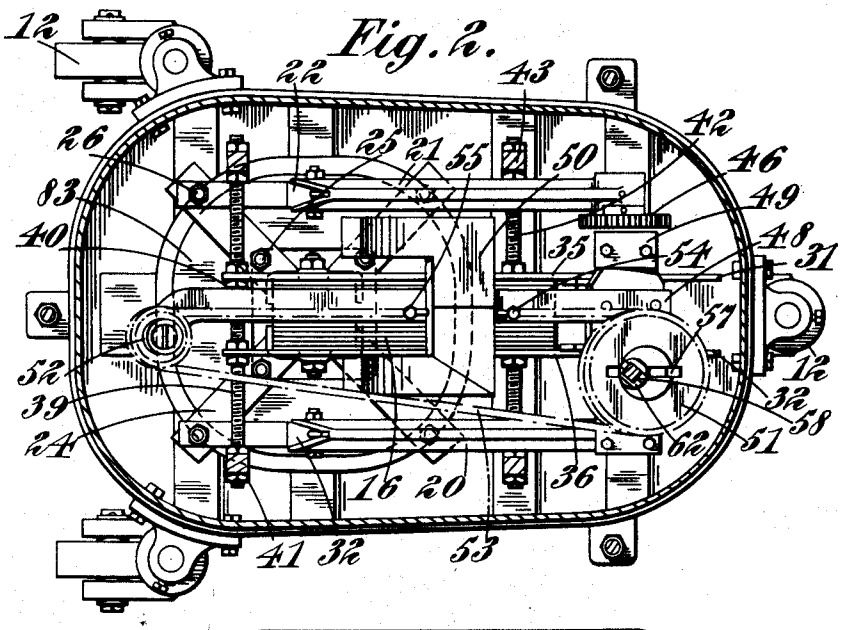
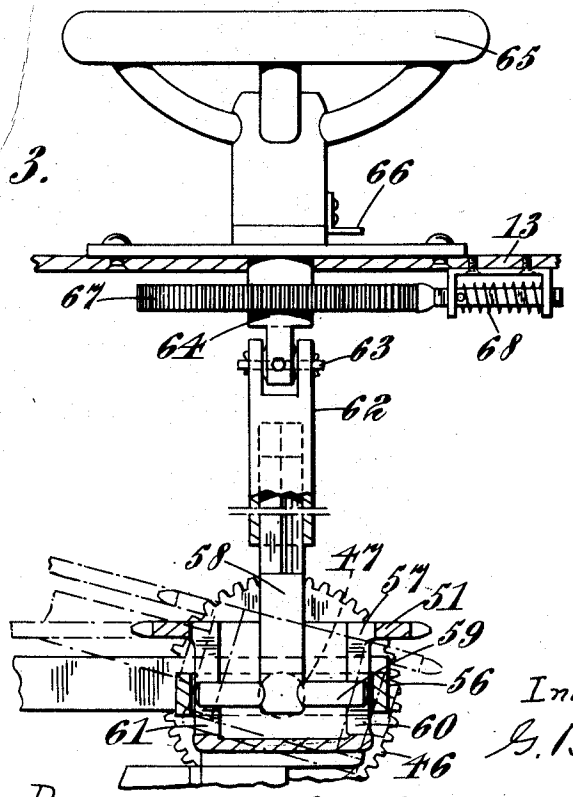


Fig. 3.



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UNITED STATES PATENT OFFICE

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TRANSFORMER FOR USE IN ELECTRIC WELDING AND LIKE OPERATIONS

Application filed August 4, 1931, Serial No. 555,122, and in Great Britain May 28, 1930.

This invention comprises improvements in or relating to transformers for use in electric welding and like operations. It is known in electric arc welding of metals to employ a transformer with an automatically movable bobbin so that the linkage between the primary and secondary of the transformer can vary during the operation.

It is an object of the present invention to provide an improved transformer of the movable bobbin type and to provide improved apparatus for electric arc welding. The present invention comprises in a transformer the combination of a magnetic core having a vertical limb, a primary coil and a secondary coil mounted thereon one of which coils is slidably mounted to move upon the vertical limb of the core towards and away from the other, means for partially counterbalancing the weight of said movable coil and means for adjusting the extent to which said weight is counterbalanced.

The invention further comprises the combination of a transformer as just described and electric arc welding apparatus connected thereto so as to be supplied with electric energy thereby. The transformer thus constructed is peculiarly adapted for operation of arc welding apparatus owing to the long range of movement which can be allowed to the movable bobbin and because the working range of the movement, once current flows, may be readily adjusted to agree with the average current which should be employed with a given electrode for the purpose of effecting the weld. That is to say, before an arc is struck the movable and fixed bobbins will be in close contact with one another, magnetic leakage will be at a minimum and the transformer secondary potential will be high. Consequently, the arc is easily struck. Immediately current begins to flow the bobbin will move to a working position where it floats, and if the counterbalancing of the movable bobbin is so adjusted that the working position is fairly near to the fixed bobbin the apparatus will have a suitable characteristic for working with a heavy current and a large electrode, while if the counterbalancing force is adjusted to be more nearly equal to the weight of the movable bobbin the working position of the bobbin even with a light current will be more remote from the fixed bobbin and the characteristics will be suitable for working with light currents and small electrodes. The apparatus, therefore, becomes readily adaptable to widely differing conditions of operation.

