

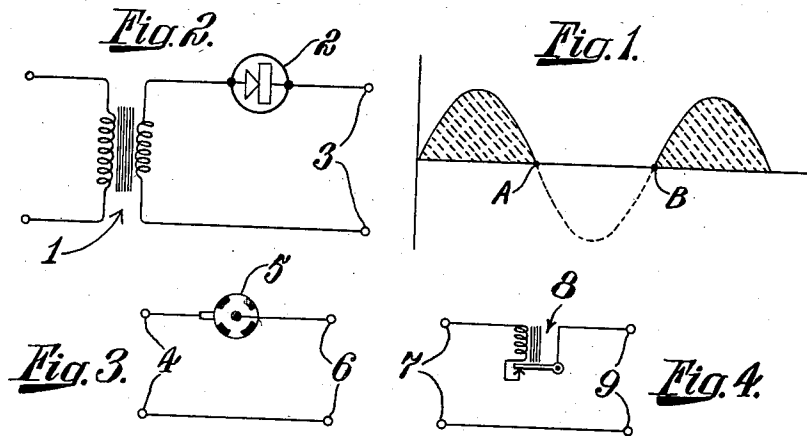
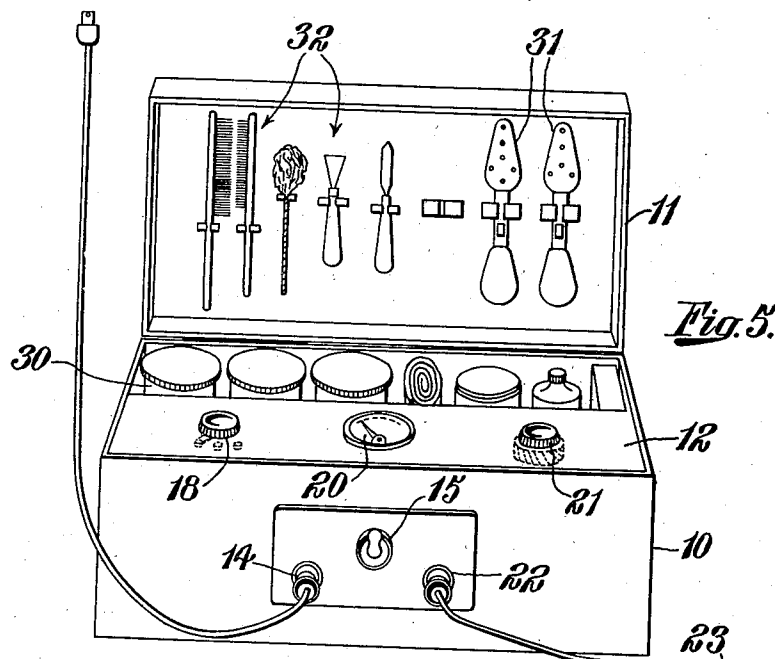
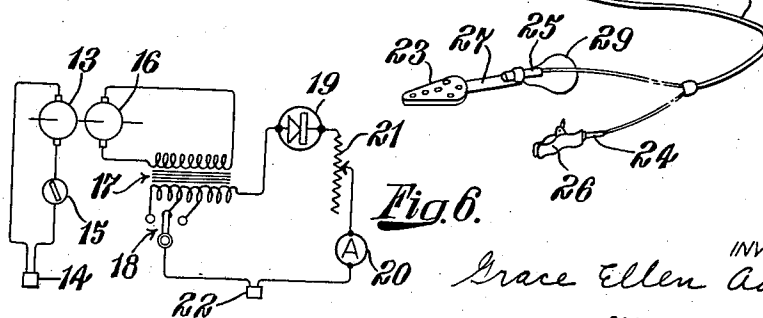
July 7, 1936.

G. E. ADEY

2,046,440

PROCESS FOR EFFECTING THE ELECTRODEPOSITION OF METALS

Filed Sept. 20, 1933



INVENTOR
Grace Ellen Adey
BY R. Singer
ATTORNEY

UNITED STATES PATENT OFFICE

2,046,440

PROCESS FOR EFFECTING THE ELECTRO-DEPOSITION OF METALS

Grace Ellen Adey, Totteridge, London, England

Application September 20, 1933, Serial No. 690,256
In Great Britain September 21, 1932

2 Claims. (Cl. 204—8)

This invention is concerned with the art of electro-deposition of metals and has for its object to provide a novel process for effecting such electro-deposition, as well as apparatus for carrying such processes into effect, which though being of an extremely simple character results in the obtaining of electro-deposits of metal which are more satisfactory than those which have been obtained up to the present, such electro-deposits being in fact of much greater density, that is to say of a less porous nature, than deposits which have hitherto been obtained.

Although the process according to the invention is suitable for the electro-deposition of metals in so-called vats or baths, it is particularly applicable when the electro-deposition is effected by an apparatus which includes an electrode of the metal to be deposited and a sheath or pad of absorbent material enclosing said electrode, the electrode-depositing element thus constituted being adapted to be saturated with an appropriate electrolyte and then passed over the surface receiving the deposit.

