

Letter  
Circular  
LC-571  
(Superseding LC-485)

U.S. DEPARTMENT OF COMMERCE  
NATIONAL BUREAU OF STANDARDS  
WASHINGTON

October 3, 1939

Optical Instruments, Refractometry, and Optical Glass:  
Publications.

Information Section  
National Bureau of Standards  
Washington, D. C.



## I. GENERAL INFORMATION

The publications listed herein relate to a particular field of activity at the National Bureau of Standards. For other Government publications issued by this bureau, see Circular 24 and its supplements (the first three listed in Section III of this letter circular).

Articles that have been published by the U. S. Government may be consulted in various Government-depository libraries of which there are two or more in each State. Publications marked OP are out of print and no longer available for distribution or sale. To obtain available publications, send orders with remittance to the Superintendent of Documents, Government Printing Office, Washington, D. C. (Do NOT send orders to the National Bureau of Standards, except for Letter Circulars, which may be obtained upon application without charge.) The particular series to which a Government publication belongs is indicated by the initial letter preceding the number as follows:

C, Circular;

LC, Letter Circular;

S, Scientific Paper;

RP, Research Paper.

In referring to publications, the serial letter and the number are both needed to give complete identification, and both should be used in ordering (as, for example, "National Bureau of Standards publication RP427"). Government publications from the Superintendent of Documents usually reach destinations within a

week or two. For convenience of the general public coupons (good until used in exchange for Government publications) may be purchased from his office in sets of 20 for \$1.00.

Domestic remittances should be made by coupons, postal money order, express order, or New York draft payable to the "Superintendent of Documents, Government Printing Office, Washington, D. C." Postage stamps, defaced or smooth coins, or foreign money will not be accepted. Publications are forwarded under Government frank to addresses in the United States and its possessions; also to Canada, Cuba, Mexico, Newfoundland, and the Republic of Panama.

Remittances from foreign countries, with exception of those mentioned in the preceding paragraph, should include in addition to the price of the publication, about one-third of the quoted price in order to cover postage. If the amount remitted exceeds postage requirements, the balance will be refunded; or if additional postage is required notification will be made. Remittances should be made by international money order or by New York draft.

In general, reprints of the articles which have appeared in scientific periodicals, other than those of the Government, are not available for distribution. Many of the larger libraries maintain files of these scientific journals and they may be readily consulted. Local libraries not having such files available, may be able to borrow desired publications from a larger library.

LIST OF NON-GOVERNMENT PERIODICALS

Inquiries regarding the purchase of back numbers of magazines containing any of the articles listed in section IV 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 Street,  
New York, N.Y.

Annual Report of Compressed Gas Manufacturers Ass'n., Inc.,  
Compressed Gas Manufacturers Ass'n., Inc.,  
120 West Forty-second Street,  
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 the American Ceramic Society,  
2525 N. High Street,  
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 Streets, N.W.,  
Washington, D.C.

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

III. PUBLICATIONS ISSUED BY THE U.S. GOVERNMENT

<u>Series</u>	<u>Price</u>	
C24	25c.	Publications of the Bureau of Standards 1901-25.
	25c.	Supplementary list of publications of the Bureau of Standards. July 1, 1925- December 31, 1931.
	5c.	Supplementary list of publications of the National Bureau of Standards. January 1, 1932 - June 30, 1936. *****
C27	OP	Testing and properties of optical instruments. Cir. BS, C27 (1918). 41 pp. 1 illus.
C110	5c.	Specifications for marine sextants. Cir. BS, C110 (1921). 8 pp.
C389	10c.	Making of mirrors by deposition of metal on glass. Cir. BS, C389 (1931) 19 pp. 2 illus.
S110	OP	New method for determining the focal length of a converging lens. I.G. Priest. B.S. Sci. Pap., <u>5</u> , 483 (1908-09) 15 pp.
S122	OP	Resolving power of objectives. P.G. Nutting. BS. Sci. Pap., <u>6</u> , 121 (1909-10) 5 pp. 1 illus.
S215	OP	Micrometer microscopes. A.W. Gray. BS Sci. Pap., <u>10</u> , 375 (1914) 16 pp. 3 illus.
S311	OP	Axial aberrations of lenses. E.D. Tillyer and H.I. Schultz. BS Sci. Pap., <u>14</u> , 341 (1918-19) 29 pp. 27 illus.
S333	OP	Optical conditions accompanying the striae which appear as imperfections in optical glass. A.A. Michelson. BS Sci. Pap., <u>15</u> , 41 (1919-20) 5 pp. 4 illus.
S358	OP	Concerning the annealing and characteristics of glass. A.Q. Tool and J. Valasek. BS Sci. Pap., <u>15</u> , 537 (1919-20) 35 pp. 10 illus.