Preferably, the weight of the movable bobbin of the transformer is counterbalanced by means of two counterbalance levers operatively connected together (for example by gear wheels) from one of which the movable bobbin is suspended, and upon the other of which a counterweight is secured.

The following is a description, by way of example, of one form of transformer with movable bobbin constructed in accordance with the present invention and of the operation of the same in combination with an electric welding machine:—

In the accompanying drawings—

Figure 1 is a vertical longitudinal section through the transformer,

Figure 2 is a sectional plan of the same, and

Figure 3 is a detail.

The transformer comprises an oil-tight casing 11 mounted upon trolley wheels 12 and provided with a removable lid 13 for access to the internal parts. In the bottom of the casing 11 there is mounted a transformer which comprises two upright laminated limbs 14, 15 of the magnetic circuit, united at the top and bottom by laminated cross members 16, 17 respectively. Upon one of the limbs 15 there is mounted at the bottom a fixed secondary coil 18 and above it a movable primary coil 19. The primary coil is suspended from two pivoted levers 20, 21 by means of flexible bands 22. The ends of the levers to which the flexible bands 22 are attached carry arc-shaped guides 23 for the bands so that the movement of the primary coil 19 is in a vertical straight line.

The construction of the primary coil 19 can best be seen in Figure 2 which shows that it comprises the usual insulating plates 83 above and below the winding and that outside these there are four radial clamping

members 24 which extend in a diagonal direction from the four corners of the limb 15 of the magnetic circuit and are drawn by bolts 25, 26 closely down on to the side plate 23. Below the bobbin 19 there are similar diagonal clamping plates 27 (Figure 1) into which the heads of the bolts 25, 26 are countersunk.

At the inner ends of the clamping plates 24, 27 they are notched to fit closely against vertical angle plates 28 which are secured to the four corners of the vertical limb 15 of the magnetic circuit. These angle plates are made of non-magnetic material and the fit of the clamping plates 24, 27 upon them at the corners is such as to ensure easy sliding of the primary coil up and down the limb 15 of the magnetic circuit. The outer bolts 26 of the primary coil 19 serve also to fasten to the coil yokes 29 carrying eyes 30 to which the suspension bands 22 are secured.

The bottom yoke 17 of the magnetic circuit is supported on each side by clamping plates 31, 32 (see Figure 2) which extend beyond the yoke and are anchored by angle plates 33, 34 to the bottom of the casing 11. The upper yoke 16 is likewise provided with clamping plates 35, 36 which are extended somewhat beyond the yoke at each end. At one end the plates 35, 36 are bent at right angles to their general plane to provide a flange 37 to which is bolted a pivot block 38 for the lever 20 as hereinafter described. At the other end the clamping plates 35, 36 are traversed by a long horizontal screwthreaded stem 39 which is secured to the clamping plates by nuts 40. At the ends of the stem it carries nuts which secure to it vertical rods 41.

A second screwthreaded stem 42 passes through the clamping plates and the yoke 16 just above the vertical limb 14 of the magnetic circuit and carries vertical rods 43. The rods 42, 43 terminate at their upper ends in screwthreaded portions which pass through the lid 13 of the casing 11 and serve not only to provide an additional fixing means for the lid but also to ensure that the lid is properly spaced from the mechanism below it. The importance of this feature will be hereinafter pointed out.

The pivots of the levers 20, 21 are located upon a horizontal shaft 44 mounted in ball bearings carried by the pivot block 38. Upon this shaft 44 is a gear wheel 45 which meshes with a second gear wheel 46 upon a second transverse shaft 47 above the first. From this second transverse shaft there projects laterally a counterweight arm 48. The counterweight arm 48 is located so that when viewed in plan it lies above the transformer and does not add to the floor space taken up by the apparatus. The shaft 47 which carries the counterweight arm 48 is mounted in ball bearings 49 carried on the pivot block 38.

A counterweight 50 is longitudinally adjustable upon the counterweight arm 48 and the method of adjustment is as follows:— Upon each end of the arm there are mounted chain sprockets 51—52 around which a chain 53 passes the ends of which are secured to the counterweight 50 at 54, 55.