The process for effecting the electro-deposition of metals, according to the invention, is characterized by the fact that during the depositing operation the direct electric current supply to the anode and cathode elements of the apparatus is interrupted intermittently.

The periodicity of such intermittent interruption can have any desired value, but in most cases a value of between thirty and sixty interruptions per second is satisfactory, although in other cases values lower or higher than these may be adopted, for instance several thousand interruptions per second or even higher.

Many forms of apparatus suitable for the practical realization of the above process are possible. For example such apparatus according to preferred embodiments is characterized in that the intermittently interrupted direct current supply is obtained by the half-wave rectification of an alternating current supply. There is shown in Fig. 1 of the accompanying drawing a diagram indicating the wave form of the intermittently interrupted direct current supply that is obtained by the half-wave rectification of an alternating current, the intermittent direct current required for the process being shown by the shaded portions of the diagram which are interrupted by the time interval indicated between the points A and B.

An apparatus for obtaining such an intermittently interrupted direct current supply from an alternating current supply is shown diagram-

matically in Fig. 2 wherein 1 indicates a transformer, the primary of which is adapted to be connected to an alternating current supply when desired, whilst the secondary includes a half-wave rectifier 2 of any desired type, the intermittently interrupted direct current supply being obtained from the output circuit 3.

Another form of apparatus for obtaining the required intermittently interrupted direct current supply is diagrammatically shown in Fig. 3 wherein a direct current input circuit 4 includes a rotary make and break switch device 5, for example a commutator, the required intermittently interrupted direct current supply being obtained from the output circuit 6. The rotary make and break device 5 may of course be rotated in any desired manner, for instance by an electric motor operated from the direct current input circuit 4.

Fig. 4 shows in a diagrammatic manner a still further form of apparatus whereby the required intermittently interrupted direct current supply can be obtained. In this case the direct current input circuit 7 includes a vibratory make and break device 8 whilst the intermittently interrupted direct current supply is obtained from the output circuit 9.

Other forms of apparatus can be provided in which thermionic valve oscillators are arranged to control the intermittent interruption of a direct current supply circuit.

As previously stated the process according to the invention is particularly applicable for effecting the electro-deposition of metals by means of a device which comprises a sheath or pad that encloses an electrode of the metal to be deposited, and in such cases the entire apparatus necessary for electro-deposition operations can be arranged so that it is readily portable, whilst moreover it can be adapted for use with several different metals which require different electrical potentials in order to obtain the most satisfactory result. In addition such an apparatus may be so arranged if desired as to be equally suitable for connecting to and operating by the usual public supply mains of either alternating current or direct current characteristics, the apparatus thus being of a most universal nature.

Such a universal apparatus according to one preferred embodiment is pictorially shown in Fig. 5 and comprises a casing 10 which is preferably of wood or light metal construction and provided with a hinged closed down lid or cover 11 as well as one or more carrying handles or

the like of any desired form (not shown) whereby the apparatus can be conveniently carried.

Within the front portion of the casing 10 there is provided a compartment for housing what may be termed the power unit of the apparatus, this compartment being closed at the top by a panel 12. Said power unit is constituted by the devices necessary for obtaining the desired intermittently interrupted direct current supply from either alternating current or direct current public supply mains. These devices are shown diagrammatically in Fig. 6 and comprise an electric motor 13 of such a character as to operate equally well from either alternating current or direct current public supply mains to which it is adapted to be connected when desired by means of a plug and socket fitting 14, this input circuit also including an "on and off" switch 15.

An alternating current generator 16 is arranged to be driven by the said motor, and the output circuit of this generator includes the primary circuit of a transformer 17, the secondary circuit of which is tapped at desired points, these tapping points being connected to the studs of an associated hand operable switch indicated at 18. This secondary circuit also includes a half-wave rectifier 19 of any desired type.

The direct current output, which has, by reason of the half-wave rectification of the alternating current, an intermittently interrupted characteristic as indicated by the diagram shown in Fig. 1, is fed by suitable conductors and through the intermediary of an ampere meter 20 and a variable series resistance element 21 to one part of a plug and socket fitting 22, to which is adapted to be detachably connected the other part of said fitting which is carried at one end of a pair of conducting wires 23. To the other ends of these two wires 23 there is secured the parts 24 and 25 of plug and socket fittings. The part 24 is adapted to be detachably connected to a metal clip device 26 which device is itself adapted to be connected when desired to the surface which is to receive the deposit.

The part 25 of the said plug and socket fittings is adapted to be detachably connected when desired to a depositing electrode element. Such a depositing electrode element for use with this apparatus consists of a tubular handle portion 27 to which an electrode formed from the class of metal to be deposited is secured, said electrode being enclosed within a sheath or pad 28 which, during the use of the device, is adapted to be maintained saturated with the required electrolyte, and for this purpose the handle portion 27 carries a rubber bulb 29 which is adapted to be filled with the required electrolyte and to subsequently discharge said electrolyte down the tubular handle on to the sheath or pad when desired, by pressing said bulb by hand.