<u>Series</u>	<u>Price</u>	
S373	5c.	Characteristics of striae in optical glass. T.T. Smith, A.H. Bennett, and G.E. Merritt. B.S. Sci. Pap., <u>16</u> , 75 (1920) 18 pp. 19 illus.
S393	10c.	Measurements of thermal dilation of glass at high temperatures. BS Sci. Pap., <u>16</u> , 449 (1920) 39 pp. 21 illus. C.G. Peters and C.H. Cragoe.
S461	OP	Spherical aberration of thin lenses. T.T. Smith. BS Sci. Pap., <u>18</u> , 559 (1922-23) 26 pp. 15 illus.
S485	5c.	Application of the interferometer to measurements of the thermal dilation of ceramic materials. G.E. Merritt. BS Sci. Pap., <u>19</u> , 357 (1923-24) 17 pp. 14 illus.
S494	OP	Aberrations of long focus anastigmatic photographic lenses. A.H. Bennett. BS Sci. Pap., <u>19</u> , 587 (1923-24) 54 pp. 52 illus.
S521	10c.	Measurements of the index of refraction of glass at high temperatures. C.G. Peters. BS Sci. Pap., <u>20</u> , (1924-26) 25 pp. 14 illus.
S550	OP	Application of the algebraic aberration equations to optical design. I.C. Gardner. BS Sci. Pap., <u>22</u> , 73 (1927-28) 131 pp. 55 illus.
S572	10c.	Cause and removal of certain heterogeneities in glass. L.W. Tilton, A.N. Finn, and A.Q. Tool. BS Sci. Pap., <u>22</u> , 719 (1927-28) 18 pp. 11 illus.
RP52	10c.	Interference method for the determination of axial and oblique aberrations. A.H. Bennett. BS J. Research, <u>2</u> , 685 (1929) 18 pp. 11 illus.
RP64	10c.	Prism refractometry and certain goniometrical requirements for precision. L.W. Tilton. BS J. Research, <u>2</u> , 909 (1929) 22 pp. 2 illus.
RP71	5c.	Determination of the source and means of prevention of striae in glass. H. Insley. BS J. Research, <u>2</u> , 1077 (1929) 8 pp. 9 illus.
RP97	10c.	Making the glass disk for a 70-inch telescope reflector. A.N. Finn. BS J. Research, <u>3</u> , 315 (1929) 15 pp. 9 illus.

