Sept. 20, 1949. R. E. IRISH 2,482,486

ELECTROLYTIC DENTAL CLEANSING APPARATUS

Filed Aug. 18, 1945

Fig. I

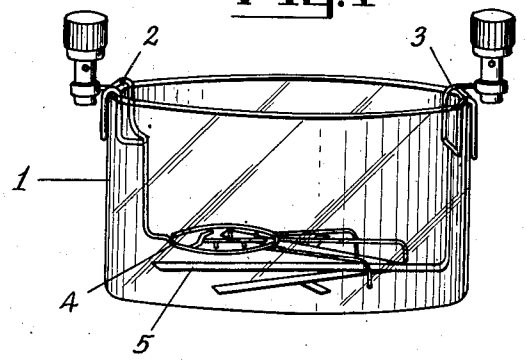


Fig. III

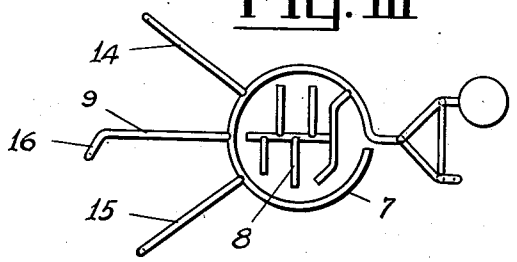
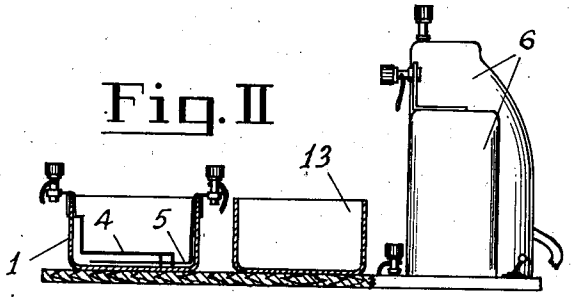


Fig. II



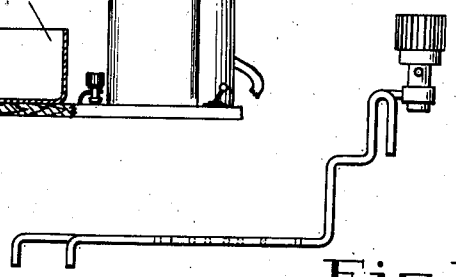


Fig. IV

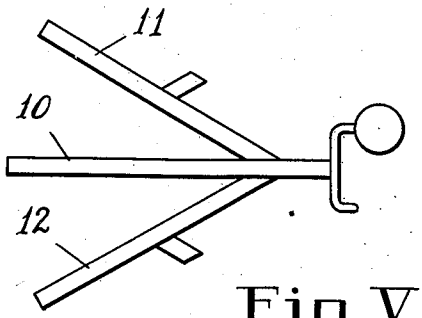


Fig. V

INVENTOR.
Russell E. Irish
BY William B. Wharton
ATTORNEY.

Patented Sept. 20, 1949

2,482,486

UNITED STATES PATENT OFFICE

2,482,486

ELECTROLYTIC DENTAL CLEANSING APPARATUS

Russell E. Irish, Pittsburgh, Pa.

Application August 18, 1945, Serial No. 611,336

4 Claims. (Cl. 204—242)

1

This invention relates to the electrolytic cleansing and polishing of dental pieces and appliances, and small dental and surgical instruments.

Taking as exemplary orthodontic appliances and bridgework of removable or relatively permanent sort, dental inlays and the like; when such appliances are removed for adjustment and cleansing, or simply for cleansing, there is advantage in performing the cleansing operation, or at least the initial stages of the cleaning, by electrolytic action. This is because such appliances and pieces have gathered such crust or film of organic matter frequently overlying or mixed with reaction products of the metal of which the appliance, or piece, is composed, that they have become unpleasant and unsanitary. Also dental inlays, cast bridgework, and the like parts as initially made, usually carry oxides and crusts of foreign matter resulting from the method of their production. Such crusts and films must be removed before the appliance or piece can be polished or sterilized. The removal is, however, extremely difficult because of the resistance of the deposits to acids and bases, and because their small size and delicacy of fundamental structure or surface contour makes mechanical cleaning impractical. This difficulty has existed in such order that resort commonly has been had to the expedient of bringing them to red heat and immersing them momentarily in a concentrated mineral acid in order to cleanse them. This disturbs the internal structural arrangement of the metal.

