U.S. Department of Commerce
NATIONAL BUREAU OF STANDARDS
Washington

OPTICAL INSTRUMENTS, REFRACTOMETRY

and

OPTICAL PROPERTIES OF GLASS:

Publications by the Staff of the National Bureau of Standards.

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Contents

I. GENERAL INFORMATION

Some of the publications in this list have appeared in the regular series of publications of the Bureau and others in various scientific and technical journals. Unless otherwise specifically stated, papers are not obtainable from the National Bureau of Standards.

Where the price is stated, the publication can be purchased from the Superintendent of Documents, Government Printing Office, Washington, D.C. The prices quoted are for delivery to addresses in the United States and its territories and possessions and in certain foreign countries which extend the franking privilege. In the case of all other countries, one-third of the cost of the publication should be added to cover postage. Remittances should be made either by coupons (obtainable from the Superintendent of Documents in sets of 20 for $1.00 and good until used), or by check or money order payable to the "Superintendent of Documents, Government Printing Office" and sent to him with order.

Publications marked "OP" are out of print, but, in general, may be consulted at technical libraries.

For papers in other scientific or technical journals, the name of the journal or of the organization publishing the article is given in abbreviated form, with the volume number (underscored), page, and year of publication, in the order named. The Bureau can not supply copies of these journals, or reprints from them, and it is unable to furnish information as to their availability or price. They, too, can usually be consulted at technical libraries.

Series letters with serial numbers are used to designate Bureau publications:

S = "Scientific Paper". S1 to S329 are "Reprints" from the "Bulletin of the Bureau of Standards". S330 to S572 were published as "Scientific Papers of the Bureau of Standards". This series was superseded by the "Bureau of Standards Journal of Research" in 1928.

T = "Technologic Paper". T1 to T370. This series was superseded by the "Bureau of Standards Journal of Research" in 1928.

RP= "Research Paper". These are reprints of articles appearing in the "Bureau of Standards Journal of Research" and

the "Journal of Research of the National Bureau of Standards", the latter being the title of this periodical since July 1934 (volume 13, number 1).

C = "Circular".

M = "Miscellaneous Publications".

LC ="Letter Circular", a mimeographed pamphlet obtainable from the National Bureau of Standards without charge.

Circular C24 and supplements giving the complete list of the Bureau's publications (1901-1936), are sold by the Superintendent of Documents for 55 cents. Announcement of new publications is made each month in the Technical News Bulletin which is obtainable from the same source by subscription at 50 cents per year.

Inquiries regarding the purchase of back numbers of magazines containing any of the articles listed in non-governmental publications should be addressed to the publishers. For this purpose their addresses are given in the list which follows:

American Machinist,
McGraw Hill Publishing Co.,
330 W. 42nd St.,
New York, N.Y.

Annual Report of Compressed Gas Manufacturers Ass'n., Inc.,
Compressed Gas Manufacturers Ass'n., Inc.,
120 West 42nd St.,
New York, N.Y.

Army Ordnance,
The Army Ordnance Association,
Mills Building,
17th St. and Pennsylvania Ave.,
Washington, D.C.

Astronomical Society of the Pacific,
318 Merchants Exchange Bldg.,
San Francisco, Calif.

Journal of American Ceramic Society,
2525 N. High St.,
Columbus, Ohio.

Journal of the Optical Society of America and Review of Scientific Instruments,
American Institute of Physics,
175 Fifth Avenue,
New York, N.Y.

Nature,
St. Martin's Street,
London, W.C. 2, England.

The Military Engineer,
Mills Building,
17th St. and Pennsylvania Ave.,
Washington, D.C.

National Geographic Magazine,
16th and M Sts., N. W.,
Washington, D.C.

Photogrammetric Engineering,
724 Ninth St., N.W.,
Washington, D.C.

II. PHOTOGRAMMETRY

Title	Series	Price
Optical requirements of airplane mapping. I.C. Gardner. BS J. Research 8, 445 (1932) 11 pp. 5 illus.	RP427	5c
Relation of camera error to photogrammetric mapping. I.C. Gardner. J. Research NBS 22, 209 (1939) 30 pp. 6 illus.	RP1177	10c
Locating the principal point of precision airplane mapping cameras, F.E. Wasner. J. Research NBS 27, 405 (1941) 7 pp. 3 illus.	RP1428	10c
A magnifying stereoscope and camera: two instruments for airplane mapping. I.C. Gardner. J. Opt. Soc. Am. and Rev. Sci. Insts. 11, No. 2, 195, (1925).		
The interpretation and uses of lens tests and camera calibrations. I.C. Gardner. Photogrammetric Engineering 3, No. 1, 12 (1937).		
Specifications for a precision mapping camera. I.C. Gardner. Photogrammetric Engineering 4, No. 3, 173 (1939).		

