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M Meetings

Reflecting Microscopes

Discussed at Meeting in Britain

Sir Isaac Newton originally suggested the possibility
of making a microscope using mirrors only. It will be
remembered that he believed that it was only by using
reflecting elements that achromatic optical systems
could be obtained. Robert Barker (1736), in fact, made
the first such microscope using a system of concave
mirrors. Later work was carried out in the nineteenth
century by Amici and others, the early efforts being all
directed towards the avoidance of chromatic errors.
After the successful manufacture of achromatic micro-
scope lenses, reflecting microscopes dropped completely
out of consideration.

There the matter rested until Burch, following the
mathematical work of Schwarzschild and Chrétien, con-
structed practical reflecting microscopes having at least
one aspherical reflecting surface. An instrument of this
type has been in use for a number of years, but the
difficulties of making the reflecting surfaces to the re-
quired degree of accuracy (about $\frac{1}{20}$ of a wavelength)
are exceedingly great.

The first two Burch-type instruments of a batch of
ten now under construction, thanks to a grant from the
Nuffield Foundation, are now in use and in these the
mechanical design and construction has been much al-
tered. The aspherical mirrors (of speculum metal and
stainless steel) for both the condenser and the objec-
tive are identical in form and have a numerical aper-
ture (N.A.) of 0.65. By the addition of a special im-
mersion lens, the N.A. can be raised to 0.95 though the
system is not then completely achromatic.

In an interesting paper presented last December 18th,
at a meeting of the Scientific and Technical Group of
the Royal Photographic Society in London, Dr. Barer
spoke on reflecting microscopes and described some of
his work at the Department of Human Anatomy, Ox-
ford, using the first of these new instruments for ultra-
violet and infrared microspectroscopy.

The illuminating system for a reflecting microscope of
this type presents considerable difficulties, particularly
with regard to the provision of an aperture stop for
the condenser and in the design of a suitable mono-
chromator. These difficulties have been satisfactorily
overcome and the special monochromator now used is
noteworthy in that it embodies a grating, ruled to put
a! the light in the first order, ultraviolet spectrum and
uses circular iris diaphragms instead of slits.

Since a reflecting microscope is perfectly achromatic

it is possible to make adjustments visually by white light even though the work is to be done by ultraviolet light.

Reviewing alternative microscopes of other workers, Dr. Barer mentioned that it had been shown by Burch that spherical mirrors cannot be successfully employed over N.A. 0.5 and that this had been confirmed by Grey in America. There are also great disadvantages in these other systems, resulting from the high obstruction ratio of the second reflecting surface, leading to greatly reduced contrast and also to very restricted field of view. Mention was made of the refracting-reflecting spherical system of Grey, employing components made of quartz and fluorite, and also to Grey's ultraviolet color-translating microscope. While this instrument is of great ingenuity and complexity, its practical use may be somewhat restricted. Solid optical components were also referred to, but practical instruments such as that of Bouwers are restricted to visual use only.

Dr. Barer's conclusions are that the new Burch instruments are unique in their high performance and are the only instruments existing which meet all the permitted tolerances.

R. Mc. V. Weston
S.I.M.P.L., Ltd., London

Instrumentation

College-Industry-Government Conference

The electrical engineering department of Michigan State College, in cooperation with the National Science Foundation, the National Bureau of Standards, the Instrument Society of America, and the American Society for Engineering Education, has announced an invitational national collegiate-industry-government conference on instrumentation to be held on the Michigan State campus, March 19th and 20th. The conference is being called in recognition of the growing importance and potential of instrumentation in research and production, and to the national defense. Its objectives will be: (a) to relate the role and needs of instrumentation in production and research to college interests and responsibilities, (b) to review current instrumentation activities in the colleges, (c) to suggest specific activities the colleges might undertake in this field, and (d) to suggest specific ways by which industry might assist the colleges in these activities.

Participating in the program and representing the sponsoring groups will be Paul E. Klopsteg, director of the Mathematical, Engineering, and Physical Sciences Division of the National Science Foundation; A. V. Astin, director of the National Bureau of Standards; Porter Hart, president of the Instrument Society of America; and E. A. Walker, Dean of Engineering at Pennsylvania State College. Others on the program include G. M. Rassweiler, assistant chief of the Physics-Instrumentation Lab, General Motors Technical Center; J. B. McMahon, Republic Flow Meters Company; George Muschamp, vice president of Brown Instrument Company; R. T. Sheen, vice president of Milton Roy

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