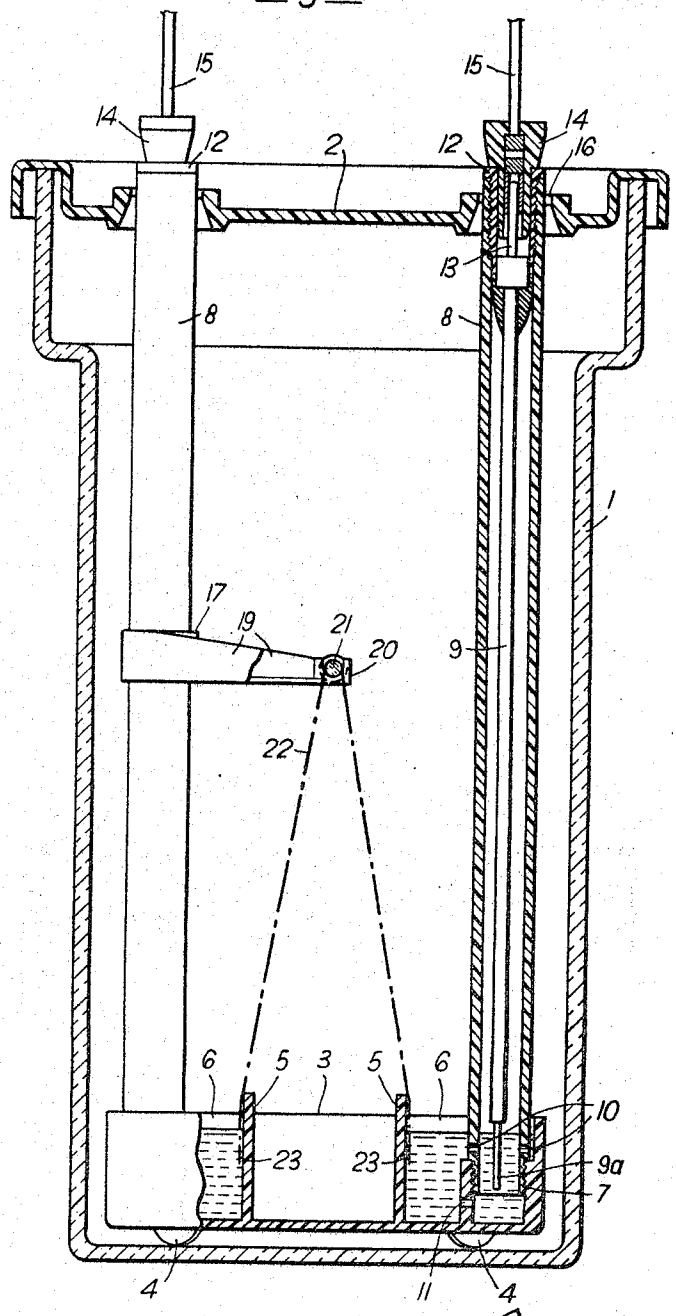
June 20, 1967 E. R. SHANDON 3,326,795

APPARATUS FOR PAPER ELECTROPHORESIS HAVING REMOVABLE ELECTRODE ASSEMBLY

Filed Aug. 2, 1962 2 Sheets-Sheet 1

Fig. 1.



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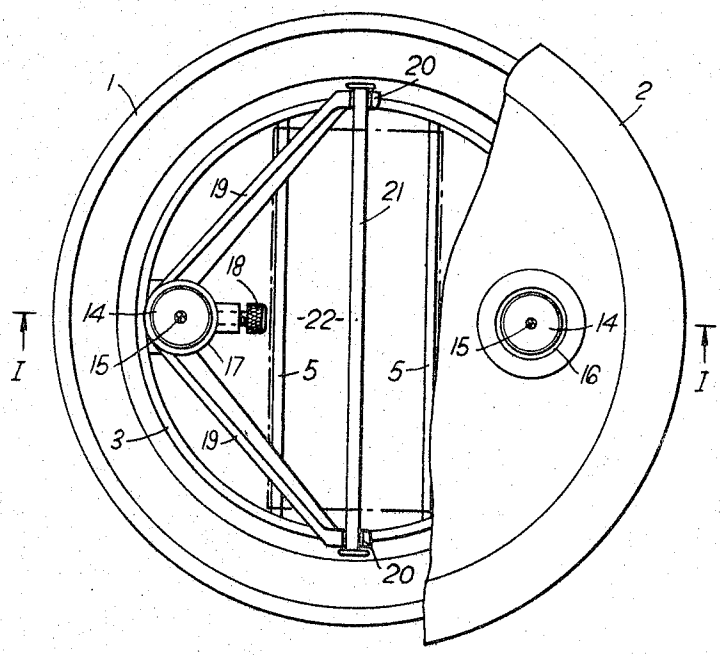
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Fig. 2.



