Nov. 16, 1937. G. E. PRINTZ 2,099,622

APPARATUS FOR ELECTRICALLY MARKING METALS

Filed March 21, 1935 2 Sheets-Sheet 1

Fig. 1.

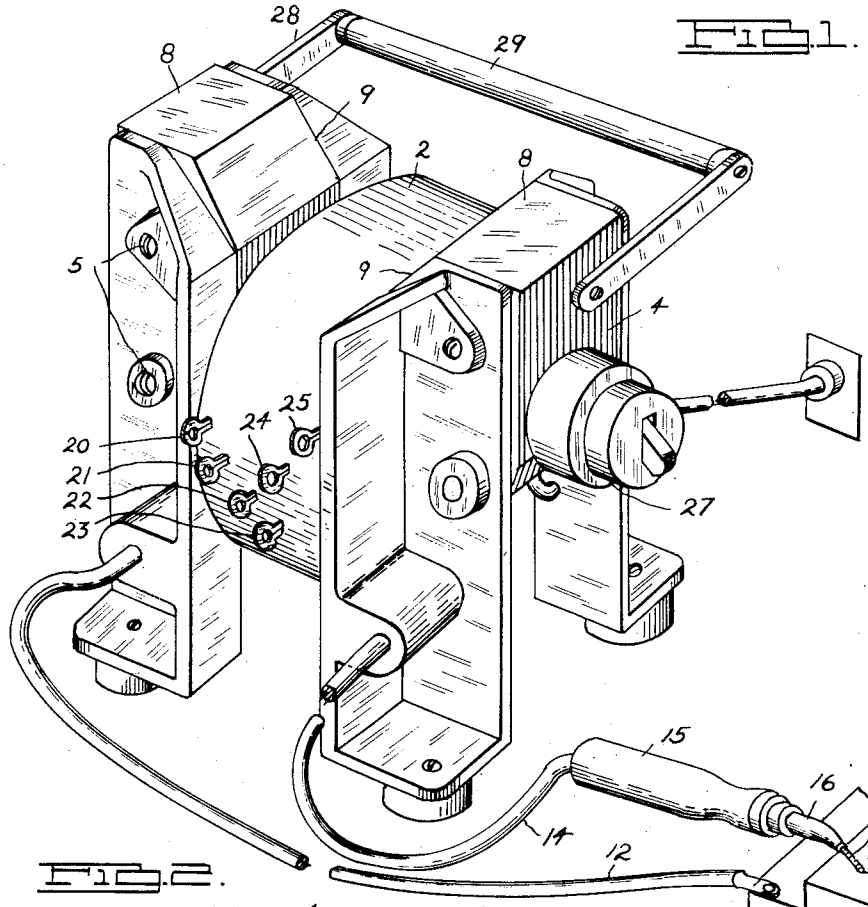
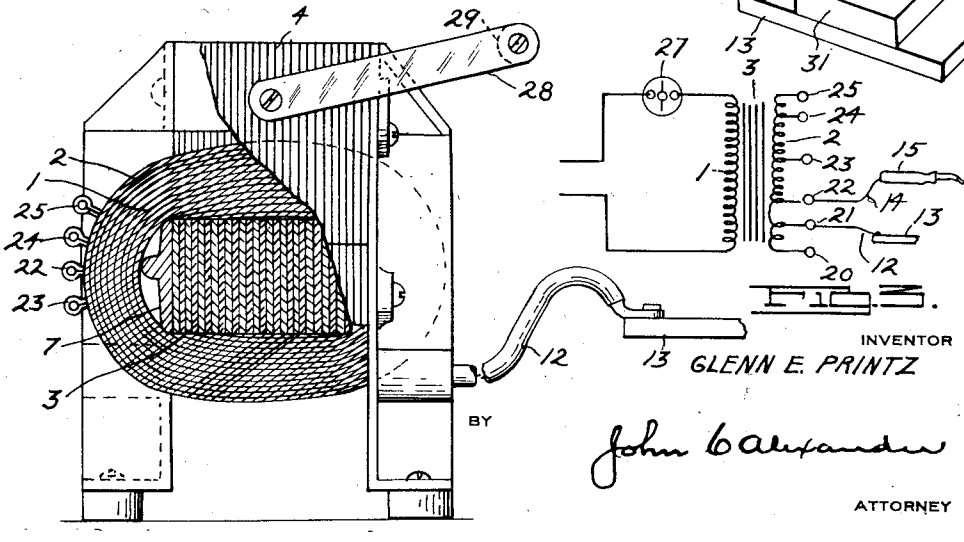


Fig. 2.



