DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS

S. W. STRATTON, Director

SUPPLEMENT NO. 4 TO CIRCULAR NO. 24: PUBLICATIONS OF THE BUREAU OF STANDARDS

September 1, 1920

This supplement is designed to keep reasonably current the more important facts concerning the Bureau's publications. It is planned that the list of publications (Circular 24) will be revised biennially, and a supplement containing information of the character listed herein will be issued quarterly.

The initial letters preceding the numbers indicate the special series; i. e., S for Scientific Papers, T for Technologic Papers, C for Circulars, M for Miscellaneous Publications. In referring to publications the series initial and number give complete identification.

PUBLICATIONS NOT AVAILABLE

The publications listed below are not available for distribution by the Bureau of Standards, nor for sale by the Superintendent of Documents, but they may be consulted at any of the designated Government libraries listed in this supplement, pages 18–21.

Some of these may be purchased from the Supt. of Documents (see list on p. 2)

Scientific papers				Technologic papers		Circulars		Miscellaneous	
S1	S64	S129	S190	T1	T56	C1	C42	M1	M25
S2	S65	S130	S191	T2	T57	C2	C43	M10	M29
S3	S66	S133	S197	T3	T59	C4	C45	M11	M30
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S24	S88	S147	S226	T29	T87	C39	C83		
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S30	S94	S152	S238	T38	T100				
S31	S95	S153	S243	T39	T116				
S33	S96	S156	S248	T43	T132				
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PUBLICATIONS OBTAINABLE ONLY BY PURCHASE FROM THE SUPERINTENDENT OF DOCUMENTS

The publications listed below may be procured only by purchase from the Superintendent of Documents, Government Printing Office, Washington, D. C., and all orders should be accompanied by money order or cash (stamps and checks are not acceptable).

Scientific papers	Technologic papers	Circulars	Miscellaneous
S1 S86 S152 S210	T7 T60	C23 C63	M1 M11
S6 S88 S153 S211	T16 T66	C37 C74	M10
S9 S92 S156 S212	T21 T67	C43 C78	
S14 S99 S157 S216	T22 T71	C54 C79	
S18 S101 S158 S221	T25 T73	C55 C80	
S20 S102 S159 S222	T29 T76	C56 C83	
S24 S105 S161 S226	T33 T79	C61	
S25 S106 S163 S232	T38 T85		
S30 S109 S164 S233	T39 T86		
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S35 S116 S166 S238	T44 T88		
S40 S125 S168 S248	T48 T96		
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S42 S130 S172 S257	T56 T116		
S46 S134 S175 S264	T57 T132		
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GENERAL INFORMATION

The large number of requests for Bureau of Standards publications precludes the sending of personal replies in each case. The request is returned with a form letter to notify the writer that the publications requested will be forwarded, if available.

1. *Free Distribution.*—Free distribution is limited to one copy of any publication dealing with an individual's specialty. Additional copies may be purchased (see paragraph 4). This does not mean that any person will be furnished with copies of all papers on a general subject such as electricity, but only those dealing with his special branch of such general subject. This applies to all general subjects. Orders should be sent in accordance with paragraph 3.

2. *Designations of Publications.*—Four series are issued, under distinctive titles, as follows: Scientific Papers, Technologic Papers, Circulars, and Miscellaneous Publications, and the issues in each series are numbered consecutively. The Scientific Papers were originally entitled "Reprints," but this title should not now be used. Bulletins (comprising 6 to 8 numbers of the Scientific Papers bound under one cover) are to be obtained by purchase only (see paragraph 4) and only for issues for volume 14 and prior issues.

3. *Ordering and Delivery of Publications.*—Order by group name and number, in addition to title, thus assisting in the prompt filling of your order. Deliveries require from 1 to 2 weeks' time, as stocks are maintained by the Superintendent of Documents and forwarded only by him, as provided by law, on orders drawn by the various Government offices.

4. *Ordering of Sales Copies.*—Orders for the purchase of any Government publication should be addressed *direct* to the Superintendent of Documents, Government Printing Office, Washington, D. C., and *not* to the office issuing same. Orders should be accompanied by cash or money-order remittance.

5. *Mailing List.*—A mailing list covering *announcement of issues* of new publications, but not providing for forwarding of copies, is maintained by this Bureau.

PUBLICATIONS ISSUED SINCE PUBLICATION OF CIRCULAR 24

1. [The following-named new papers were described in Supplement No. 3, issued January 1, 1920:]

S339. Standardization of the Sulphur Boiling Point...*E. F. Mueller and H. A. Burgess*
Oct. 4, 1919. 22 pp. Price, 5 cents.

S340. A Standardized Method for the Determination of Solidification Points, Especially of Naphthalene and Paraffin....*R. M. Wilhelm and J. L. Finkelstein*
Sept. 12, 1919. 13 pp. Price, 5 cents.

S341. Airplane Antenna Constants.....*J. M. Cork*
Sept. 17, 1919. 15 pp. Price, 5 cents.

S342. Reflecting Power of Stellite and Lacquered Silver.
W. W. Coblentz and H. Kahler
Sept. 11, 1919. 3 pp. Price, 5 cents.

S343. Location of Flaws in Rifle-Barrel Steel by Magnetic Analysis.
R. L. Sanford and Wm. B. Kouwenhoven
Oct. 3, 1919. 12 pp. Price, 5 cents.

S344. Spectral Photoelectric Sensitivity of Silver Sulphide and Several Other Substances.....*W. W. Coblentz and H. Kahler*
Sept. 19, 1919. 19 pp. Price, 5 cents.

S345. Measurements of Wave Lengths in the Spectra of Krypton and Xenon.
Paul W. Merrill
Oct. 3, 1919. 8 pp. Price, 5 cents.

S346. Oxygen Content by the Ledebur Method of Acid Bessemer Steels Deoxidized in Various Ways.....*J. R. Cain and Earl Pettijohn*
Nov. 11, 1919. 12 pp. Price, 5 cents.

S347. The Heat Treatment of Duralumin.
P. D. Merica, R. G. Waltenberg, and H. Scott
Nov. 15, 1919. 46 pp. Price, 10 cents.

S348. Use of a Modified Rosenhain Furnace for Thermal Analysis.
H. Scott and J. R. Freeman
Oct. 24, 1919. 7 pp. Price, 5 cents.

S349. Photoelectric Spectrophotometry by the Null Method.....*K. S. Gibson*
Oct. 11, 1919. 28 pp. Price, 5 cents.

S350. Equilibrium Conditions in the System Carbon, Iron Oxide, and Hydrogen in Relation to the Ledebur Method for Determining Oxygen in Steel.
J. R. Cain
Nov. 10, 1919. 14 pp. Price, 5 cents.

