level was raised by means of the buret until it was completely free of the mounting block. It was now necessary to dilute the etchant to approximately twenty times its volume to raise the pH to a level where the replicas could be picked up on the metal grids. The hosecock, shown in Fig. 2, and the stopcock of the buret were opened. The flow into and out of the funnel was adjusted so that the liquid level remained essentially constant. The distilled water from the buret was introduced below the surface of the etchant via a polyethylene tube. This step greatly reduced the turbulence of the surface and, hence, reduced the tearing of the replicas during the dilution. When the pH of the solution in the top of the funnel was approximately 5, the replica was placed on a grid.

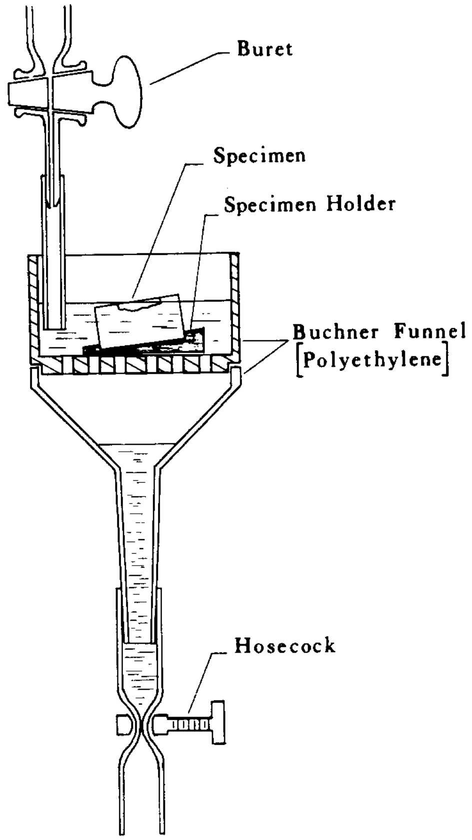

FIG. 2. Apparatus for separating replica from specimen in solutions of low pH.

The diluting process could be accelerated by removing the plastic block containing the sample from the etchant after the replica was released. The danger of the resulting turbulence tearing the replica usually precluded the use of this time-saving step.

This technique should be applicable to the removal of carbon replicas from any solid material which can be etched from beneath the replica by acid solutions, particularly those containing hydrofluoric acid.

Heated Vapor Absorption Cell for Infrared Spectroscopy

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IN order to observe the infrared absorption spectrum of a substance in the vapor state, it is necessary to have a sufficient number of molecules in the absorption path of the spectrometer. To study a substance having a low vapor pressure, the liquid or solid sample must be heated in an enclosed absorption cell. Such a heated absorption cell has been constructed and used to obtain the vapor spectrum of N-methyl formamide.[1] This cell with its heating jacket fits in the sample space of a Perkin-Elmer model 21 or model 112 spectrometer.

The design of this cell is sketched in Fig. 1. The sample path length is 7 cm. The cell body, cell ends, and the reservoir which holds the condensed sample are made of brass. The 5-cm diam windows are kept in good thermal contact with the cell by a lead cylinder (not shown in Fig. 1) which fits snugly between the windows and the cell ends. The windows are tightened against the O-ring gaskets by screwing the ends onto the cell. The vacuum-tight exit valve permits easy evacuation of the cell. The sample reservoir is also vacuum tight and is kept in good thermal contact with the cell body by being screwed into it from below.

The arrangement of inner and outer windows, separated by an air space, is used in order to maintain the inner window at approximately the same temperature as the cell body. To ensure that no condensation of sample vapor will occur on the inner cell windows, the reservoir is maintained as the coldest part of the cell by circulating ice water through a coil of copper tubing which fits snugly on a vertical brass rod attached to the bottom of the reservoir.

The heating jacket was built around two brass cylinders,

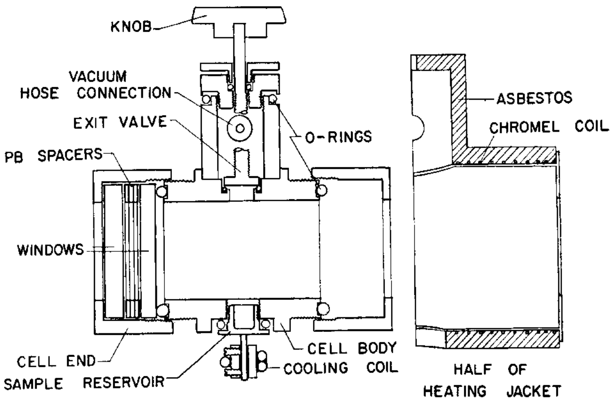

FIG. 1. Heated absorption cell suitable for obtaining infrared vapor spectra of samples having a low vapor pressure. One-half of the heating jacket slips over each end of the cell.

one of which fits closely over each end of the cell. Heat is supplied by current flowing through Chromel wire windings, which are electrically insulated from the cylinders by porcelain cement and covered with asbestos thermal insulation. Each cylinder is wound with approximately 2.7 ft of 28 gauge Chromel-A wire, having a resistance of 11 ohms. These windings are closer together near the outer ends of the cylinder in order to furnish more heat to the cell windows.