III. PHOTOGRAPHIC OBJECTIVES

Title	Series	Price
Axial aberrations of lenses. E.D. Tillyer and H.I. Schultz. BS Sci. Pap. 14, 341 (1918-19) 29 pp. 27 illus.	S 311	OP
Aberrations of long focus anastigmatic photographic lenses. A.H. Bennett. BS Sci. Pap. 19, 587 (1923-24) 54 pp. 52 illus.	S494	OP
Precision camera for testing lenses. I.G. Gardner and F.A. Case. J. Research NBS 18, 449 (1937) 12 pp. 8 illus.	RP984	10c
Resolving power and distortion of typical airplane-camera lenses. F.E. Washer. J. Research NBS 22, 729 (1939) 18 pp. 4 illus.	RP1216	5c
Charts for testing lens resolution. (1940). 48 charts.	M166	$1.25
A test of lens resolution for the photographer. I.C. Gardner. (1941) 15 pp. 7 illus.	C428	40c
The distortion of some typical photographic objectives. A.H. Bennett. J. Opt. Soc. Am. and Rev. Sci. Insts. 14, No. 3, 235 (1927).		
The compensation of distortion in objectives for airplane photography. I.C. Gardner and A.H. Bennett. J. Opt. Soc. Am. and Rev. Sci. Insts. 14, No. 3, 245 (1927).		

IV. DESIGN AND CONSTRUCTION OF OPTICAL INSTRUMENTS

Title	Series	Price
Spherical aberration of thin lenses. T.T. Smith. BS Sci. Pap. 18,559 (1922-23) 26 pp. 15 illus.	S461	OP
Application of the algebraic aberration equations to optical design. I.C. Gardner. BS Sci. Pap. 22, 73 (1927-28) 131 pp. 55 illus.	S550	OP
Making of mirrors by deposition of metal on glass. (1931) 19 pp. 2 illus.	C389	10c
Optical coincidence gage. I.C. Gardner and F.A. Case. BS J. Research 6, 229 (1931) 9 pp. 6 illus.	RP272	10c
Reciprocal spherical aberration of an optical system including higher orders. Harold F. Bennett. BS J. Research 9, 187 (1932) 39 pp. 11 illus.	RP466	5c
Attachment for turning approximately spherical surfaces of small curvature on a lathe. I.C. Gardner. BS J. Research 9, 227 (1932) 11 pp. 4 illus.	RP467	5c
Compound lens systems. T. Townsend Smith. J. Opt. Soc. Am. 1, No. 4, 113 (1917).		
The cemented telescope objective of barium crown and flint. I.C. Gardner. J. Opt. Soc. Am. 4, No. 5, 274 (1920).		
The coincidence type of self-contained range finder. I.C. Gardner. J. Opt. Soc. Am. 5, No. 5, 420 (1921).		
Constructional data for a cemented telescope objective of barium crown and flint. I.C. Gardner. J. Opt. Soc. Am. and Rev. Sci. Insts. 6, No. 3, 379 (1922).		
A field telemeter for approximate surveying. I.C. Gardner. J. Opt. Soc. Am. and Rev. Sci. Insts. 6, No. 5, 489 (1922).		

IV. DESIGN AND CONSTRUCTION OF OPTICAL INSTRUMENTS (continued)

Title	Series	Price

Image curvature as a function of diaphragm position. I.C. Gardner and J.J. Arnaud. J. Opt. Soc. Am. and Rev. Sci. Insts. 9, No. 6, 675 (1924).

A camera for photographing the interior of a rifle barrel. I.C. Gardner and F.A. Case. J. Opt. Soc. Am. and Rev. Sci. Insts. 12, 159 (1926).

An optical system for reading the angular deflection of a mirror. I.C. Gardner. J. Opt. Soc. Am. and Rev. Sci. Insts. 12, 529 (1926).

Optical methods for testing compressed gas containers. I.C. Gardner. Fourteenth Ann. Rep., Compressed Gas Manufacturers' Ass'n. Inc. 24 (Jan. 1927).