Rotation of the sprockets, therefore, moves the counterweight along the arm. The sprocket 51 at the pivoted end of the arm 48 is so located that its axis intersects the axis of the shaft 47 and the shaft is enlarged to form a banjo 56 at the place where the sprocket is mounted. The banjo 56 receives a large hollow sleeve 57 (Figure 3) which forms an extension of the chain sprocket 51. Within the sleeve 57 and co-axial with the shaft 47 there is located a cardan joint which enables the sprocket to be rotated by a vertical shaft 58 extending into the centre of the sleeve 57. The cardan joint is constituted by a cross member 59 of the shaft 58 entering the vertical slots 60, 61 in the walls of the hollow sleeve 57.

The shaft 58 extends vertically upwards and is provided with a telescopic section 62 and with a universal joint 63 at the top just below the lid 13 of the casing 11. The upper end portion 64 of the shaft 58 passes through the lid 13, in which it is provided with a bearing, and outside the casing it carries a hand wheel 65 having a pointer 66 which moves over a scale to show the setting of the counterweight 50. At the underside of the lid there is mounted upon the vertical telescopic operating shaft a notched disc 67 and on the lid there is a spring plunger 68 which engages the notches in the disc 67 and serves to centre the operating hand-wheel 65 at any one of a large number of definite operating positions.

The lid 13 is secured to the casing by a flanged joint around its periphery and is furthermore located in relation to the transformer by means of the upwardly extending bolts 41, 43 hereinbefore referred to secured to the magnetic frame of the transformer and extending upwardly through the lid of the casing.

It will be seen that owing to the accurate spacing means provided by the bolts 41, 43, it is possible to assemble the lid 13 relatively to the transformer before mounting the parts in the case and to verify the exact setting of all the mechanism and its correct operation by the hand-wheel 65. Subsequently the transformer can be mounted in the casing and by varying the thickness of the packing blocks 71 beneath the yoke 17 the apparatus may be adjusted so that the lid 13 can be closed down upon the parts without altering the relative adjustment of the hand-wheel 65 to the mechanism below. Moreover, it becomes possible if desired to remove the internal mechanism along with the lid

by undoing the bolts to the angle plates 33, 34, the heads of which project through the bottom of the casing.

Terminals 69, 70 for the connection of the electric supply and for the secondary of the transformer are mounted in the lid. The whole of the internal apparatus is adapted to work immersed in oil which secures not only effective insulation of the parts but also automatic lubrication of the mechanism. The transformer is preferably made with the primary and secondary of substantially similar form so that the ratio of the primary to the secondary voltage is 1:1. When the coils are close together the voltage is suitable for striking an arc with an arc-welding electrode. It will be understood that any desired ratio between the primary and secondary voltages can be arranged.

The apparatus described operates to regulate the voltage without the interposition of an ohmic resistance and therefore without the serious loss of energy which such a resistance involves. Furthermore, the characteristic of the current output can be regulated at will by adjustment of the handwheel, after which the operation is automatic. The variation of the current during operation is perfectly regular and does not present any steps as is the case when a rheostat is employed. The transformer can be instantly adjusted to suit variations of work and the adjustment can be made even during the course of operations while the machine is at work.

Although the invention has been described in relation to arc welding, for which purpose it will be found to afford peculiarly useful control of the current, it will be obvious that the same or a suitably modified transformer could be employed for operating forging or upsetting machines, either themselves containing a transformer or to feed the electrodes thereof direct.

I claim:—

1. In a transformer, in combination, a magnetic core including a vertical limb, a primary coil and a secondary coil mounted upon said vertical limb, one of said coils being mounted to move upon the vertical limb towards and away from the other coil, two counterbalance levers operatively connected together for movement in opposite directions and supported one above the other to extend over the plan area of the transformer, means suspending the movable coil from one of said levers, and a counterweight for the movable coil mounted upon the other of said levers.

2. Apparatus as claimed in claim 1 wherein there is means for adjusting the counterweight on its lever comprising sprockets on said lever and a chain passing over said sprockets and connected to said weight.

3. In a transformer, in combination, a magnetic core including a vertical limb, a primary coil and a secondary coil mounted upon said vertical limb, one of said coils being mounted to move upon the vertical limb towards and away from the other coil, two counterbalance levers operatively connected together for movement in opposite directions and supported one above the other to extend over the plan area of the transformer, means suspending the movable coil from one of said levers, a counterweight for the movable coil mounted upon the other of said levers, a casing for said transformer, a cover for said casing, and means carried by said cover to adjust the position of said counterweight on its lever.

4. In a transformer, in combination, a magnetic core including a vertical limb, a primary coil and a secondary coil mounted upon said vertical limb, one of said coils being mounted to move upon the vertical limb towards and away from the other coil, two counterbalance levers operatively connected together for movement in opposite directions and supported one above the other to extend over the plan area of the transformer, means suspending the movable coil from one of said levers, a counterweight for the movable coil mounted upon the other of said levers, a casing for said transformer, a cover for said casing, means to accurately space said cover from the core and levers, and means carried by said cover to adjust the position of said counterweight on its lever.

In testimony whereof I affix my signature.

GIUSEPPE BENEDETTO.