S351. Dependence of the Input Impedence of a Three-Electrode Vacuum Tube upon the Load in the Plate Circuit.....*John M. Miller*
Nov. 21, 1919. 19 pp. Price, 5 cents.

S352. Thermal Expansion of Insulating Materials.
Wilmer H. Souder and Peter Hidnert
Dec. 27, 1919. 30 pp. Price, 10 cents.

S353. Variation in Direction of Propagation of Long Electromagnetic Waves.
Lt. A. Hoyt Taylor
Nov. 29, 1919. 15 pp. Price, 5 cents.

S354. Principles of Radio Transmission and Reception with Antenna and Coil Aerials.
J. H. Dellinger
Dec. 11, 1919. 60 pp. Price, 10 cents.

S355. The Determination of the Output Characteristics of Electron Tube Generators.
Lewis M. Hull
Dec. 1, 1919. 21 pp. Price, 5 cents.

S356. Notes on the Microstructure of Iron and Mild Steel at High Temperatures.
Henry S. Rawdon and Howard Scott
Mar. 15, 1920. 10 pp. Price, 10 cents.

S357. Constants of Radiation of a Uniformly Heated Inclosure.....*W. W. Coblentz*
Jan. 16, 1920. 7 pp. Price, 5 cents.

S358. Concerning the Annealing and Characteristics of Glass.
A. Q. Tool and J. Valasek
Jan. 31, 1920. 35 pp. Price, 10 cents.

S359. Efflux of Gases through Small Orifices.
Edgar Buckingham and Junius David Edwards
Jan. 28, 1920. 42 pp. Price, 10 cents.

T127. Leakage Resistance of Street-Railway Roadbeds and Its Relation to Electrolysis of Underground Structures.....*E. R. Shepard*
Oct. 6, 1919. 39 pp. Price, 10 cents.

T130. A Comparison of the Heat-Insulating Properties of Some of the Materials Used in Fire-Resistive Construction.....*Walter A. Hull*
Nov. 12, 1919. 40 pp. Price, 10 cents.

T131. Application of the Interferometer to Gas Analysis.....*Junius David Edwards*
Oct. 6, 1919. 19 pp. Price, 5 cents.

T132. Mechanical Properties and Resistance to Corrosion of Rolled Light Alloys of Aluminum and Magnesium with Copper, with Nickel, and with Manganese.....*P. D. Merica, R. G. Waltenberg, and A. N. Finn*
Oct. 25, 1919. 11 pp. Price, 5 cents.

T133. Tests of Flexible Gas Tubing.....*R. S. McBride and Walter M. Berry*
Oct. 27, 1919. 37 pp. Price, 10 cents.

T134. Experimental-Retort Tests of Orient Coal..*R. S. McBride and I. V. Brumbaugh*
Sept. 26, 1919. 10 pp. Price, 5 cents.

T135. Behavior of Wrought Manganese Bronze Exposed to Corrosion while under Tensile Stress.....*P. D. Merica and R. W. Woodward*
Oct. 6, 1919. 9 pp. Price, 5 cents.

T137. Coking of Illinois Coal in Koppers Type Oven....*R. S. McBride and W. A. Selvig*
Nov. 17, 1919. 51 pp. Price, 10 cents.

T139. Some Tests of Light Aluminum Casting Alloys—The Effect of Heat Treatment.....*P. D. Merica and C. P. Carr*
Oct. 24, 1919. 31 pp. Price, 10 cents.

T140. Constant-Temperature Still Head for Light-Oil Fractionation.
Frederick M. Washburn
Oct. 18, 1919. 12 pp. Price, 5 cents.

T141. An Electrolytic Resistance Method for Determining Carbon.....*J. R. Cain*
Dec. 6, 1919. 21 pp. Price, 5 cents.

T142. Materials and Methods Used in the Manufacture of Enameled Cast-Iron Wares.
Homer F. Staley
Dec. 20, 1919. 158 pp. Price, 20 cents.

T143. A Study of the Deterioration of Nickel Spark-Plug Electrodes in Service.
H. S. Rawdon and A. I. Krynitzky
Jan. 22, 1920. 16 pp. Price, 10 cents.

T144. The Properties of American Bond Clays and Their Use in Graphite Crucibles and Glass Pots.....*A. V. Bleininger*
Jan. 28, 1920. 52 pp. Price, 10 cents.

T145. Direct Determination of India Rubber by the Nitrosite Method.
John B. Tuttle and Louis Yurow
Oct. 22, 1919. 16 pp. Price, 5 cents.

T146. The Cadmium Electrode for Storage Battery Testing.
H. D. Holler and J. M. Braham
Dec. 12, 1919. 15 pp. Price, 5 cents.

T147. An Apparatus for Measuring the Relative Wear of Sole Leathers, and the Results Obtained with Leather from the Different Parts of a Hide.
R. W. Hart and R. C. Bowker
Nov. 22, 1919. 10 pp. Price, 5 cents.

C80. Protective Metallic Coatings for the Rustproofing of Iron and Steel.
Oct. 4, 1919. 34 pp. Price, 10 cents.

C81. Bibliography of Scientific Literature Relating to Helium.
Sept. 10, 1919. 21 pp. Price, 5 cents.

C83. Specifications for the Manufacture and Installation of Railroad Track Scales.
Jan. 31, 1920. 35 pp. Price, 5 cents.

C84. Recommended Specifications for Basic Carbonate White Lead, Dry and Paste.
Dec. 27, 1919. 10 pp. Price, 5 cents.

M39. Household Weights and Measures.
Apr. 1, 1920. 2 pp.

M40. Annual Report of the Director of the Bureau of Standards for 1919.
July 1, 1919. 293 pp.

SCIENTIFIC PAPERS

S360. Methods for Computing and Intercomparing Radiation Data...*W. W. Coblentz*
This paper gives a simple method for computing spectral energy curves, using the Planck formula. A table of values of log $[e^u-1]$ is given. The paper gives also a chart for intercomparing thermal radiation constants with similar data obtained indirectly from photoelectric X-ray and ionization potential measurements. (Jan. 31, 1920.) 8 pp. Price, 5 cents.

S361. Magnetic Testing of Straight Rods in Intense Fields.....*W. L. Cheney*
Previous experiments on high inductions are discussed. A method which is suitable for measuring the magnetic properties of fairly long rods of ferromagnetic materials, when magnetized in intense fields, is described. Normal induction data are compared with those obtained by the Burrows method and found to agree satisfactorily within the range of the latter. From the normal induction data, the intensity of magnetization and reluctivity are calculated and discussed. (Feb. 21, 1920.) 14 pp. Price, 5 cents.

