Electrical Admittance

Valuable information about many liquids and solids can be obtained by measuring their capacitance and conductance, particularly if this can be done over a wide range of frequencies. This paper describes an alternating current bridge for the range fifty cycles per second to about five megacycles per second, which, by its design, eliminates or greatly reduces errors and complications in more conventional circuits.

Two modifications of the familiar Wheatstone bridge are employed, both developed from earlier, more special designs of other bridges. The first modification is to use two equal, closely coupled, transformer windings as ratio arms. Lead capacitances or other residuals shunting either coil are reflected across the other, with little change in the bridge balance. The second feature is use of a "wye" resistance divider network to shift a fixed conductance electrically from the unknown to the standard bridge arm. The divider setting for balance is essentially direct-reading in conductance of the unknown, and the components are readily chosen to give small residual errors at radio frequencies. These properties are difficult or impossible to achieve in more usual designs.

The circuit is particularly adapted to measurements of dielectrics and electrolytes, since it reads parallel capacitance and conductance directly and lead capacitance and surface leakage effects are virtually eliminated. The circuit has been used for dielectric constant measurements on polar liquids and is now being employed to study relaxation effects in solids and "associated" electrolytes. R.H.C.

A Wide Range Capacitance-Conductance Bridge. By Robert H. Cole and P. M. Gross, Jr. *Rev. Sci. Inst. 20: 225, April, 1949.*

Flow Patterns

This paper deals with the patterns of a two-dimensional supersonic potential flow of a perfect gas. In the vicinity of Mach number 1.58 (provided the ratio of the specific heats is 1.4) all Mach lines are virtually straight. If the Mach number is near 1.58 throughout the entire flow, all Mach lines may be replaced by straight lines. This is illustrated by an example.

It is further discussed how the flow pattern may be subdivided into regions such that within each region the Mach lines are replaced by straight lines. This leads the author to inquire for a hypothetical fluid having the property that, for the class of flows considered, all Mach lines are strictly straight. Its equation of state is derived. It is shown that the condition leading to it is mathematically equivalent to the requirement that the flow problem can be reduced to the solution of the simple wave equation. M.M.M.

On Supersonic Flow Patterns. By M. M. Munk. *J. App. Phys. 20: 302, April, 1949.*

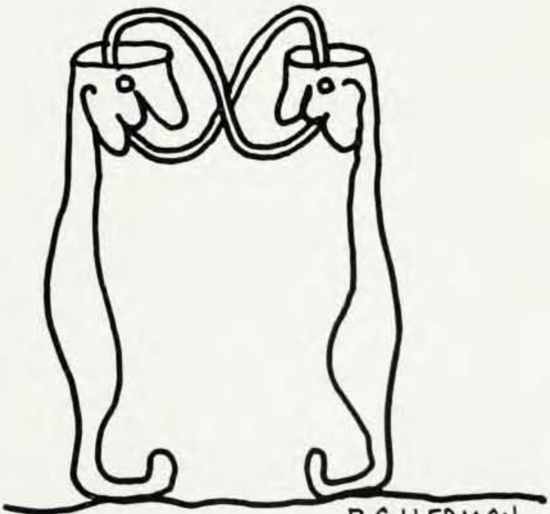
The Birefringent Filter

The birefringent filter, invented in 1933 by Bernard Lyot, and independently in 1938 by Yngve Öhman, has been widely used in observing solar limb emission line phenomena which are ordinarily invisible because of the background of atmospheric and instrumental scattered light. The filter can be designed to transmit a very sharp spectral band (down to a fraction of an angstrom effective width) centered on any desired wave length. It is used like an ordinary glass filter, but with some restriction on the maximum angle off axis, depending on the sharpness of the transmission band, the material of the filter, and the complexity of construction.

All of the several possible types of birefringent filter depend for their action on the interference of polarized light in passing through a series of layers of polarizing film and birefringent crystal. The filter at the Climax, Colorado station of the High Altitude Observatory of Harvard University and the University of Colorado (used for observing solar prominences) has six layers of crystal quartz sandwiched between seven layers of Polaroid film. The total thickness is about twelve centimeters, and the transmission band is 4.1 angstroms wide in the red.

Complex types of birefringent filters have been devised to increase the field, to reduce the number of polarizers required and to permit the adjustment of the transmission band to any desired wave length. The success of these filters in astronomical research suggests that they may also find important applications in the physical laboratory. J.W.E.

The Birefringent Filter. By John W. Evans. *J. Opt. Soc. Am. 39: 229, March, 1949.*



Cooperative Research