Electrolytic cleansing presents an ideal cleansing action on delicate structures of this sort, because it is effective to remove crusts and films of organic and inorganic matter, or mixed organic and inorganic crusts and films, and to polish the surfaces of the metal parts. This it can do without detriment to the tensile strength, or resiliency of the metal of which the parts are composed. Whereas electrolytic cleansing has been well known and successfully practiced on massive or substantial bodies of metal it has not previously been made successfully available for use in dental and the like laboratories, to act on appliances and pieces of the delicacy of those which it is there desired rapidly and effectively to cleanse in such manner as to avoid danger of removing metal of the work-piece itself.

It is an object of my invention to provide apparatus well adapted to the efficient electrolytic cleaning of dental appliances and pieces, and of analogous parts and instruments of like delicacy.

It is a further object of my invention to provide

2

apparatus for the thorough cleaning of delicate dental appliances, dental pieces and the like which will perform a cleansing operation, thoroughly and completely to cleanse the surfaces of such parts without electrolytic removal of metal therefrom.

In the accompanying drawings:

Fig. I is a perspective view of a vessel for containing an electrolytic cleansing bath, said vessel being equipped with electrodes formed and arranged in accordance with my invention.

Fig. II is a general assembly of apparatus for conducting the method of my invention, showing the bath vessel of Fig. I, a vessel for containing a rinsing bath, and preferred means for delivering current to the electrolytic bath, this view of the drawings being taken partly in longitudinal section and partly in side elevation.

Fig. III is a plan view of an anode made in accordance with my invention for use as an element of my electrolytic cleansing apparatus.

Fig. IV is a side elevation of such anode.

Fig. V is a plan view of the cathode forming an element of the electrolytic cleansing apparatus of my invention.

Initially it may be explained that in my electrolytic cleansing apparatus, the cleansing operation is performed by supporting the part to be cleansed on the structure of the anode in such manner that it is directly subjected at short range to bombardment by a great multitude of minute bubbles of hydrogen liberated at the cathode of the apparatus. The initial cleansing, or loosening of deposits, is thus performed partly by the chemical effect of the hydrogen in its action on greases and other organic matter and the reduction of oxides on the part to be cleansed, and in part by the scouring effect of the great number of minute hydrogen bubbles in tending to dislodge materials and reaction products from the surfaces of the part which is being cleansed. Under suitable operating conditions my apparatus performs this operation without any perceptible tendency electrolytically to remove metal from the part subjected to cleansing, or to deposit metal thereon. Because of the small size and delicacy of the part subjected to treatment this feature is of primary importance.

My apparatus organization comprises a bath vessel made of material which is non-conductive electrically and which is resistant to the chemical action of the bath; the vessel desirably being as shown of transparent material, such as glass or a transparent chemically resistant plastic, so that the progress of the cleansing operation is

observable. On this vessel 1 there are mounted an electrically connected anode clamp 2 and an electrically connected cathode clamp 3, arranged to support the anode and cathode of the bath organization in a position within the vessel and immersed in the electrolyte. The anode designated generally by reference numeral 4 overlies the cathode designated generally by reference numeral 5 in the structural arrangement which I have found to provide an organization resulting in my desired cleansing effect. In Fig. II of the drawings there is shown a pair of copper oxide rectifiers 6. As a preferred adjunct of my apparatus, one or more of such rectifiers, which are of well known sort, are used to provide direct current of from about 5 to 15 volts and very low amperage from a standard 110 volt 60 cycle alternating house current, or to bring a D. C. house current to an equivalent value. The use of such rectifier is convenient, but if requisite or desirable a plurality of dry cells arranged in series may be used to give direct current of low value.