S362. Distribution of Energy in the Spectrum of an Acetylene Flame.
W. W. Coblentz
New data are given on the distribution of energy in the spectrum of a flat and of a cylindrical acetylene flame. A revision is made of the spectral energy data previously published. The optical properties of the flame are discussed, and it is shown that, owing to the high selective absorption in the visible spectrum, the apparent color temperature is higher than that obtained from consideration of the maximum emission in the infra-red. The radiometric as well as the color temperature measurements indicate that in the visible spectrum from 0.48 to 0.75 μ the spectral energy distribution of the cylindrical flame is that of a black body at 2360° K. The visibility data (Scientific Paper No. 303) remain unchanged. A table is given of the visibility of the average of 29 observers having closely normal color vision. (Feb. 12, 1920.) 13 pp. Price, 5 cents.

S363. Preparation and Reflective Properties of Some Alloys of Aluminum with Magnesium and with Zinc.
R. G. Waltenberg and W. W. Coblentz
This paper gives the manner of preparation and determination of the spectral reflective properties of alloys of aluminum with magnesium and with zinc. All of these alloys tarnish in time and hence are not suitable for mirrors where permanency is of prime importance. The compound of aluminum and magnesium, Al_3Mg_4, deteriorates less rapidly than any of the other alloys examined and could be used in apparatus where a highly reflecting mirror is desired for a short time. A reflectivity of 92 per cent at 0.7 μ was obtained with this compound. The zinc-aluminum alloy has a minimum reflectivity at 0.9 μ. An examination of the reflectivity of pure zinc disclosed a similar reflectivity minimum at 1.0 μ. (Feb. 12, 1920.) 6 pp. Price, 5 cents.

S364. Relation of Voltage of Dry Cells to Hydrogen-Ion Concentration.
H. D. Holler and L. M. Ritchie

The potentials of electrodes consisting of Acheson graphite and certain manganese ores was found to be a logarithmic function of the hydrogen-ion concentration of the solution in contact with the electrode, while that of electrodes containing a chemically prepared oxide of manganese is independent of hydrogen-ion concentration. The relation between the potential of the manganese dioxide electrode and hydrogen-ion concentration explains variations in open-circuit voltages of dry cells and accounts for a portion of the polarization of a dry cell on discharge. (Feb. 24, 1920.) 10 pp. Price, 5 cents.

S365. A New Interferential Dilatometer.....*Irwin G. Priest*

Description of a dilatometer for measuring small differential thermal or other changes in length by means of the change in width of interference fringes. The principal practical feature of the method is that the sample is one small pin easily prepared. The method gives results as accurate as the previously used standard Fizeau-Pulfrich method, while it is, in many cases, more convenient and direct and possesses several other advantages. The instrument has actually been used at the Bureau of Standards for some time in determining thermal expansion. It is thought that it would also be applicable to the measurement of small length changes due to loss of moisture, magnetization, mechanical stress, etc. (Feb. 28, 1920.) 12 pp. Price, 5 cents.

S366. Contrast Sensibility of the Eye. *Enoch Karrer and E. P. T. Tyndall*

To obtain data on the contrast sensibility of the eye under conditions similar to those encountered in searchlight illumination, laboratory experiments were performed simulating as closely as possible actual conditions. An illuminated strip was projected on a field of known brightness. The length of the strip was increased from zero to a length just visible to the observer. The results obtained are expressed by curves showing the relation between (1) strip length (visual angle) and field brightness, for constant contrast between strip and field; (2) strip length and contrast between field and strip, for constant values of field brightness. These curves lie in groups consistent with each other, and those obtained for the two observers are similar. (Mar. 8, 1920.) 16 pp. Price, 5 cents.

S367. The Turbidity Standard of Water Analysis.....*P. V. Wells*

The paper describes an investigation of the methods of measuring turbidity. The standards of turbidity used in water analysis were intercompared with a turbidimeter constructed at the Bureau, showing variations from the average of more than 50 per cent in some cases, and averaging 18 per cent. Possible means of improving the standard are suggested. (Mar. 17, 1920.) 29 pp. Price, 10 cents.

S368. Ionization and Resonance Potentials for Electrons in Vapors of Lead and Calcium.
F. L. Mohler, Paul D. Foote, and H. F. Stimson

The resonance and ionization potentials of lead are 1.26 and 7.93 volts, respectively. The line λ=10 291 gives the probable theoretical value for the former as 1.198 volts. Calcium has two resonance potentials, 1.90 volts and 2.85 volts, of which the first is most prominent. Ionization was observed at 6.01 volts. The following spectral frequencies determine these potentials:

First resonance.....	$1.5S-2p_2$,	λ=6572.78 Å, V=1.877 volts
Second resonance.....	$1.5S-2p$,	λ=4226.73 Å, V=2.918 volts
Ionization	$1.5S$,	λ=2027.56 Å, V=6.08 volts

(Feb. 26, 1920.) 16 pp. Price, 5 cents.

S369. Vapor Pressure of Ammonia.....*C. S. Cragoe, C. H. Meyers, and C. S. Taylor*

Previous measurements are briefly reviewed, tabulated, and compared with authors' results. Methods of purification of the ammonia are briefly described. A detailed description is given of the apparatus and procedure employed in the measurements by the static method from $-78°$ to $+70°$ C. The phenomenon of hysteresis was observed near the normal boiling point with a commercial sample containing air. Lags in coming to equilibrium were encountered and studied. The normal boiling point was determined by the static and dynamic methods as $-33.35°$ C. Two empirical equations represent closely the results and also the latest critical data. One hundred twenty-two measurements from $-78°$ to $+25°$ C made with direct observation of mercury columns agree with the equations within 1 mm of mercury. Twenty-eight measurements from $+15°$ to $+70°$ C made with an accurately calibrated piston gage agree within 3 mm of mercury. (Apr. 10, 1920.) 42 pp. Price, 10 cents.

S370. A New Form of Vibration Galvanometer.....*P. G. Agnew*

Vibration galvanometers are very useful in null measurements, but have not been much used in industrial laboratories on account of their being sensitive to external vibrations and requiring delicate adjustments. The present instrument, which has a sensitivity higher than other forms of the moving-iron type, but less than that of the most sensitive forms of the moving-coil type, has the advantages of sturdiness, quick responsiveness, and freedom from the effects of external vibration. It consists essentially of a fine steel wire mounted on one pole of a permanent magnet, and so arranged that the free end of the wire may vibrate between the poles of an electromagnet through which the current to be detected passes. (Mar. 12, 1920.) 10 pp. Price, 5 cents.

