Improved Electrophoresis Cell and Cell Holder

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Those laboratories fortunate enough to possess a Tiselius electrophoresis apparatus frequently accumulate more work than they can handle because of the length of time required for each determination. Unless the cells are cleaned frequently and the sliding joints regreased, experiments may be spoiled by the development of leaks between the sections or at the neoprene connections with the electrode vessels. Much time may be saved by using a pair of the cells and cell holders, as shown in Fig. 1,

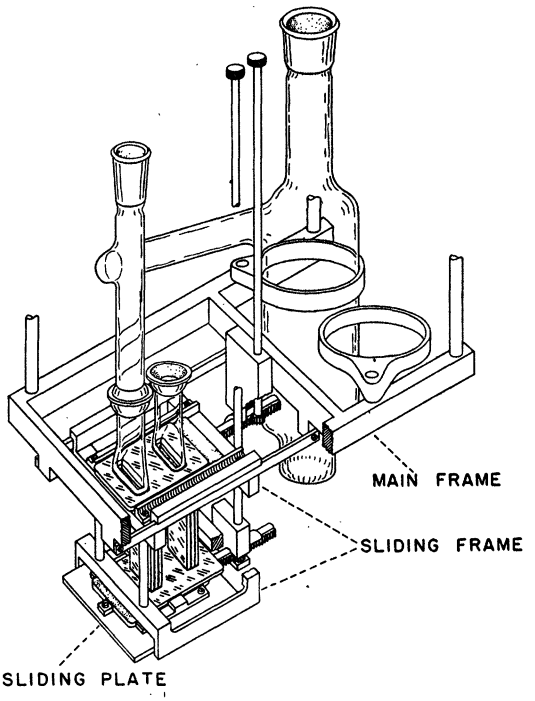

FIG. 1

which permit two electrophoresis experiments to be conducted simultaneously in one apparatus with a minimum of trouble from leakage. The double-length cells described by Longsworth, Cannan, and MacInnes (*1*) are particularly easy to manipulate for filling in this cell holder, and the danger of breakage is eliminated because the force required to slide the joints is applied directly at the edges of the sliding glass plates.

The main frame of the cell holder carries a smaller sliding frame in which are held both the middle section of the cell and a device for manipulating the bottom section. When the right-hand knob at the top is turned, the corresponding rack and pinion move this sliding frame, thus opening or closing the connection between the middle and top sections without, however, affecting the lower joint. The top section is held in place by a removable holder (not shown) on the main frame, which has projections to locate the glass plate by the edges and springs to press the sliding joint together. Similarly, the left-hand knob and a second rack and pinion mounted on the sliding frame move a sliding plate in which is held the bottom section, thus operating the lower joint without affecting the top joint. This is in contrast to the operation of the usual cell holders in which a piston (*3*) or rack and pinion (*2*), by applying force near the center of the middle section, moves this section while both the top and bottom stay fixed. If the frictional forces at the two joints are not equal, the resultant torque tends to tilt the middle section and either open the joints or break the cell.

Much of the success of the new holder depends on mounting the cell so that there is no overconstraint. Attached to the sliding frame along opposite edges of the glass plates of the top joint are two guide bars, which keep the top and middle sections parallel with the frame. Six additional points of contact between the middle section and the sliding frame are provided by buttons (not shown) located at the midpoints of the two remaining edges of the top glass plate and the four edges of the bottom plate. Thus, the middle section is fixed and strain free relative to the sliding frame, except that it can move vertically to make contact with the bottom section. The bottom section is held in the bottom sliding plate which maintains alignment with the middle. This sliding plate, which holds the entire weight of the cell as well as the force of the springs on the top section, rides on a single point at its center so that the pressure between the sections of the cell is uniformly distributed over the entire area of the sliding joints. In the usual type of cell holder, the weight is carried by guides at both sides of the bottom, with the result that, unless the frame and cell conform exactly, the weight is actually carried at only one edge, and the bottom joint is held together only by the cohesion of the grease. Leakage usually develops after the joint has been slid only a few times. The use of such a one-point support in other types of holder or simple cushioning of the bottom section on soft rubber, as suggested by Svensson (*3*), would probably help. With the new holder, leakage has never been observed. Even after 20 consecutive runs on one occasion, there was no obvious leak, although the delicate test of electrical leakage was not applied.