This cell has been used satisfactorily at temperatures up to 180°C. The cell temperature was measured by a thermocouple inserted into a hole drilled into the outside of the cell near the reservoir. It was possible to control the temperature of the cell to within 1°C during a run of 2 or 3 hr.

Sodium chloride windows have been used with this cell in the region from 700 to 4000 cm^{-1}, and potassium bromide windows have been used in the 400- to 800-cm^{-1} region. By using KBr inner windows, and outer windows of 0.00025-in. thick Teflon mounted in lead rings, it was possible to extend the range of observation to about 350 cm^{-1}.

This cell was constructed in the instrument shop of the University of Michigan Physics Department. The helpful suggestions of Professor G. B. B. M. Sutherland are gratefully acknowledged.

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[1] D. E. DeGraaf and G. B. B. M. Sutherland, J. Chem. Phys. 26, 716 (1957).

Rotating Cylinder Function Generator

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In a recent paper,[1] a rotating disk function generator for analog computers was described. A function generator of the type discussed has been used for some time in the NRC Radio and Electrical Engineering Division Laboratory. The principle of operation of the NRC function generator is the same as that of the rotating disk function generator. However, the particular problem being solved led to the use of a rotating cylinder instead of a rotating disk. Two significant differences in operation follow from this: (a) The function to be generated is plotted without any transformation, except scaling, and (b) A number of outputs, each representing the desired function with a different delay, may be obtained simultaneously.

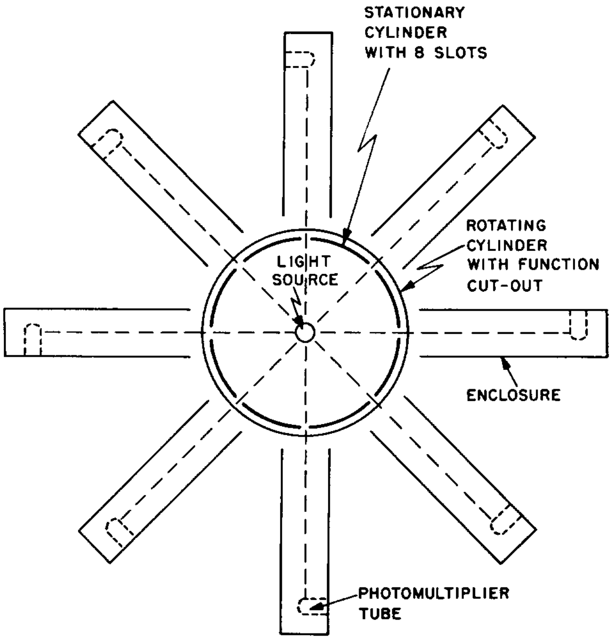

FIG. 1. Schematic of rotating cylinder function generator.

The function generator is shown schematically in Fig. 1, for the case where 8 outputs each delayed $\frac{1}{8}$ of a period are required. It consists of a light source, a cylinder in which 8 vertical slots are cut at intervals of 45° around the circumference, a diffusing screen, and 8 photomultipliers in light-proof enclosures. A cylinder from which the desired function has been cut is rotated between the cylinder containing the light source and the photomultiplier enclosures. The rotating cylinder is made by scaling and plotting the function to be generated on a sheet of light cardboard. The area under the curve is then cut out and the cardboard formed into a cylinder.

The rotating cylinder function generator is subject to substantially the same errors as the rotating disk function generator. However, the errors due to misalignment are less serious because accurate alignment is easier in the cylindrical system.

Precautions which reduce the error in the optical part of the system are: (a) a diffusing screen of translucent paper immediately inside the stationary cylinder, (b) flat finishes inside the cylinder to minimize specular reflections, (c) spacing between photomultiplier and slot of at least three times slot length, (d) a lining of black felt on the inner surfaces of the light proof enclosures, and (e) horizontal mounting of the photomultiplier tubes (type 931A) so that the narrow dimension of the cathode would be parallel to the length of the slot.

The static error was reduced to 3%. Further refinement is undoubtedly possible, but this accuracy was adequate for our application.

The output of each photomultiplier was adjusted with a potentiometer. The outputs can, therefore, be made equal for a given input or they can be weighted arbitrarily.

Only the ratio of combinations of the outputs of the