S371. A New Cadmium Vapor Arc Lamp.....*Frederick Bates*

A new method for producing a cadmium vapor arc of great brilliancy has been discovered. It was found that the metal gallium alloyed with cadmium. Since gallium has a boiling point above 1500° C, the vapor pressure relation which exists between cadmium and mercury is reversed when compared with cadmium and gallium. The cadmium therefore acts as the energy carrier when used in combination with gallium in a quartz lamp. (Apr. 10, 1920.) 8 pp. Price, 5 cents.

S372. Wave Lengths Longer than 5500 A in the Arc Spectra of Seven Elements.
C. C. Kiess and W. F. Meggers

The yellow, red, and infra-red regions of the arc spectra of titanium, vanadium, chromium, manganese, molybednum, tungsten, and uranium were photographed with a large concave grating spectrograph. The photographs were made on plates sensitized to these spectral regions by means of pinacyanol and dicyanin dyes. The wave lengths of more than 2500 spectal lines were measured extending from the green at 5500 A into the infra-red beyond 9700 A. So far as known, impurity lines and spurious lines have been eliminated from the wavelength tables. Frequency differences which are suspected of being constant have been found in each of the spectra. (May 7, 1920.) 26 pp. Price, 5 cents.

S373. Characteristics of Striae in Optical Glass.
T. T. Smith, A. H. Bennett, and G. E. Merritt

Striae are imperfections in optical glass which are revealed by and cause consequent damage because of their refractive index being slightly different from the surrounding glass. Various methods for detecting their presence are described, and photographic illustrations by a highly sensitive one are given. The comparative effects of striae on the definition given by binocular prisms, in which striae are present in different degrees, are exhibited by photographs of an artificial star taken through these prisms. The refractive indices were found to be either above or below those of the surrounding glass by about 2 in

the fourth decimal place. It is concluded that in most visual work a few striae do real damage only when in focus or nearly in focus in the field of view. (May 3, 1920.) 18 pp. Price, 5 cents.

S374. An Integration Method of Deriving the Alternating-Current Resistance and Inductance of Conductors.....*H. L. Curtis*

An integration method of deriving formulas for the alternating-current resistance and inductance of a straight cylindrical conductor by the use of both real and imaginary power series, and for a return circuit by the use of imaginary power series, together with an application to experimental results. (Apr. 7, 1920.) 32 pp. Price, 10 cents.

S375. The Double-Polarization Method for Estimation of Sucrose and the Evaluation of the Clerget Divisor.....*R. F. Jackson and Clara L. Gillis*

The velocity of inversion of sucrose as a function of temperature and concentration of hydrochloric acid has been determined and the time required for 99.99 per cent inversion has been computed. The rate of decomposition of invert sugar in the presence of acid has been measured. By using these data the value of the Clerget divisor for complete inversion and in absence of decomposition of invert sugar has been determined. The prevailing accepted value has been found to be in considerable error. Several isolated empirical values at different concentrations of acid have been correlated by a single fomula. Methods of analysis of sucrose when mixed with various classes of impurities have been suggested, and tables have been prepared for convenient operation. (Mar. 30, 1920.) 70 pp. Price, 10 cents.

S376. Critical Ranges of Some Commercial Nickel Steels.....*Howard Scott*

The thermal critical ranges of some of the industrially important nickel steels have been investigated by the method usually employed at the Bureau. It was found that the Ac_3 transformation is more sharply displayed at slower rates of temperature change, within limits, and that the end of the Ac_3 range, as interpreted, is the fundamental criterion of heat-treatment temperatures. Curves are given to show the effect of carbon on the Ac ranges of carbon steels. The effect of nickel and carbon on the end of Ac_3 is also estimated. (Apr. 6, 1920.) 20 pp. Price, 5 cents.

S377. The Intercrystalline Brittleness of Lead.....*H. S. Rawdon*

Lead sometimes assumes a brittle granular form due to corrosion. An explanation offered by previous investigators for the change is that it is due to an allotropic transformation, the product being analogous to the well-known gray-tin. Contact with a weak acid solution of a lead salt has been claimed to be the agency for promoting the change. The rate at which the brittleness is produced is proportional to the purity of the lead. Practically all impurities in lead are lodges between the grains. The preferential attack of these impurities accounts for the brittleness. Even specimens of exceptional purity (99.993 per cent) immersed in neutral lead-acetate solution developed intercrystalline brittleness. No evidence of the existence of allotropic lead analogous to gray-tin could be obtained. (Apr. 6, 1920.) 18 pp. Price, 5 cents.

S378. A New Spectropyrheliometer and Measurements of the Component Radiations from the Sun and from a Quartz Mercury Vapor Lamp.

W. W. Coblentz and H. Kahler

The spectropyrheliometer consists of a quartz spectrograph and cylindrical condensing lens, placed upon an equatorial mounting. In this manner the ultra-violet absorption in heliostat mirrors is avoided. Data are given on the relative components of infra-red visible and ultra-violet radiation from the sun, and from a quartz mercury arc lamp; also data on the gas-filled tungsten lamp, the iron arc, and the carbon arc. In two appendices methods are given for excluding ultra-violet light from buildings, and for protecting projection lantern films from the heat of the lamp. (Apr. 9, 1920.) 20 pp. Price, 5 cents.

S379. Reflecting Power of Monel Metal, Stellite, and Zinc.....*W. W. Coblentz*

Data are given on the reflecting power of monel metal, stellite, and zinc in the visible and in the infra-red spectrum. The reflectivity of monel metal is practically the same as that of nickel, except in the short wave lengths where the reflecting power is somewhat lower than that of pure nickel. A new determination of the reflectivity of stellite gave values about 1 per cent lower than previously observed in the visible spectrum. (See Scientific Paper No. 342.) The reflectivity of zinc is unique in having a deep minimum at 1μ followed by an unusually high value beyond 2μ. (June 10, 1920.) 4 pp. Price, 5 cents.

S380. The Spectrophotoelectric Sensitivity of Thalofide.....*W. W. Coblentz*

Experimental data are given on the spectrophotoelectric sensitivity of Case's preparation of thallium-oxy-sulfid, called thalofide, when exposed to thermal radiation of wave lengths extending from 0.58μ to 3μ. This substance has a wide unsymmetrical, complex band of photoelectric sensitivity which terminates abruptly at 1.2μ. The effect of temperature was investigated. It was found that, in common with nearly all photoelectric substances thus far examined, the sensitivity increases the most rapidly on the short wave-length side of the maximum. The application of this substance to stellar radiometry is discussed. (June 17, 1920.) 6 pp. Price, 5 cents.