Bearing in mind the small size and delicacy of the work-pieces and the necessity of presenting such pieces to the maximum effect of hydrogen from the cathode, I make my anode in the form of an open rack which will support the work in the bath of electrolyte in a position directly exposed to hydrogen liberated at the underlying cathode. Considered in detail, this anode rack is shown as composed of an annular rim 7 which embraces bars 8 extended inwardly therefrom. This gives a roughly reticulate rack structure, which I have found suitable for supporting orthodontic appliances and most of the other dental pieces the necessity for cleansing which occurs most frequently. If desired, however, the rack may be made of more closely meshed construction, and in fact of any extended supporting structure which is sufficiently open to provide free upward passage of minute bubbles of hydrogen liberated at the cathode. As shown, the cathode 5 is forked into three branching ribbons, one element 10 of which extends centrally beneath the anode rack and two elements, 11 and 12, of which lie beneath or closely adjacent its rim. The branching ribbons of the cathode are adapted to lie on the bottom of the vessel 1, to provide a horizontally extended area for the liberation of hydrogen.

It is thus apparent that the great multitude of minute bubbles of hydrogen from the cathode pass upward directly into contact with the work-piece supported by the closely spaced anode rack in such manner that there is not only collection of such minute bubbles on the work, but there is also an impingement effect, of bombardment, of the work-piece by the bubbles. Additionally, oxygen liberated at the anode collects upon the work and probably performs a cooperative function in disintegrating the films and crusts which are to be removed from it.

In the use of my apparatus I obtain a thorough cleansing effect by using a relatively mild electrolyte, as well as a low voltage and amperage electric current. Any electrolytic bath which is to be considered as mild in the art may be used at about room temperature. As exemplary of such baths I may give one composed of three volumes of a 10% water solution of sulphuric acid, and one volume of a saturated water solution of trisodium phosphate, desirably with the addition of about 20 drops of a saturated water solution of sodium hydroxide to each 30 drams of the combined sulphuric acid and trisodium phosphate solution. Using an electrolyte of the sort thus typified and a current of the indicated low value, the usual duration of cleansing treatment is less than one minute but the work-piece may remain in the electrolytic bath for much longer periods without any bad result. The action is not of a sort to require rapid removal of the parts subjected to the cleansing treatment in order to limit or prevent destructive effects on them. After the electrolytic treatment I desirably agitate the work-piece in a rinsing bath consisting of a saturated water solution of trisodium phosphate in the second vessel 13 shown in Fig. 11 of the drawings, definitely to remove any deposits which have been disintegrated but not physically removed by the electrolytic bath.

It is, of course, possible so to construct the anode that the rack forming part of it is suitably supported by suspension in close vertically spaced relation to the cathode. The electrodes being, however, preferably made of platinum because of its resistance to the dissolving effect of the electrolytic bath, both the electrodes desirably are of light construction to lessen their cost. In order, therefore, to obtain the economy of such light construction while closely and accurately spacing the anode from the cathode to avoid direct contact between them, preferably I provide a plurality of spider legs which are outwardly and downwardly extended from the rack structure of the anode to contact the bottom of the vessel and definitely and closely to space the anode in overlying position with respect to the cathode. As shown, there are two spider legs, 14 and 15, divergently extended from the rack structure of the anode intersectingly to overlie the ribbons 11 and 12 of the cathode, and to contact the bottom of the vessel outwardly therebeyond. A third spider leg 9 lies in approximate vertical alignment with the central ribbon 10 of the cathode, and has in its downward projection an offset portion 16 which extends to the bottom of the vessel without making direct contact with the cathode strucure.

The formation of the anode of the electrolytic bath assembly in the form of a rack closely overlying the horizontally extended cathode gives the desired effect of subjecting the entire surface of the work-piece to the effect of hydrogen rising from the cathode. I do not know to what extent such nascent hydrogen may change from its ionic form to the form of minute bubbles on the work-piece directly subjected to an upper current of the hydrogen so close to the cathode. I do, however, know that I am able to observe in the bath profuse streams of very minute hydrogen bubbles, which as the passage of the current proceeds become so profuse as to give the entire area of electrolyte in the region of the electrodes a milky appearance. Apparently thus the cleansing action which involves disintegration of the deposits on the parts to be cleansed is effected primarily by direct subjection of the work to this profuse stream of minute hydrogen bubbles. As has been explained, this action effects the desired cleansing operation in such manner that the work-piece is cleansed, and in measure polished, without loss of any appreciable quantity of the metal of which it is composed. Also there is no loss of the structural strength of that metal. My apparatus thus provides for the electrolytic cleansing of small delicate work-pieces in a manner impossible by previous methods of heating and dipping, and which have been impossible in

other attempts electrolytically to clean work-pieces of like sort.