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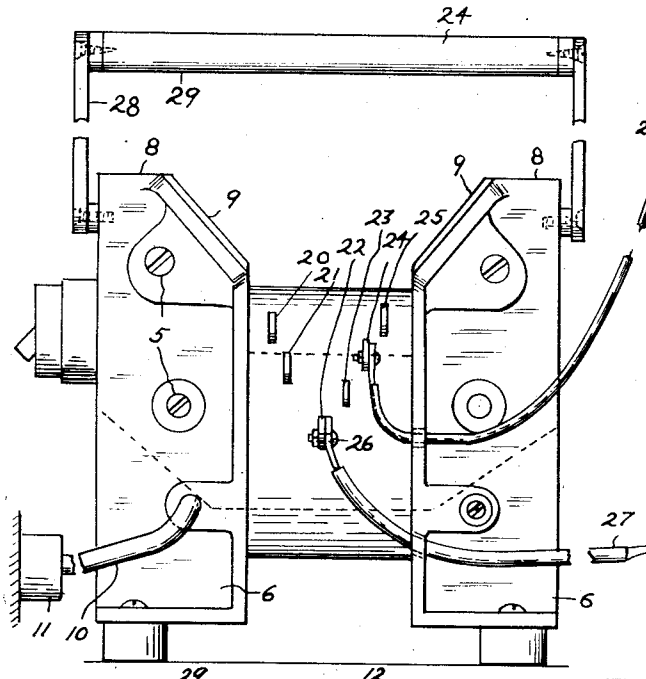


Fig. 4.

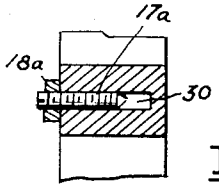


Fig. 7.

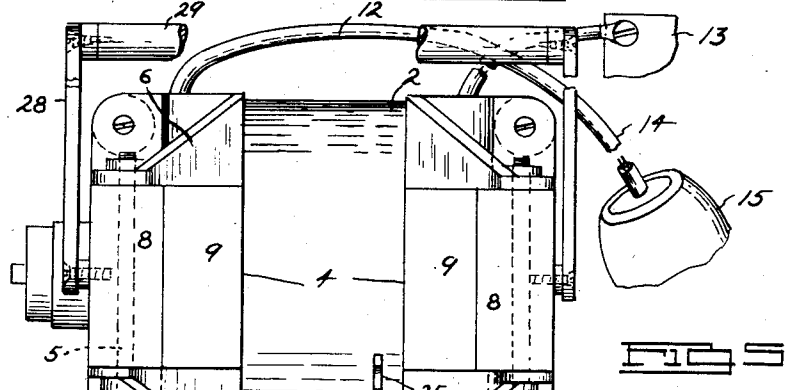


Fig. 5.

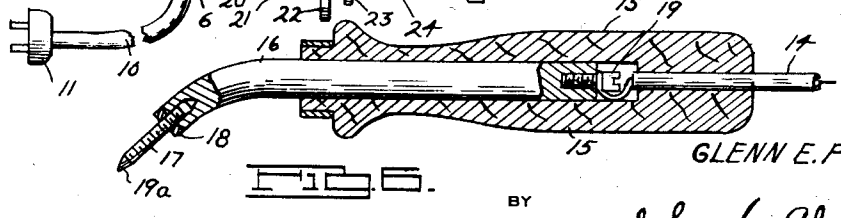


Fig. 6.

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APPARATUS FOR ELECTRICALLY MARKING METALS

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Application March 21, 1935, Serial No. 12,161

3 Claims. (Cl. 175—367)

This invention relates to apparatus for electrically marking metals, and to means for magnetically holding work during a marking or other operation, and for subsequently demagnetizing the work.

An object of the invention is to provide a very light and compact apparatus of the above mentioned character that may be conveniently carried to non-portable work, and which is adapted by the design and arrangement of its pole pieces to powerfully hold magnetizable work of almost any structural shape or form.

Another object is to provide in an improved and simplified manner for tapping the secondary coil of a transformer at predetermined points.

A further object is to so arrange said taps as to obtain a maximum number of voltage adjustments with a minimum number of taps.

A further object is to provide an improved tool for electrically marking or engraving metal, which tool will produce either a fine or heavy mark, the electrode of which will last indefinitely, and will require no periodic refinishing, and which will be safeguarded against overheating of the electrode or undue heating of the operator's hand.

These and various other objects the invention attains by the construction hereinafter described, and illustrated in the accompanying drawings, wherein;

Fig. 1 is a perspective view of the apparatus, showing a piece of work engaged by the marking tool,

Fig. 2 is an end elevational view of the apparatus, partially in section,

Fig. 3 is a diagram of the electrical connections,

Fig. 4 is a side elevational view,

Fig. 5 is a top plan view,

Fig. 6 is an axial sectional view of the marking tool,

Fig. 7 is a sectional detail showing how an extra point for the marking tool is carried by the apparatus.