S381. An Electron Tube Transmitter of Completely Modulated Waves. .*Lewis M. Hull*

In order to utilize a radiofrequency wave train of given power most effectively in a nonoscillating receiving system, it must be completely modulated at some suitable audio frequency. A convenient way of accomplishing this modulation, when an electron tube generator is used, is by supplying the plate circuit of the tube or tubes with an audio-frequency alternating emf. An alternator may be used with suitable transformers to supply both the filament and plate circuits. A self-contained transmitting set of this type has been designed and built at the Bureau of Standards. A description of the set, with photograph and diagrams, is given. Over-all efficiency as high as 35 per cent is obtained with set. Transmission and reception tests are described in which the waves were received by heterodyne methods and also with a crystal detector. (June 18, 1920.) 13 pp. Price, 5 cents.

S382. Notes on the Testing of Magnetic Compasses.....*R. L. Sanford*

The work of the Bureau of Standards on magnetic compasses was undertaken in response to requests for information and cooperation from the War Department of the United States Shipping Board. In the course of the investigation, certain facts concerning the general characteristics of compasses were brought out which were considered to be of interest to users of magnetic compasses. This paper gives a brief discussion of the principal performance characteristics of magnetic compasses together with a description of some of the apparatus which is used at the Bureau for testing. (June 18, 1920.) 7 pp. Price, 5 cents.

S383. Measurement of Hysteresis Values from High Magnetizing Forces. .*W. L. Cheney*

After reviewing former attempts to measure hysteresis values with apparatus of a modified isthmus type and discussing possible causes for errors in observation, an improved method for measuring hysteresis values by means of this apparatus is described. The results agree favorably, within the experimental error, with those obtained on standard types of apparatus. Observations carried as high as $H=2500$ gausses are shown graphically. (June 19, 1920.) 9 pp. Price, 5 cents.

S384. Variation of Residual Induction and Coercive Force with Magnetizing Force.
R. L. Sanford and W. L. Cheney

This paper is a report of an investigation to ascertain whether or not analytical expressions similar to the reluctivity relationship of Kennelly correctly repre-

sent the variation of residual induction and coercive force with the maximum magnetizing force. Hysteresis measurements were made on a number of samples covering a wide range of materials using magnetizing forces up to 2500 gausses. The relationships

$$H_m/B_r = a_1 + b_1 H_m$$
$$H_m/H_c = a_2 + b_2 H.$$

were found to hold within the limits of the probable experimental error. (June 23, 1920.) 8 pp. Price, 5 cents.

S385. A New Microphotometer for Photographic Densities.

W. F. Meggers and P. D. Foote

The micropyrometer described by Burgess (B. S. Bulletin, **9**, p. 475; 1913) was modified and calibrated so that ammeter readings of the current through the pyrometer lamp, when matched to equal brightness with a portion of an illuminated photographic plate, were readily converted to values of photographic density. Illustrations are given of the use of this instrument for measurements of densities in spectral lines and for speed and color sensitivity measurements of photographic plates. (June 30, 1920.) 10 pp. Price, 5 cents.

S386. Atomic Theory and Low-Voltage Arcs in Caesium Vapor.

P. D. Foote and W. F. Meggers

An extension of Bohr's theory of atomic structure is developed and applied to such phenomena as the operation of arcs below the ionization potential, fluoresence of alkali vapors, single-line, single-series and group-line spectra. The caesium arc was photographed at various voltages and from λ 3878 to λ 9208. The plate characteristics were determined, and all lines of the spectrum were reduced to a true intensity scale. The existence of a single-line spectrum was shown for voltages less than the ionization potential. As the accelerating voltage is increased above the ionization potential the energy of radiation of frequency 1.5 $s-2p_{12}$ is sacrificed for that of the complete line spectrum—a fact which affords a strong argument for Bohr's theory. The ratio of intensity of the components of the first doublet of the principal series is 1.5 independent of the exciting voltage. Further conclusions are drawn for sodium and potassium. Only two types of inelastic atomic-electronic collision occur in vapors of the alkali metals. (July 7, 1920.) 17 pp. Price, 5 cents.

S387. Permeability of Rubber to Gases.....*J. D. Edwards and S. F. Pickering*

This paper gives the major details of an extended investigation of the factors governing the permeability of rubber to gases. The permeability of rubber to a number of the more common gases and vapors has been determined. (July 12, 1920.) 36 pp. Price, 10 cents.

S388. Adjustment of Parabolic and Linear Curves to Observations Taken at Equal Intervals of the Independent Variable.....*H. M. Roeser*

Least squares reductions of observations that follow a parabolic or linear law taken at equal intervals of the independent variable frequently occur in physics and engineering practice. Makeshift devices are often employed to evade the arithmetical work of determining the constants of curves which properly represent such data. In this paper the ordinary least squares formulas are subjected to mathematical treatment and rigorous solutions are evolved which require an ultimate minimum of arithmetical work. A table is furnished from which a large portion of the solutions can be written down from inspection of the observations. Application of the solutions is made to typical problems, and an absolute check with the regular least squares solutions is shown. (July 21, 1920.) 13 pp. Price, 5 cents.

S389. Relative Spectral Transmission of the Atmosphere.

E. Karrer and E. P. T. Tyndall

As part of the searchlight investigation of the Bureau some data have been taken on the relative spectral transmission of the atmosphere. Light from an incandescent lamp was reflected by a mirror 600 m distant, and the intensity of this reflected light was compared by means of a spectrophotometer with the intensity of a beam directly from the lamp. Curves are given for three types of weather conditions: (1) Clear and cold; (2) overcast and high humidity; and (3) rainy. The first type shows very little selectivity. The second and third types are similar for wave lengths less than 540 μ, there being a decrease in transmission for shorter wave lengths. In the rest of the visible spectrum the curves of the second type present two maxima and a minimum, which are entirely lacking in the curves for rainy weather. The conclusion drawn from these curves is that the transmission of the atmosphere under the conditions prevailing during the experiments is greatest in the yellow and orange regions of the spectrum. (July 21, 1920.) 32 pp. Price, 10 cents.

S390. The Two Common Failures of the Clark Standard Cell.

E. C. McKelvy and M. P. Shoemaker

The causes and effects of the cracking of Clark cells at the amalgam terminal and the formation of gas in the amalgam limb are discussed, as are also the methods employed by the authors and others in an attempt to eliminate these defects. It is shown that the cracking of the cell can best be prevented by the very simple expedient of using a cell blank in which platinum wire previously subjected to the action of zinc amalgam is employed as the negative terminal, also that the effects of gas formation can be minimized through the employment of the smallest excess of crystals required to insure saturation at the highest temperature at which the cell is to be used. (July 21, 1920.) 20 pp. Price, 5 cents.