Spherical surfaces of slight curvatures. I.C. Gardner. Am. Machinist 76, 994 (Sept. 1932).

V. TESTING AND USE OF OPTICAL INSTRUMENTS

Title	Series	Price
Testing and properties of optical instruments. (1918). 41 pp. 1 illus.	C27	OP
New method for determining the focal length of a converging lens. I.G. Priest. BS Sci. Pap. 5, 483 (1908-09) 15 pp. 1 illus.	S110	OP
Resolving power of objectives. P.G. Nutting. BS Sci. Pap. 6, 121 (1909-10) 5 pp. 1 illus.	S122	OP
Micrometer microscopes. A.W. Gray. BS Sci. Pap. 10, 375 (1914) 16 pp. 3 illus.	S215	OP
Interference method for the determination of axial and oblique aberrations. A.H. Bennett. BS J. Research 2, 685 (1929) 18 pp. 11 illus.	RP52	OP
Lateral chromatic aberration of apochromatic microscope systems. I.C. Gardner and F.A. Case. BS J. Research 6, 937 (1931) 10 pp. 3 illus.	RP316	5c
Apparatus for the testing of binocular telescopes. T. Townsend Smith. J. Opt. Soc. Am. 2, 3, Nos. 3-6, 76-90 (1919).		
A modified Hartmann test based on interference. I.C. Gardner and A.H. Bennett. J. Opt. Soc. Am. and Rev. Sci. Insts. 11, No. 4, 441, (1925).		
Photographing the bore of a rifle. I.C. Gardner. The Military Engineer 18, 480 (1926).		
A modified Hartmann test based on interference. I.C. Gardner and A.H. Bennett. (translated from paper in J. Opt. Soc. Am. and Rev. Sci. Insts. 1925) Zeitschrift für Instrumentenkunde 4, No. 47, 197 (1927).		
An optical coincidence gage. I.C. Gardner. Am. Machinist 74, No. 4, 155 (1931).		

VI. MISCELLANEOUS PAPERS ON OPTICAL INSTRUMENTS

Title	Series	Price
Specifications for marine sextants. (1921). 8 pp. -	C110	OP
Representation of aberration diffraction effects by means of rotating sectors. A.H. Bennett. BS J. Research 3, 391 (1929) 8 pp. 9 illus.- -	RP102	OP
"Camera Finish" at the race track. I.C. Gardner. J. Research NBS 18, 467 (1937) 8 pp. 3 illus. -	RP986	5c
Radiometry: Publications by the Staff of the National Bureau of Standards. (1941).- - - - -	LC635	Free

The standardization of optical fire control instruments. I.C. Gardner. Army Ordnance 5, 512 (Sept.-Oct. 1924).

Making a standard of planeness. C.A. Skinner. General Electric Rev. 29, No. 8, 528 (August 1926).

Observing an eclipse in Asiatic Russia. I.C. Gardner. National Geographic Magazine 71, 179 (1937).

Corona photography during the eclipses of 1936 and 1937. I.C. Gardner. National Geographic Society, Contributed Technical Papers, Solar Eclipse Series, No. 1, 39 (1939).

VII. REFRACTOMETRY

Title	Series	Price
Prism refractometry and certain goniometrical requirements for precision. L.W. Tilton. BS J. Research 2, 909 (1929) 22 pp. 2 illus.	RP64	10c
Prism size and orientation in mininum deviation refractometry. L.W. Tilton. BS J. Research 6, 59 (1931) 18 pp. 6 illus.	RP262	10c
Permissible curvature of prism surfaces and inaccuracy of collimation in precise minimum-deviation refractometry. L.W. Tilton. BS J. Research 11, 25 (1933) 33 pp. 9 illus.	RP575	5c
Variations in refractive index of CO_2-free air and a statistical correlation with solar activity. L.W. Tilton. J. Research NBS 13, 111 (1934) 14 pp. 2 illus.	RP695	5c
Refractive index and dispersion of normal and heavy water. L.W. Tilton and J.K. Taylor. J. Research NBS 13, 207 (1934) 3 pp.	RP703	5c
Standard conditions for precise prism refractometry. L.W. Tilton. J. Research NBS 14, 393 (1935) 26 pp. 1 illus.	RP776	5c
A thin cell for use in determining the refractive indices of crystal grains. C.P. Saylor. BS J. Research 15, 97 (1935) 2 pp. 1 illus.	RP814	5c
Thermal control in minimum-deviation refractometry and temperature coefficients for a medium flint glass. L.W. Tilton. J. Research NBS 17, 389 (1936) 12 pp. 5 illus.	RP919	5c
Accurate representation of refractive index of distilled water as a function of wavelength. L.W. Tilton. J. Research NBS 17, 639 (1936) 12 pp. 2 illus.	RP934	5c
Accurate representation of the refractivity and density of distilled water as a function of temperature. L.W. Tilton and J.K. Taylor. J. Research NBS 18, 205 (1937) 10 pp. 2 illus.	RP971	5c