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APPARATUS FOR PAPER ELECTROPHORESIS HAVING REMOVABLE ELECTRODE ASSEMBLY

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This invention concerns apparatus for performing electrophoresis on paper, on cellulose acetate sheet or on such other materials, all hereinafter referred to inclusively as "paper," as are commonly used in this type of work. An object of the invention is to provide apparatus for this purpose that is simple and robust in construction and easy to use, and which is especially suitable for use by students being taught the techniques of electrophoresis in laboratory work.

Electrophoresis apparatus in accordance with the present invention comprises a vessel or receptacle and a removable unitary assembly comprising an electrode dish or container divided into at least two compartments, such dish being dimensioned to fit within said vessel, a pair of electrodes associated one with each of a pair of compartments of the electrode dish and extending upwardly from the dish, and paper support means carried by one of said electrodes for supporting the apex of a strip of paper arranged in inverted "V" form with its ends in the respective electrode dish compartments associated with the individual electrodes.

Conveniently the electrode dish may be divided into three compartments by a pair of spaced-apart parallel barriers, these barriers serving to prevent the ends of a paper strip, supported by said support means, from approaching one another, the electrodes being associated respectively with the compartments on each side of the central compartment defined between said barriers.

Preferably said electrodes are disposed within individual tubular insulating sleeves carried by the respective electrode compartments of the electrode dish. In a preferred embodiment, the electrode dish includes a socket in each electrode compartment to receive such insulating sleeves, the sleeves and/or socket walls having apertures to provide access to the electrodes for the buffer solution that is contained in the electrode compartments during an electrophoretic run.

The paper support means may conveniently comprise a carrier formed of any suitable material, for instance stainless steel or plastics (or a metal coated with a suitable plastics), this carrier being of substantially triangular form and being supported on one of the electrodes with one side of the carrier extending parallel with the barrier or barriers of the electrode dish. If the electrode mounting such support is not provided with an insulating sheath, it will be understood that the support means will be of an insulating nature or otherwise insulated from the electrode so as to prevent the electrode potential being applied to the paper strip via the support.

In a typical embodiment of the invention, the paper support means comprise a plastics tubular boss adapted to fit over one of the electrode sheats and to be secured in adjusted position thereon by means of a set-screw in the boss, the boss having a pair of arms inclined to one another at an angle of about 90° and terminating in notched lugs to receive the ends of a glass rod that serves to support the paper strip.

Conveniently the vessel is cylindrical in form and the electrode dish is of circular plan-form to correspond with the internal dimensions of the vessel. The electrode dish

may be made of glass or any other material suitable for the purpose and capable of resisting attack by the substances with which it may come into contact, a convenient material for construction of the dish being polyethylene.

A typical embodiment of the invention is illustrated in the accompanying drawings in which:

FIGURE 1 is a part-sectional elevation of one form of electrophoresis apparatus in accordance with the invention; and

FIGURE 2 is a plan view of the apparatus of FIGURE 1, part of the cover of the apparatus being broken away to reveal the internal arrangements.

The electrophoresis apparatus shown in the drawings comprises a vessel **1** that is circular in plan and, in this embodiment, formed with an upper end portion of enlarged diameter. The vessel is closed by a cover **2** having a peripheral groove to engage over the upper end of the vessel and to locate the cover in place on the vessel.

The apparatus further comprises an electrode dish **3** of circular plan-form dimensioned to fit within the vessel **1**, the dish **3** having projections **4** on its underside to support the dish just clear of the bottom of the vessel **1**. The electrode dish **3** is divided into three compartments by a pair of spaced-apart parallel barriers **5** and in the outer (electrode) compartments **6**, **6** the dish **3** has sockets **7** internally screw-threaded to receive correspondingly threaded ends of tubular insulating sheaths **8** that enclose electrodes **9**.

The lower portion of each electrode sheath **8** is formed with radial apertures **10** and, at the base of each socket **7**, the wall thereof is sloted at **11** to provide for communication between the interior of the socket and the compartment **6** having such socket.

Each electrode **9** comprises a platinised nickel-iron wire loop **9***a* within the lower end of the sheath **8** and at the lower end of an insulated lead that extends axially within the sheath **8** and into a tubular plug **12** screwed into the upper end of the sheath **8**. The plug **12** houses a contact pin **13** electrically connected to the electrode lead and adapted to enter a female socket contact in a terminal **14** removably fitted into the upper end of plug **12** for connecting the electrode to an external lead **15** and retaining the cover in position. The upper ends of the plugs **12** extend through apertures **16** in the cover **2**.