Having described one apparatus embodiment exemplary of my invention, I wish it to be understood that various modifications in the form and arrangement of the parts and in adjunct instrumentalities may be made without going beyond the scope of my invention as defined in the appended claims.

I claim as my invention:

1. Apparatus for electrolytically cleansing small delicate work-pieces comprising an electrically non-conductive electrolyte - containing vessel, an anode and a cathode both composed of platinum connected in a low-voltage and low-amperage D. C. circuit, the said anode being horizontally arranged to overlie the said cathode in an electrolyte bath in the said vessel, the said cathode being formed as an open horizontally arranged structure to include an extended horizontal area for liberation of hydrogen at the bottom of said vessel and the said anode comprising an open rack structure arranged to expose the surface of a work-piece supported thereby directly to contact with an upward flow of hydrogen liberated at the cathode and said anode including legs extended horizontally from the rack structure of the anode overlying the structure of the cathode and extended downwardly out of contact with said cathode structure into contact with the non-conductive bottom of the vessel.

2. Apparatus for electrolytically cleansing small delicate work-pieces, comprising an electrically non-conductive electrolyte - containing vessel, an anode and cathode both composed of platinum connected in a low-voltage and low-amperage D. C. circuit, the said anode being arranged to overlie the said cathode in an electrolyte bath in the said vessel, the said cathode being formed terminally as a plurality of ribbons including a horizontally extended area for liberation of hydrogen at the bottom of said vessel, and the said anode comprising an open rack structure and a plurality of legs extended outwardly and downwardly therefrom to contact the non-conductive bottom of the vessel out of contact with the structure of the said cathode.

3. Apparatus for electrolytically cleansing small delicate work-pieces comprising an electrically non-conductive electrolyte - containing vessel, an anode and a cathode connected in a low-voltage and low-amperage D. C. circuit, the said anode being horizontally arranged to overlie the said cathode in an electrolyte bath in the said

vessel, the said anode and cathode both being composed of a metal resistant to the dissolving effect of the electrolyte bath, the said cathode being formed as an open horizontally arranged structure to include an extended horizontal area for liberation of hydrogen at the bottom of said vessel and the said anode comprising an open rack structure arranged to expose the surface of a work-piece supported thereby directly to contact with an upward flow of hydrogen liberated at the cathode and said anode including legs extended horizontally from the rack structure of the anode overlying the structure of the cathode and extended downwardly out of contact with said cathode structure into contact with the non-conductive bottom of the vessel.

4. Apparatus for electrolytically cleansing small delicate work-pieces comprising an electrically non-conductive electrolyte-containing vessel, an anode and a cathode connected in a low-voltage and low-amperage D. C. circuit, the said anode being horizontally arranged to overlie the said cathode in an electroyte bath in the said vessel, the said anode and cathode both being composed of a metal resistant to the dissolving effect of the electrolyte bath, the said cathode being formed terminally to include a horizontally extended area for liberation of hydrogen at the bottom of said vessel but overlying less than the entire area of the said bottom, and the said anode comprising an open rack structure and including legs extended horizontally and downwardly therefrom out of contact with said cathode and into contact with the non-conductive bottom of the vessel.

RUSSELL E. IRISH.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
349,535	Sohner	Sept.21, 1886
569,877	Flower	July 28, 1896
1,234,319	Euler	July 24, 1917
1,902,390	Wormley	Mar. 21, 1933
1,917,022	Dunn	July 4, 1933

OTHER REFERENCES

"Industrial Electrochemistry," by Mantell; McGraw-Hill Book Co. Inc., New York, 1931; pages 110 and 111.