VII. REFRACTOMETRY (continued)

Title	Series	Price
Refractive index and dispersion of distilled water for visible radiation, at temperatures 0 to 60°C. L.W. Tilton and J.K. Taylor. J. Research NBS 20, 419 (1938) 59 pp. 19 illus. -	RP1085	15c
Sunspot number and the refractivity of dry air. L.W. Tilton. Nature (London) 132, 855 (1933).		

VIII. OPTICAL PROPERTIES OF GLASS

Title	Series	Price
Glasses for protecting the eyes from injurious radiations. W.W. Coblentz and W.B. Emerson. Tech. Pap. BS No. 93, 1st Ed., 1917; 2nd Ed. 1918; 3rd Ed. 1919.	T93	OP
Optical conditions accompanying the striae which appear as imperfections in optical glass. A.A. Michelson. BS Sci. Pap. 15, 41 (1919-20) 5 pp. 4 illus.	S333	OP
Characteristics of striae in optical glass. T.T. Smith, A.H. Bennett, and G.E. Merritt. BS Sci. Pap. 16, 75 (1920) 18 pp. 19 illus.	S373	OP
Measurements of the index of refraction of glass at high temperatures. C.G. Peters. BS Sci. Pap. 20, 635 (1924-26) 25 pp. 14 illus.	S521	10c
Cause and removal of certain heterogeneities in glass. L.W. Tilton, A.N. Finn, and A.Q. Tool. BS Sci. Pap. 22, 719 (1927-28) 18 pp. 7 illus.	S572	OP
Transmissive properties of eye protective glasses and other substances. W.W. Coblentz and R. Stair. Tech. Pap. BS 22, 555 (1928) 24 pp. 15 illus.	T369	OP
Optical heterogeneity of a fused quartz disk. L.W. Tilton and A.Q. Tool. BS J. Research 3, 619 (1929) 10 pp. 2 illus.	RP112	5c
Index of refraction of some soda-lime-silica glasses as a function of the composition. C.A. Faick and A.N. Finn. BS J. Research 6, 993 (1931) 10 pp. 3 illus.	RP320	OP
Restoration of solarized ultra-violet transmitting glasses by heat treatment. A.Q. Tool and R. Stair. BS J. Research 7, 357 (1931) 18 pp. 5 illus.	RP345	10c
Index of refraction, density, and thermal expansion of some soda-alumina-silica glasses as functions of the composition. C.A. Faick, J.C. Young, D. Hubbard, and A.N. Finn. J. Research NBS 14, 133 (1935) 5 pp. 4 illus.	RP762	5c

VIII. OPTICAL PROPERTIES OF GLASS (continued)

Title	Series	Price
Publications on glass technology and a list of standard samples of interest to the glass industry (1935).	LC350	Free
Spectral-transmissive properties and use of colored eye-protective glass. W.W. Coblentz and R. Stair. (1938).	C421	10c
Effect of composition and other factors on the specific refraction and dispersion of glasses. J.C. Young and A.N. Finn. BS J. Research 25, 759 (1940) 24 pp. 5 illus.	RP1353	5c

Optical glass. Heber D. Curtis. Pub., Astronomical Soc. Pacific 31, No. 180, 77 (1919).

Some light transmissive characteristics of eye glasses. W.W. Coblentz. The Central J. of Homeopathy 5, 597 (1924).

Regarding the heat treatment of glass and its refractivity and density. A.Q. Tool, L.W. Tilton, and E.E. Hill. J. Opt. Soc. Am. and Rev. Sci. Insts. 12, No. 4, 490 (1926).

Some effects of carefully annealing optical glass. L.W. Tilton. J. Wash. Acad. Sci. 20, No. 1, 12 (1930).

The transmissive properties of tinted lenses. W.W. Coblentz. Am. J. of Opthalmology 15, 932 (1932).