<u>Series</u>	<u>Price</u>	
RP102	10c.	Representation of aberration diffraction effects by means of rotating sectors. A. H. Bennett. BS J. Research, <u>3</u> , 391 (1929) 8pp. 4 illus.
RP112	5c.	Optical heterogeneity of a fused quartz disk. L. W. Tilton and A. Q. Tool. BS J. Research, <u>3</u> , 619 (1929) 10pp. 2 illus.
RP219	10c.	Dimensional changes caused in glass by heating cycles. A. Q. Tool, D. B. Lloyd, and G. E. Merritt. BS J. Research, <u>5</u> , 627 (1930) 20pp 7 illus.
RP262	10c.	Prism size and orientation in minimum deviation refractometry. L. W. Tilton. BS J. Research, <u>6</u> , 59 (1931) 18 pp. 6 illus.
RP272	10c.	Optical coincidence gage. I. C. Gardner and F. A. Case. BS J. Research, <u>6</u> , 229 (1931) 9pp. 6 illus.
RP292	10c.	Variations caused in heating curves of glass by heat treatment. A. Q. Tool and C. G. Eichlin. BS J. Research, <u>6</u> , 523 (1931) 30pp. 11 illus.
RP316	5c.	Lateral chromatic aberration of apochromatic microscope systems. I. C. Gardner and F. A. Case. BS J. Research, <u>6</u> , 937 (1931) 10pp. 3 illus.
RP320	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, <u>6</u> , 993 (1931) 10pp. 3 illus.
RP345	10c.	Restoration of solarized ultra-violet transmitting glasses by heat treatment. A. Q. Tool and R. Stair. BS J. Research, <u>7</u> , 357 (1931) 18pp. 5 illus.
RP427	5c.	Optical requirements of airplane mapping. I. C. Gardner. BS J. Research, <u>8</u> , 445 (1932) 11pp. 5 illus.
RP466	5c.	Reciprocal spherical aberration of an optical system including higher orders. Harold F. Bennett. BS J. Research, <u>9</u> , 187 (1932) 39pp. 11 illus.
RP467	5c.	Attachment for turning approximately spherical surfaces of small curvature on a lathe. I. C. Gardner. BS J. Research, <u>9</u> , 227 (1932) 11 pp. 2 illus.



<u>Series</u>	<u>Price</u>	
RP575	5c.	Permissible curvature of prism surfaces and inaccuracy of collimation in precise minimum-deviation refractometry. L.W. Tilton. BS J. Research, <u>11</u> , 25 (1933) 33 pp. 9 illus.
RP577	5c.	Viscosity of optical glass. W.H. Wadleigh. BS J. Research, <u>11</u> , 65 (1933) 14 pp. 6 illus.
RP626	5c.	Effect of heat treatment on the expansivity of a pyrex glass. J.B. Saunders and A. Q. Tool. BS J. Research, <u>11</u> , 799 (1933) 12 pp. 1 illus.
RP667	5c.	Thermal expansions of some soda-lime-silica glasses as functions of the composition. B.C. Schmid, A.N. Finn, and J.C. Young. BS J. Research, <u>12</u> , 421 (1934) 8 pp. 3 illus.
RP695	5c.	Variations in refractive index of CO <sub>2</sub> -free air and a statistical correlation with solar activity. L.W. Tilton. J. Research NBS <u>13</u> , 111 (1934) 14 pp. 2 illus.
RP703	5c.	Refractive index and dispersion of normal and heavy water. L.W. Tilton and J.K. Taylor. J. Research NBS <u>13</u> , 207 (1934) 3 pp.
RP762	5c.	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 <u>14</u> , 133 (1935) 5 pp. 4 illus.
RP776	5c.	Standard conditions for precise prism refractometry. L.W. Tilton. J. Research NBS <u>14</u> , 393 (1935) 26 pp. 1 illus.
RP919	5c.	Thermal control in minimum-deviation refractometry and temperature coefficients for a medium flint glass. L.W. Tilton. J. Research NBS <u>17</u> , 389 (1936) 12 pp. 5 illus.