In these views, the reference characters 1 and 2 designate the primary and secondary coils of a portable transformer, adapted to also function as a magnetic work holder. Said coils are wound on a core 3 and between a pair of pole pieces 4, the core and pole pieces jointly forming a laminated U-shaped magnet.

Each pole piece is clamped tightly by bolts 5 between a pair of cast frame members 6, whereby the laminations are held firmly together so as to prevent their relative vibration and resultant humming. The two frame members at each side of the U magnet are integrally connected by a cross bar 7, and the two cross bars 7 engage opposite sides of the core 3, and pass through the coils. The frame members have leg portions extending below the coils to elevate the latter above a supporting surface, and the upper ends of the pole pieces and frame members jointly form two coplanar, horizontal, work-supporing faces 8 and two inclined work-supporting faces 9. The faces 8 adjoin the relatively remote end faces of the pole pieces, while the faces 9 adjoin the coil-engaging faces of the pole pieces and converge downwardly toward the coils at approximately forty-five degrees to the coil axis.

The secondary coil is formed preferably of a single layer of fairly heavy wire and surrounds the numerous coils of relatively fine wire which form the primary coil. The terminals of the primary coil are connected through a two-wire cord 10 to an ordinary plug 11, adapting such coil to be energized from the usual mains. The secondary coil may be terminally connected through a conductor 12 to a work-grounding plate 13 and through a conductor 14 to a suitable marking tool, best shown in Fig. 6.

This tool comprises a hollow handle 15, formed preferably of wood having axially mounted therein a heavy copper rod 16, having a curved end portion projecting from the handle and terminally carrying an electrode 17 having the nature of a threaded rod, considerably smaller in diameter than the rod 16, and tapped into the latter and held fixed thereon by a lock-nut 18. Said electrode is formed of a metal such as steel, capable of withstanding quite high temperatures and having a conductivity and cross-sectional area adequate to transmit the maximum required current without appreciable heating effect, and has a pointed free end to the point of which is welded (or otherwise molecularly united) a tip 19*a*, formed of an alloy of tungsten or some other metal capable of indefinitely withstanding the exceedingly high temperatures to be induced at such tip. Interiorly of the handle 15, the rod 16 terminally carries a screw 19 serving to fasten the conductor 14 securely to said rod.

The current requirements for proper functioning of the marking tool vary considerably accordingly as light or heavy marking is desired and further must be suited to the electrical resistance of the work. It is therefore desirable to provide for such regulation of the secondary current, as will allow variation of its volume through a considerable range. Thus the secondary coil

is provided with a suitable number of taps **20**, **21**, **22**, **23**, **24**, and **25** so arranged as to afford a wide range of variation in the effective length of said coil. Thus said taps are arranged so that the lengths of secondary wire between taps **20** and **21** and between **24** and **25** are each twice that between the taps **21** and **22**, and the lengths between **22** and **23** and between **23** and **24** are each four times that between **21** and **22**. This provides for deriving the current values shown in the following table, wherein *a* represents the minimum secondary current which the machine is designed to furnish.

a—current value	Connect to taps 23 and 24—tap connections
a	21 and 22
2*a*	21 and 20
3*a*	22 and 20
4*a*	22 and 23
5*a*	21 and 23
6*a*	25 and 23
7*a*	20 and 23
8*a*	22 and 24
9*a*	21 and 24
10*a*	22 and 25
11*a*	21 and 25
13*a*	20 and 25

Thus it is seen that the provision of the six taps shown not only permits a large selection of current values but also permits, in many cases, a change from one current value to another by moving only one of the current take-off wires to a different tap. Preferably said taps are formed in a very simple manner as return-bent, outwardly projecting portions of the coil, looped at their bends to accommodate bolts **26** by which lead wires may be attached. Fig. 4, two of the taps are shown engaged by a pair of lead wires **27** leading one to the marking tool and the other to the grounding plate.

To facilitate carrying the described apparatus, there may be provided a handle comprising a pair of links **28** coaxially pivoted to the pole pieces **4** and carrying and connected by a hand piece **29** formed of suitable non-magnetic material.

An extra electrode **17***a* is normally screwed into a socket **30** of one of the frame members, and with its lock-nut **18***a* may serve as a binding post, if desired, for grounding the conductor **12** to the frame, rather than to the plate **13** when desired.

In use of the described apparatus, a piece of work **31** may be positioned, in whole or in part, on the grounding plate, so that the secondary circuit will be closed through the work to the electrode **17** when the latter is applied to the work. Because of the high resistance prevailing at the point of contact of the electrode and work, there is generated at such point a high heat, acting to discolor the work and to form a depression therein if the position of the electrode is maintained. By moving the electrode over the work at a suitable speed, the work may be marked to any desired depth with any desired design, words or numerals. Generally the tool may produce a suitable mark by moving it at a gradual speed, as in writing with a pencil.