One electrode sheath **8** mounts paper support means in the form of a tubular boss **17** equipped with a set-screw **18** for clamping the boss **17** at an adjusted position along the sheath **8**. The boss **17** has a pair of arms **19** that are mutually inclined at an angle of about 90°, and terminate in lugs **20** having notches to receive the ends of a glass rod **21** that with the arms **19** forms a triangular carrier and extends parallel with the barriers **5** of the electrode dish **3** and centrally therebetween, so as to be capable of supporting a strip of paper as at **22** in inverted V shape formation with its ends **23** in the respective electrode compartments **6**, **6** of the dish **3**.

In use of the apparatus, the electrode compartments **6**, **6** of the electrode dish **3** are filled with an appropriate buffer solution to a level such that the apertures **10** in the electrode sheaths **8** are submerged, whereby the buffer solution may circulate freely, through the apertures **10** and the slot **11**, between the interior of each sheath **8** and its compartment **6**, the wire loop **9***a* of each electrode being thereby immersed in the buffer solution in its respective compartment **6**.

To facilitate observation of the progress of an electrophoretic run, the vessel **1** is conveniently formed of glass. The electrode dish **3**, the cover **2** and the electrode sheaths **8** are conveniently formed of plastics, for instance, polyethylene, and the paper support boss **17** and its arms **19**

are also conveniently formed as an integral moulding of polyethylene.

Sheaths or tubes 8 forming a part of the unitary assembly, provide a rigid handle means for lowering and raising the assembly into and out of the receptacle 1. In order to facilitate removal of terminals 14 from pins 13, the assembly may be conveniently raised within receptacle 1 to a point where tubes 8 project sufficiently beyond cover 2 to be firmly gripped during such operation.

The forms of the invention here described and illustrated are presented merely as examples of how the invention may be embodied and applied. Other forms, embodiments and applications of the invention, coming within the proper scope of the appended claims, will, of course suggest themselves to those skilled in the art.

I claim:

1. An electrophoresis apparatus comprising a receptacle, a cover for said receptacle and a unitary assembly contained within said receptacle and readily removable therefrom, said assembly comprising an electrolyte container, at least two upwardly open separate compartments disposed within said container, a pair of vertical tube means interconnecting said container and said cover, an electrode disposed within each of said tube means, each of said electrodes extending into one of said compartments, and paper support means slidably mounted on one of said tube means for varying the height of the apex of a paper strip folded thereover into an inverted V shape with each of its ends inserted into one of said compartments.

2. An electrophoresis apparatus comprising a receptacle, a cover therefor and a unitary assembly contained within said receptacle and readily removable therefrom, said assembly comprising a container for vertical insertion within said receptacle, at least two upwardly open separate compartments disposed within said container, diametrically opposed sockets disposed proximate the outer wall of said container, insulating tubes, the lower end of said tubes being removably secured to said sockets, the upper end of said tubes extending to said cover, at least one aperture disposed in said lower end forming access between each said socket and each said respective compartment, a longitudinal electrode housed within each said tube, the lower end of each said electrode being positioned within one of said sockets, support means adjustably mounted on one of said tubes for retaining the center of a folded strip of paper in regulated position so that each of its ends dip into one of said compartments, and separation means disposed within said container for maintaining said paper ends in mutually spaced relationship.

3. An electrophoresis apparatus according to claim 2, including aligned apertures disposed in said cover, said apertures being dimensioned to fit around the upper ends of said tubes when said assembly is placed in operative position, a pair of terminals provided with contact pins at the free ends thereof for insertion through said aligned apertures and electrical connection with said electrodes.

4. An electrophoresis apparatus according to claim 2, wherein a wall of each said compartment forms said separation means.

5. An electrophoresis apparatus according to claim 2, wherein said support means comprises a tubular boss, means for releasably mounting said boss on said tube, a pair of angular arms carried by said boss, a rod connecting the free ends of said arms, said rod being parallel to and disposed intermediate said separation means to retain the apex of said paper strip in inverted V formation.

6. An electrophoresis apparatus according to claim 2, wherein the wall of said container forms part of said socket, said socket being internally threaded, the lower ends of said tubes being correspondingly externally threaded, whereby at least one of said tubes when threadably secured to said sockets forms a rigid handle for insertion of said assembly into and withdrawal from said receptacle.

7. An electrophoresis apparatus according to claim 3, wherein said tubes are extendable beyond said cover to facilitate disconnection of said terminals from said electrodes before said cover is removed.

8. An electrophoresis apparatus according to claim 2, wherein said container is provided with three compartments therein and said separation means forms at least one integral wall of each said compartment.

9. An electrophoresis apparatus according to claim 2, wherein said receptacle is provided with a lower portion and an integral upper portion, said upper portion being wider than said lower portion and wherein said cover is recessed below the rim of said upper portion.

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