S391. The Measurement of Diffuse Reflection Factors, and a New Absolute Reflectometer.....*A. H. Taylor*

The paper discusses the nature of reflection and describes the various methods which have been used to measure reflection factors. The complete theory and description of a new absolute reflectometer are presented. Thorough tests of the instrument show that it gives correct results. Five absolute methods of determining reflection factors are described, and experimental results with this instrument and two other methods show excellent agreement. The reflection factor of a block of magnesium carbonate was found to be 99 per cent, whereas the previously accepted value was 88 per cent. The reflectometer is portable, and can be used to measure reflection factors of surfaces in situ. (July 28, 1920.) 16 pp. Price, 5 cents.

S392. A Photographic Method of Detecting Changes in a Complicated Group of Objects.....*M. H. Stillman*

The method consists of the following procedure: Two negatives of the group of objects are made; one before the expected change, the other afterwards. A positive is printed from one of the negatives, is superposed in register upon the other negative, and the combination viewed against a light source. Portions of the combination corresponding to unchanged portions of subject will be of nearly uniform opacity, while changes will be revealed by marked variations in opacity. Factors of importance in the successfu lapplication of the method are discussed. Some useful applications of the method are suggested. (July 31, 1920.) 12 pp. Price, 5 cents.

S393. Measurements of Thermal Dilatation of Glass at High Temperatures.
C. G. Peters and C. H. Cragoe

The thermal dilatation of 32 different kinds of glass of known compositions was determined by the Fizeau interference method. Observations were made in the temperature region between 20° and 650° C. The dimensional changes are represented by curves which show that the glass passes through a critical expansion region in which the expansion rate increases by two to seven times. This critical region which does not exceed 40° was found as low as 400° with one glass and as high as 575° with another. About 75° above the critical region the glass softens and contracts. (August 20, 1920.) 39 pp. Price, 10 cents.

TECHNOLOGIC PAPERS

T148. The Ultra-Violet and Visible Transmission of Various Colored Glasses.
K. S. Gibson, E. P. T. Tyndall, and H. J. McNicholas

Spectral transmission curves for 87 samples of glass, representing over 50 different kinds, mostly colored, are given in this paper. These curves extend from 710 mμ throughout the visible and ultra-violet as far as the specimens show any appreciable transmission. Most of these glasses are of American manufacture, but a comparison is afforded with some samples of Jena glass obtained before the war. Various practical uses to which these glasses are put are indicated, such as ultra-violet signaling, railway signaling, improvement of visibility both for visual and photographic work, protection of the eyes, and selective ray filters. Of special value is their use as filters to obtain monochromatic light from the mercury, helium, or hydrogen lamps. (Mar. 19, 1920.) 27 pp. Price, 10 cents.

T149. Estimation of Nitrates and Nitrites in Battery Acid.....*L. B. Sefton*

Three methods for the determination of nitrates—the diphenylamine, the "hydrostrychnique," and the brucine—were studied with reference to their use in testing battery acid. It was found that nitrates in dilute acid could not be estimated in the presence of nitrites, but that by means of either the hydro strychnique or brucine method, nitrates and nitrites could be estimated together. In the absence of iron, either the hydrostrychnique or the modification of the brucine method is recommended for the determination of nitrates and nitrites. In the presence of iron, the original brucine method alone is applicable. The dimethylaniline test was found to be best for the determination of nitrates. (Feb. 24, 1920.) 10 pp. Price, 5 cents.

T150. Physical Tests of Motor-Truck Wheels.....*Charles P. Hoffmann*

In designing class B military truck, it was found desirable to develop a metal wheel having the good qualities of all the wheels on the market. No comparative values were available, however, and there was no time for service tests. The Bureau of Standards was therefore called upon to make laboratory tests. From these data a cast-steel wheel known as the Composite wheel was designed. Tests showed it to be satisfactory in its final form and it was adopted by the Quartermaster's Department. (Mar. 17, 1920.) 61 pp. Price, 15 cents.

T151. Load Strain-Gage Test of 150-Ton Floating Crane for the Bureau of Yards and Docks, U. S. Navy Department..*Louis J. Larson and Richard L. Templin*

The fact that a floating crane failed under load on the Panama Canal made it desirable to test a 150-ton revolving floating crane built for use at the navy yard, Norfolk, Va. This structure is statically indeterminate and strain-gage measurements were taken under load to determine the stress in the more important members. It was found that the stresses in the deck were low. The maximum stresses in the outer edge of the tower legs are 17 000 compression and 13 500 pounds per square inch tension. The maximum stress in the pintle post is 18 000 pounds per square inch compression. The stresses in the superstructure and in the luffing screws due to the load are not excessive. (Mar. 18, 1920.) 34 pp. Price, 10 cents.

T152. Investigation of the Compressive Strength of Spruce Struts of Rectangular Cross Section and the Derivation of Formulas Suitable for Use in Airplane Design.....*J. E. Boyd*

The experimental work was confined to spruce struts of approximately square cross section. The ratio of $\frac{l}{r}$ varied from 25 to 250. The amount of compression and of deflection under compressive loading was observed for each specimen. About 60 square-end and 25 round-end struts were tested and formulas deduced which gave results agreeing with the experimental values. These formulas apply to struts of any cross section provided it is of uniform section throughout its length. By a careful mathematical analysis a generalization of Euler's formula is obtained, applicable to a type of tapered struts which approximates the tapers used in airplane wing struts. Because of its rational basis, this formula should give reliable values for these important members of the airplane wing structure. (Apr. 10, 1920.) 43 pp. Price, 10 cents.

T153. Area Measurement of Leather.....*Frederick J. Schlink*

This paper deals with the investigation of area-measuring machines used for integrating the area of leather hides and skins. The importance of the problem of area measurement in view of the enormous amount and value of leather handled annually on this basis is indicated. The principles of design involved in typical machines are set forth in detail and an analysis is made of the sources of the serious errors which commonly exist and of the means available for detecting and correcting them, including a complete outline of procedure for the determination of the performance of the machine tested, with regard to both the accuracy and consistency of its determinations. Numerical data illustrative of the various errors and performance characteristics of typical measuring machines are tabulated in detail. (Apr. 24, 1920.) 47 pp. Price, 10 cents.