<u>Series</u>	<u>Price</u>	
RP934	5c.	Accurate representation of refractive index of distilled water as a function of wavelength. L.W. Tilton. J. Research NBS <u>17</u> , 639 (1936) 12 pp. 2 illus.
RP971	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 <u>18</u> , 205 (1937) 10 pp. 2 illus.
RP984	5c.	Precision camera for testing lenses. Irvine C. Gardner and Frank A. Case. J. Research NBS <u>18</u> , 449 (1937) 12 pp. 8 illus.
RP986	5c	"Camera Finish" at the race track. Irvine C. Gardner. J. Research NBS <u>18</u> , 467 (1937) 8 pp. 3 illus.
RP1003	10c.	Compressibility of fused-quartz glass at atmospheric pressure. W.B. Emerson. J. Research NBS <u>18</u> , 683 (1937) 30 pp. 5 illus.
RP1014	5c.	Gases in some optical and other glasses. C. Hahner, G.Q. Voigt and A.N. Finn. J. Research NBS <u>19</u> , 95 (1937) 10 pp. 2 illus.
RP1085	15c.	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 <u>20</u> , 419 (1938) 59 pp. 19 illus.
RP1177	10c.	Relation of camera error to photogrammetric mapping. I. C. Gardner. J. Research NBS <u>22</u> , 209 (1939) 30 pp. 6 illus.
RP1187	5c.	Effect of the solubility of glass on the behavior of the glass electrode. D. Hubbard, E.H. Hamilton and A.N. Finn. J. Research NBS <u>22</u> , 339 (1939) 12 pp. 7 illus.

<u>Series</u>	<u>Price</u>	
RP1197	5c.	Density of some soda-potash-silica glasses as a function of the composition. J.C. Young, F.W. Glaze, C.A. Faick and A.N. Finn J. Research NBS <u>22</u> , 453 (1939) 12 pp. 5 illus.
RP1216	5c.	Resolving power and distortion of typical airplane-camera lenses. F.E. Washer. J. Research NBS <u>22</u> , 729 (1939) 18 pp. 4 illus.



IV. PUBLICATIONS IN NON-GOVERNMENT PERIODICALS

Compound lens systems. T. Townsend Smith.  
J. Opt. Soc. Am.  
1. No. 4, 113 (1917)

A qualitative determination of the reflection coefficients  
of some metals. in the Schumann region. I. C. Gardner.  
Astro.-Phys. J. 45, No. 1, 30 (1917).  
Sci. Am. Suppl., 84, No. 2174, 140 (1917).

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

Apparatus for the testing of binocular telescopes  
T. Townsend Smith  
J. Opt. Soc. Am. 2, 3, Nos. 3-6.  
76-90 (1919).

The cemented telescope objective of barium crown and  
flint. I. C. Gardner.  
J. Opt. Soc. Am., 4, No. 5, 275 (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).

Certain effects produced by chilling glass A.Q. Tool.  
J. Opt. Soc. Am. and Rev. Sci. Insts.,  
8, 479 (1924).

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

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)

Variations in glass caused by heat treatment. A. Q. Tool.  
J. Am. Ceramic Soc. 8, 1 (January 1925).

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).

A modified Hartmann test based on interference. I. C. Gardner.

J. Opt. Soc. Am. and Rev. Sci. Insts.,  
11, No. 4, 441, (1926).

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).

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).

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).

Photographing the bore of a rifle. I. C. Gardner.

The Military Engineer, 18, 480 (1926).

Making a standard of planeness. C. A. Skinner.

General Electric Rev.  
29 No. 8, 528, (August 1926).

Optical methods for testing compressed gas containers. I. C. Gardner.

Fourteenth Ann. Rep., Compressed Gas  
Manufacturers' Assn. Inc., 24 (Jan. 1927).

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).

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 fur Instrumentenkunde. 4, No. 47,  
197, (1927).

Some effects of carefully annealing optical glass.  
L.W. Tilton, A.N. Finn, and A.Q. Tool.  
J. Am. Ceramic Soc., 11, No. 5, 292 (1928)

Variations in the optical density of glass.  
L.W. Tilton.  
J. Wash. Acad. Sci., 20, No. 1, 12 (1930).

An optical coincidence gage.  
I.C. Gardner.  
Am. Machinist 74, No. 4, 155 (1931).

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

Sunspot number and the refractivity of dry air.  
L.W. Tilton.  
Nature (London), 132, p. 855 (1933).

The interpretation and uses of lens tests and camera  
calibrations.  
Irvine C. Gardner.  
Photogrammetric Engineering 3, No. 1, 12 (1937).

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

Specifications for a precision mapping camera.  
Irvine C. Gardner.  
Photogrammetric Engineering 4, No. 3, 173 (1939).

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

