JOURNAL NOTES

Magnetic Servo

Making a flexible servo system to satisfy the specialized control requirements of most laboratories is usually difficult and expensive. These disadvantages are reduced by adapting the electromagnetic fluid clutch principle to servo use and thus should place servo development within the reach of the average laboratory. A fluid, such as an iron-oil mixture, links the faces of a conventional magnetic clutch. By regulating the current in an exciting coil the viscosity of the fluid changes and the clutch faces are linked more or less tightly. One can thus control the torque transmitted through the clutch to the servo mechanical linkage. A compensating voltage, proportional to the servo movement, establishes position equilibrium points. Servo overshoot is prevented by using an anticipatory balance voltage. The characteristics of a prototype magnetic servo unit have been studied experimentally. Preliminary determinations of its torque, response, driving speed, reliability, and other pertinent factors have been made, and the principle apparently is highly applicable. E.S.B.

A Servo Employing the Magnetic Fluid Clutch. By E. S. Bettis and E. R. Mann. *Rev. Sci. Inst. 20: 97, February, 1949.*

Electron Optics

Present-day electron microscopes do not achieve the magnifications theoretically possible because of the aberrations introduced by the axially symmetric electrical and magnetic fields used for lenses. This limits the instrument's ability to distinguish objects smaller than a few times the distance between atoms in a solid. Although the major effort of electron microscopy is necessarily directed toward the development of techniques for using the enormous gain in resolution already available, there have been many suggestions for improving present-day lenses. This paper considers the correction of electron microscope objectives by means of electron mirrors, or path-reversing electric fields, of a form which is convenient for specimen introduction and which obviates the need for conducting films in the ray path. It is found that the mirror dimensions required to achieve compensation are so unreasonably small that the fundamental advantages of the proposed technique are largely outbalanced; the practical attainment of greatly enhanced resolving powers through electron-lens correction still appears remote. E.G.R.

Aberration Correction with Electron Mirrors. By E. G. Ramberg. *J. App. Phys. 20: 183, February, 1949.*

Trochotron

Several "trochotron" mass spectrometers (so called because of the trochoidal ion trajectories) have been built using an arrangement of crossed, uniform electric and magnetic fields which has a focal distance independent of the initial direction or speed of the particles. One difficulty in designing such a spectrometer is in determining the ion paths for the range of initial conditions that may exist in practice. The paper gives general trochoids drawn by machine and nomographs to allow a rapid graphical determination of the ion paths in the crossed fields. The information should prove useful in other problems involving charged particles in such fields. G.K.W.

Trochotron Design Principles. By G. W. Monk and G. K. Werner. *Rev. Sci. Inst. 20: 93, February, 1949.*

Optical Coatings

To increase the efficiency of optical components of military equipment, Corps of Engineers technicians have been investigating German developments in optical coatings with the help of German scientists who were familiar with such techniques. Among the coatings investigated thus far is silicon monoxide. Front surface mirrors with good abrasion, corrosion, and reflection properties have been produced. Aluminum is used as the reflecting material because vacuum-evaporated aluminum films have high reflectivity throughout most of the useful spectral range, and greater adherence and a much finer grain and smoother surface (as revealed by the electron microscope) than similar silver coatings. These last factors are important for depositing effective protective coatings on the mirror. The protective silicon monoxide is applied by high vacuum evaporation from a tantalum boat electrically heated to incandescence.

In the visual and infrared portion of the spectrum, reflectivity of aluminum mirrors protected with an optimum thickness (about fifteen millionths of a centimeter) of silicon monoxide is only one percent lower than that of unprotected aluminum surfaces except for wavelengths of light from eight to ten microns. In this region, the silicon oxides cause some decrease in mirror reflectivity. In the ultraviolet, the silicon monoxide layer shows appreciable absorption which varies with the evaporation conditions. However, it may be decreased somewhat by an oxidizing treatment.

To produce mirrors on metallic bases, it is advisable to first lay down a silicon monoxide film because it improves adherence and prevents diffusion of the base metal into the reflecting material. With an initial application of silicon monoxide, it is also possible to make protected front surface mirrors on plastic materials. Evaporated silicon monoxide layers have been successfully used as replica and support films for electron microscope examinations. N.W.S.

Silicon Monoxide Protected Front Surface Mirrors. By Georg Hass and Noel W. Scott. *J. Opt. Soc. Am. 39: 179, February, 1949.*