T154. Determination of Cellulose in Rubber Goods....*S. W. Epstein and R. L. Moore*

A method is presented which is readily applicable to the determination of fabric in rubber sheeting, raincoat materials, waterproofed fabrics, spread goods, frictioned and calendered fabrics in general. The results which are obtained by this method have been found to be accurate by analysis of known compounds. The method is shown to be useful in the detection and determination of cellulose in reclaims. The determination and detection of leather, wood, jute, and cork in rubber mixings is also considered. (Feb. 20, 1920.) 16 pp. Price, 5 cents.

T155. Cements for Spark-Plug Electrodes.....*Homer F. Staley*

The use of cements for sealing electrodes into spark-plug porcelain has been found to be attended by serious difficulties in high-temperature engines such as airplanes. Among these are: promotion of oxidation and destruction of the electrode wires by reactions taking place in the cement and between the cement and electrode wires; breaking of spark-plug porcelains caused by difference in coefficients of thermal expansion of electrode wires and porcelain; and cracking of cement, with consequent gas leakage, due to the same cause. A cement composed of silicate of soda and raw kaolin has been found to give little trouble from chemical action. In order to avoid the difficulties attending the use of any form of cement, the use of a mechanical seal at the top of the porcelain has been tried with promising results. (Feb. 21, 1920.) 10 pp. Price, 5 cents.

T156. Metallographic Features Revealed by the Deep Etching of Steel.
H. S. Rawdon and Samuel Epstein

Deep etching of steel by concentrated acids may reveal three different structural conditions—chemical heterogeneity (segregation), mechanical nonuniformity (initial stresses), and physical discontinuities within the metal. A marked roughening of the surface indicating chemical heterogeneity is due to the greater solubility of the impurities and the widening and deepening of the resultant

pits. Hardened steel balls, highly stressed as a result of the treatment received, will often spontaneously split when deeply etched. Physical discontinuities may exist within the steel, such as internal fractures in steel rails. The metal is in such intimate contact that the defects can not be located by ordinary means. They may be located by magnetizing the polished specimen and then bathing it in a suspension of fine iron dust in kerosene. Subsequent deep etching serves to widen and deepen these preexisting defects. (Mar. 19, 1920.) 24 pp. Price, 10 cents.

T157. An Investigation of the Physical Properties of Dental Materials.
Wilmer H. Souder and Chauncey G. Peters

The Surgeon-General of the Army asked the Bureau's assistance in selecting proper dental amalgam. The properties of dental materials and tooth structures were investigated in this research. This paper includes a review of the instruments and tests applied by early investigators, and gives description of more suitable apparatus together with results obtained therefrom. Comparative tests on crushing, strength, flow, thermal and chemical expansion, chemical composition, electrode potentials, etc., are included. (May 22, 1920.) 40 pp. Price, 10 cents.

T158. A Peculiar Type of Intercrystalline Brittleness of Copper.
Henry S. Rawdon and S. C. Langdon

A copper rod used as cathode in a bath of molten sodium chloride, mild steel being the anode, with an emf of approximately 6 volts was embrittled to a very appreciable extent. No embrittlement occurred when the copper was the anode of a similar set-up. The change of microstructure which occurred in the first case suggests that metallic sodium is formed by electrolysis, which alloys with the copper along the boundaries of the crystals and so induces the brittleness observed. The results throw some light upon brittleness of copper wire and rods which sometimes occurs in commercial practice in the annealing in a bath of fused salt if the copper is in contact with iron or a similar metal. (Apr. 10, 1920.) 5 pp. Price, 5 cents.

T159. Porosity and Volume Changes of Clay Fire Bricks at FurnaceTemperatures.
George A. Loomis

This investigation is a study of some of the physical properties of clay fire bricks by a comparison of their changes in porosity and volume on heating to different temperatures with the amount of contraction of the bricks under load at furnace temperatures, and with the so-called melting point. It is also found that these porosity and volume changes serve in explaining the failure of fire bricks in use from such causes as insufficient burning in manufacture. (Apr. 26, 1920.) 29 pp. Price, 5 cents.

T160. Effects of Oils, Greases, and Degree of Tannage on the Physical Properties of Russet Harness Leather.....*R. C. Bowker and J. B. Churchill*

Information is presented showing the method of preparing the leather for the different tests, of making the various physical tests and also data and results obtained from these tests. The results indicate that the amount of stuffing content and degree of tannage affect the physical properties, but that the use of mineral oils instead of animal oils in the stuffing content does not affect these properties. (Apr. 17, 1920.) 18 pp. Price, 5 cents.

T161. A Picnometer for the Determination of Density of Molasses..*W. B. Newkirk*

A picnometer has been designed to determine, with a greater degree of precision than hitherto possible, the density of very viscous materials, such as molasses. A modified form is proposed which permits the removal of the air without the use of heat but with the use of vacuum. The removal of air by heat is shown to be inaccurate due to decomposition of an unknown character. The proper use of vacuum is shown to give, with ease, results correct to within a few hundredths of a degree Brix. (Apr. 6, 1920.) 7 pp. Price, 5 cents.

T162. Extraction of Rubber Goods.....*S. W. Epstein and B. L. Gonyo*

This paper makes a complete study of the various extracts as determined in the analysis of rubber goods. The subject of mixed solvents, namely, carbon bisulphide and acetone, and chloroform and acetone, is gone into in considerable detail. A large number of figures are presented to show the advantage of using such mixed solvents in the analysis of rubber. (Apr. 9, 1920.) 13 pp. Price, 5 cents.

T163. Stresses Caused by Cold-Rolling.....*H. M. Howe and E. C. Groesbeck*

The experimental data here presented show that a given amount of reduction by rolling causes less residual stress in the metal rolled if it is brought about by a large number of light drafts than by a smaller number of heavy ones. This is shown by means of the curvature induced in each of a pair of superposed strips when they are simultaneously reduced in thickness by rolling, with varying reductions. The result is attributed to the greater skin friction between the metal rolled and the face of the rolls with heavy than with light reductions. Because of this greater skin friction more of the reduction occurs through the backward forcing of the deeper-seated layers, and less through the elongation of the surface of the metal in contact with the rolls. (May 18, 1920.) 8 pp. Price, 5 cents.

T164. The Saybolt Viscosity of Blends.....*W. H. Herschel*

The problem often arises to get a blend of definite viscosity from two oils of known viscosity. To reduce the amount of labor involved in cut and try methods, it is desirable to have a table or chart showing the viscosity of a blend of any two oils mixed in any proportions. The problem has been solved by giving a table calculated from a simple formula, with diagrams for estimating the correction factors to be applied under various conditions. (June 18, 1920.) 21 pp. Price, 5 cents.