The arrangement of the spherical glass connection with the electrode vessels is apparent from Fig. 1. In order that the joints may be assembled without strain, each electrode vessel is mounted with some freedom in a sling (not shown) under the ring holding the vessel to the main frame. This ring, in turn, is pivoted to allow some horizontal motion. By mounting both electrode vessels on the same side of the cell, two complete units can be put simultaneously in the thermostat bath with the cells adjacent. The frames are supported from the top on a track across

[1] Contribution No. 1120.

the tank so that either cell may be rolled into position in front of the windows for observation. Spherical joints can be added to pre-existing equipment if the supports for the electrode vessels are given slight horizontal freedom. A method for making cells has been published (*5*). Pyrex glass plates, of course, must be used for cementing to the spherical joints.

The cells and holders have been used successfully for several years in an electrophoresis apparatus using parabolic mirrors in the optical system, as described elsewhere (*4*).

References

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Administration of Micronized Therapeutic Agents by Inhalation or Topical Application

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There are many disadvantages to the present method of administering therapeutic agents by the aerosol principle. The major objections are: (1) the wasteful, expensive, and unnecessary use of oxygen merely as a source of pressure; (2) the fact that the manual methods are time consuming and tiring (20–30 minutes/dose); and (3) the fact that the penicillin solutions used deteriorate rapidly and must be kept refrigerated to retain full potency for one week.

A small ball mill (Fig. 1) has been built, using readily available materials, which will grind various therapeutic agents to a micronized state in two hours. The material is then bolted through fine-meshed silk bolting cloth. When 40–50 grams of the mixture is prepared by use of this apparatus, the loss is less than 10 per cent.

Several modifications of the apparatus for administration of the smoke have been devised. The final apparatus is shown in Fig. 2. The lower chamber contains drierite, which is a dehydrating substance (anhydrous calcium sulfate), with an indicator which turns from blue to pink when it has picked up all the moisture it can. The lower chamber is filtered on both ends to prevent the drierite from being blown into the smoke-producing chamber or from being drawn into the air-intake opening. The smoke chamber has been built with a small surface area to increase the emptying efficiency. The air vents into this compartment are placed at an acute angle to force the powder into a spiral path in order to create turbulence. The outlet tube is likewise made of small internal caliber to reduce the amount of precipitate on the walls of the tube. Various adapters (nasal, oral, dental, vaginal, etc.) can be fitted to the outlet tube. This equipment can be used as it stands or fitted with a rubber mouthpiece. In other words, no bulb is necessary, but the exit tube or rubber mouthpiece can be placed in the mouth, and, by inhaling through the apparatus, the finely divided therapeutic agents can be drawn into the lungs. Efficiency studies indicate that, when used correctly, the apparatus will deliver in the smoke form 95 per cent of the

Fig. 1. The ball mill.

therapeutic agent originally placed in the cup and may be administered by the patient in from two to four minutes.

A disposable apparatus containing the principles of the smoke chamber may be molded very inexpensively by the

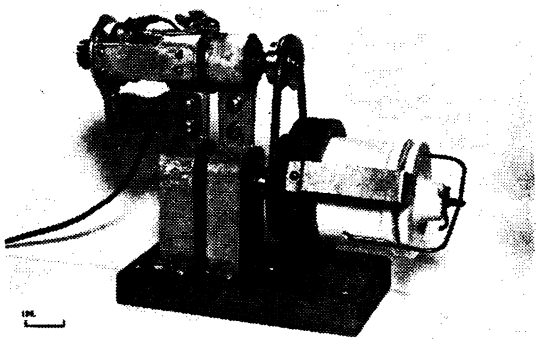

Fig. 2. The apparatus.

use of one of the transparent plastics. This apparatus may be used as both container and dispenser for the penicillin or other therapeutic agents.

Blood penicillin concentrations were determined by the