To complete the apparatus there is provided various accessories which include three separate containers for different electrolyte solutions, for instance, a copper electrolyte, a nickel electrolyte and a chromium electrolyte. These containers are conveniently comprised by glass jars 30 suitably supported within the rear portion of the casing and provided with removable stoppers or other closure means. In addition the equipment also includes a desired number of further depositing electrode elements similar to that above described but for use when depositing different metals, for example three such elements may be provided in all, one for copper,

one for nickel and one for chromium, and when not in use are adapted to be accommodated within the lid or cover 11 by suitable clip devices in the manner indicated at 33. Still further the accessories include cleaning brushes and scrapers, such for instance as indicated at 32 and in addition so-called priming solutions, polishing solutions or cleaning acids contained in bottles or tins as indicated at 33, as well as other accessories which it may be found desirable to incorporate in the apparatus such for instance as polishing rags.

It will be realized that such a unit assembly can be readily transported.

Further with such an apparatus it is possible to effect, in a most efficient manner, the electro-deposition of either of the several metals at will, and moreover by means of the switch device 18 associated with the tapings of the secondary circuit of the transformer 17, the voltage of the intermittently interrupted direct current output can be adjusted to suit the requirements of the different metals so that optimum results will at all times be possible.

It will be obvious that such an apparatus is particularly useful and suitable for universal adoption, whilst in addition to the improved quality of the electro-deposits obtained by adopting the process according to the invention, it is to be understood that the electro-depositing operation can be effected without in any way interfering with the permanent position of the surface receiving the deposit, for instance the fittings of an automobile vehicle can be readily electro-plated with nickel and/or chromium without removing such fittings from the vehicle.

In other forms of apparatus suitable for the practical realization of the process according to the invention, the intermittently interrupted direct current supply can be obtained by means of an electric motor which can be operated from either alternating current or direct current public supply mains, a direct current generator driven by the said motor and a rotary switch device adapted to be rotated by the shaft of the motor either directly or otherwise and associated with the direct current output circuit of the generator so as to effect the desired intermittent interruption thereof.

As an alternative to arranging the power unit aforesaid and the various accessories in a single unit assembly, the power unit may be mounted within a casing of its own, whilst the accessories are arranged in a separate casing, thus two co-operating portable units would be provided.

Further, in some cases another portable unit may be provided, this unit containing means for polishing the deposited metal and may comprise for example a rotary polishing mop of any desired suitable form and construction and an electric motor for operating said mop, or as an alternative flexible shafting may be provided connecting the spindle of the polishing mop to the shaft of the electric motor provided in the power unit aforesaid.

In some cases the apparatus may be adapted to effect the simultaneous electro-deposition of two or more different metals, and for this purpose the intermittently interrupted direct current output is divided into a number of parallel circuits, each incorporating its own regulating resistance and provided with means whereby it can be connected to a separate depositing electrode. A similar arrangement would also enable

a number of persons to effect the electro-deposition of a single metal in cases where very large surfaces are to be treated, and it is desired to effect the depositing in as short a time as possible.

5 In other cases and where the apparatus is larger than that hereinbefore more particularly described, the power unit, the accessories and if desired, a polishing mop unit can be combined
10 in a single unit assembly which may be mounted upon a wheeled trolley or the like so that it can be more readily transported as a whole.

It is to be understood that as an alternative to providing a rubber bulb in association with
15 the depositing element for discharging the required electrolyte on to the sheath or pad as hereinbefore more particularly described, other means such for example as a piston pump may be provided in association with the said depositing
20 element to effect this purpose.

As previously stated the process according to the invention is equally suitable for the electro-deposition of metals in so-called vats or baths as distinguished from the particular form of
25 "pad" depositing as herein described, it only being necessary to provide suitable vats or baths for containing the desired electrolyte, in fact with the apparatus hereinbefore more particularly described the jar-like containers
30 for the various electrolytes can be conveniently used as vats for the electro-deposition of small articles.

The invention is not limited to the precise

forms or details of construction or arrangements described, as these may be varied to suit particular cases.

What I claim and desire to secure by Letters Patent of the United States of America is:—

5 1. The hereindescribed process for effecting the electro-deposition of metals, consisting in passing over and in contact with the surface receiving the deposit a depositing element which comprises an electrode of the metal to be de-
10 posited and an associated covering of absorbent material which is saturated with an appropriate electrolyte and conducting to said electrode and the surface receiving the deposit a periodically interrupted direct electric current, the periods
15 of flow of said current being equal to the periods of cessation.

2. The hereindescribed process for effecting the electro-deposition of metals, consisting in passing over and in contact with the surface
20 receiving the deposit a depositing element which comprises an electrode of the metal to be deposited and an associated covering of absorbent material which is saturated with an appropriate electrolyte, and conducting to said electrode and
25 the surface receiving the deposit uniformly spaced direct current impulses of symmetrical form, the periods of rest between said impulses being equal to the periods at which said impulses are impressed upon said electrode and
30 said deposit receiving surface.

GRACE ELLEN ADEY.