It will in some cases be found convenient to dispose work for marking in a bridging relation to the pole pieces **4**, where it will be magnetically held in place. When the size and shape of the work permits, it will be engaged with the convergent pole faces **9**, since there prevails a stronger field between these faces than that between the coplanar faces, and since the convergent faces exercise a wedging effect tending to more firmly hold the work.

A switch **27** controlling the primary coil is preferably conveniently mounted on one of the pole pieces **4**.

Employment of only one pair of poles, as disclosed, is highly desirable, since the resulting magnetic field across the gap is of maximum concentration for a given current, and a concentrated flux is essential to quick and complete magnetization and demagnetization of the work, particularly when of high magnetic retentivity.

Complete and ready portability is achieved in the described construction by elimination of inactive parts and elements and by extreme compactness and low weight. Ready portability is highly desirable, as the work in many cases will be not readily portable.

Provision of the two differential pairs of pole faces **8** and **9** adapts the apparatus to work widely varying in shape and size, and the larger clearance space about the pole faces permits their proper engagement with work with a minimum of interference due to projections on the work. The apparatus is especially well suited to magnetization and demagnetization of small parts of extreme hardness, because of the high density and constancy of the magnetic field, and the ample space between the poles for accommodation of such parts.

In using the apparatus to magnetize or demagnetize a large number of quite small parts, the same may be retained in suitable bags or the like, in being disposed between the poles.

The V-form of the faces **9** particularly adapts said faces to engage long bars of work, since it eliminates the tendency to slip or roll off that prevails when the work engages flat faces. The V-shape further adapts round or cylindrical objects to be completely and uniformly magnetized throughout by rotating the same between the convergent walls.

The apparatus, by reason of the high density and volume of its field, may be employed in freeing and making workable various compounds and liquids in metal cases or containers by a mere application of the poles to such containers, so as to induce through the latter a heavy short circuited flow of current such as will gently heat the container while avoiding the dangerous use of flames for that purpose. Similarly, the apparatus may be employed to moderately heat parts to effect their expansion or for any other reason.

Formation of the taps as integral portions of the secondary coil eliminates joints between the taps and coil, and relatively complex switching devices heretofore employed with attendant expense, loss of current, and upkeep. Also, this provision insures that all joints are readily accessible for inspection, and guards against either gradual or sudden falling off of conductivity in the secondary circuit.

Furthermore, the use of bolted tap connections tends to deter chance users of the machine from experimentally changing from one tap to another, with detriment to the resulting work.

In prior apparatus for electrically marking metals, it has been necessary to quite frequently refinish or discard the electrodes owing to their deterioration by heat. In the described apparatus, the provision at the electrode point of a very highly heat-resistant alloy safeguards the

electrode against deterioration over a long period of time. The threaded engagement of the electrode with the copper rod 16 is such as to establish a fully adequate thermal and electrical connection between said parts. The thermal connection at this point is vital in assuring conduction to the copper rod 16 of any excess heat generated in the electrode, the copper rod being of adequate size to readily dissipate such heat by radiation. The bend in the exterior portion of the rod 16 serves to dispose the electrode at a convenient angle to the handle of the tool for conveniently marking work.

The invention is presented as including all such modifications and changes as come within the scope of the following claims.

What I claim is:

1. A work-holding electro-magnet comprising a magnetizing coil, a magnetizable laminated core within the coil, having a pair of pole pieces at its ends, projecting similarly beyond the coil periphery and having coplanar work-seating faces and also having work-seating faces convergent toward the coil, and a pair of frame members clamping the laminations together, and projecting beyond the coil coextensively with the laminations and having upper end faces approximately flush with the said work-engaging faces.

2. A portable transformer comprising U-shaped laminations forming a core and pole pieces, primary and secondary coils wound on said core between the pole pieces, a pair of H-shaped frame members between which the laminations are clamped and comprising cross bars extending through said coils and at opposite sides of the core portions of said laminations, the lower portions of said frame members forming supporting legs for the transformer, and said frames jointly forming pockets beneath the pole pieces for electrical connections to the coils.

3. A work holding electro-magnet, comprising a magnetizing coil, a magnetizable core within the coil, having a pair of pole pieces projecting similarly beyond the coil periphery and having coplanar work-seating faces and also having work-seating faces convergent toward the coil, the core and pole pieces being laminated, a pair of frame elements clamping the laminations together and formed with bars extending through the coil, one at each side of the core, and clamping connections between the frame members.

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