T165. Enamels for Sheet Iron and Steel.....*J. B. Shaw*

This paper is a general treatise dealing with the technology of the manufacture of vitreous enamels for sheet iron and steel and the application of these to the metals. Sections are devoted to: The properties and preparation of steel for enameling, the characteristics of the various chemicals used in compounding enamels, and the function of each of these in enamel compositions, the preparation of enamels, the various processes used in applying enamels, the calculation of enamel formulas, the physical properties of enamel coatings, and the resistance of enamels to chemical action. (July 22, 1920.) 88 pp. Price, 15 cents.

T166. Laboratory Wearing Test to Determine the Relative Wear Resistance of the Different Depths Throughout the Thickness of a Hide.....*R. W. Hart*

A short paper giving the results of laboratory tests on the resistance of sole leather to wear at different depths throughout the thickness of a hide. The results are clearly shown by graphs and they indicate a greater resistance in the inner portions of the hide than in the grain or flesh portions. This difference is explained by the tanning process and by the anatomy of the skin. The structure of the skin is briefly described and several photomicrographs are shown which illustrate the differences in the structure of the leather throughout its thickness. (August 21, 1920.) 7 pp. Price, 5cents.

T167. An Examination of the Munsell Color System. I. Spectral and Total Reflection and the Munsell Scale of Value.

I. G. Priest, K. S. Gibson, and H. J. McNicholas

1. Results of extensive measurements of spectral reflection of colored card standards submitted by the Munsell Color Co.

2. Determination of total reflections for sunlight from above curves and relation of these reflections to Munsell value scale.

3. Recommendations for the improvement of the Munsell system. 33 pp.

T168. The Color and Spectral Composition of Certain High-Intensity Searchlight Arcs.....*I. G. Priest, W. F. Meggers, K. S. Gibson E. P. T. Tyndall, and H. J. McNicholas*

Quantitative data on the color and spectral distribution of energy of some modern searchlight arcs, together with spectroscopic analysis of the carbons. Methods of measurement are described. 14 pp.

T169. Measurement of Plasticity of Mortars and Plasters.....*W. E. Emley*

Description of a new instrument designed to measure plasticity, together with a short history of the work leading up to the design of the instrument. (June 28, 1920.) 27 pp. Price, 10 cents.

CIRCULARS

C85. Recommended Specification for Basic Sulphate White Lead, Dry and Paste.

These specifications were prepared under the auspices of the Bureau of Standards by the U. S. Interdepartmental Committee on Paint Specification Standardization. The topics include the general maximum and minimum specifications controlling the grain size and composition, also the methods of sampling, laboratory examination, and preparation of reagents. (Jan. 26, 1920.) 11 pp. Price, 5 cents.

C86. Recommended Specifications for Turpentine.

These specifications were prepared under the auspices of the Bureau of Standards by the U. S. Interdepartmental Committee on Paint Specification Standardization. The topics considered are the general maximum and minimum of the values of the significant properties, the appearance, color, and odor. The specification also includes the methods of sampling, laboratory examination, basis of purchase, and table of correction to barometer readings. (Feb. 16, 1920.) 11 pp. Price, 5 cents.

C87. Recommended Specifications for Zinc Oxide, Dry and Paste.

These specifications were prepared under the auspices of the Bureau of Standards by the U. S. Interdepartmental Committee on Paint Specification Standardization. The specifications cover the maxima and minima of the ingredients and grain size; also methods of sampling and laboratory examination and the methods of preparing the reagents. (Feb. 16, 1920.) 8 pp. Price, 5 cents.

C88. Recommended Specifications for Leaded Zinc Oxide, Dry and Paste.

These specifications were prepared under the auspices of the Bureau of Standards by the U. S. Interdepartmental Committee on Paint Specification Standardization. The specifications cover the maxima and minima of the ingredients and grain size; also methods of sampling and laboratory examination and the methods of preparing the reagents. (Feb. 16, 1920.) 8 pp. Price, 5 cents.

C89. Recommended Specifications for White Paint and Tinted Paints Made on a White Base, Semipaste and Ready Mixed.

These specifications were prepared under the auspices of the Bureau of Standards by the U. S. Interdepartmental Committee on Paint Specification Standardization. The specifications cover the maxima and minima of the ingredients as in the case of the pigment, the semipaste, and ready-mixed paint, and the quality standards for the liquid in semipaste paint. The subjects treated include also the methods of sampling, laboratory examination, and preparation of reagents. (Mar. 10, 1920.) 11 pp. Price, 5 cents.

C90. Recommended Specifications for Red Lead, Dry and Paste.

These specifications were prepared under the auspices of the Bureau of Standards by the U. S. Interdepartmental Committee on Paint Specification Standardization. These specifications give for the dry pigment or paste the maxima and minima and other quality standards, as well as the statement of methods of sampling and laboratory examination, and the preparation of the reagents. (Apr. 3, 1920.) 8 pp. Price, 5 cents.

C91. Recommended Specification for Ocher, Dry and Paste.

This specification for Ocher, Dry and Paste, is one of a series of specifications for paints and paint materials. It was prepared under the auspices of the Bureau of Standards with the cooperation of an interdepartmental committee organized for the purpose, and in cooperation with the Educational Bureau of the Paint Manufacturers' Association of the United States. Before final approval, the specification was submitted to a large number of paint manufacturers whose suggestions were carefully considered. The specification gives the required composition, methods of sampling, analytical methods for laboratory examination of both dry pigment and paste, and describes acceptable methods of preparing the reagents to be used. (Apr. 15, 1920.) 8 pp.

C92. Operation and Care of Vehicle-Type Batteries.

The preparation of this circular was begun by the Construction Division of the Army using as a basis the results of tests made on tractor batteries at the Bureau of Standards. The circular contains a description of both the lead-acid and the nickel-iron types of batteries with the elementary theory of operation. Performance curves for both types are given, showing the characteristics of constant current and constant potential charging and for discharges at the normal five-hour rate and at five times this rate. Later sections of the circular discuss the subjects of capacity, voltage, resistance, methods of testing, methods of charging, and directions for repairing lead-acid batteries. Appendices A and B contain War Department specifications for batteries of this type and for charging equipment. Appendix C gives record forms to be used in maintenance, and appendix D outlines the method of computing costs of operation. Appendix E is a glossary of terms used in connection with storage batteries. (June 7, 1920.) 96 pp. Price, 30 cents.

C93. Recommended Specification for Iron-Oxide and Iron-Hydroxide Paints.

This specification for iron-oxide and iron-hydroxide paints is one of a series of specifications for paint and paint materials. It was prepared under the auspices of the Bureau of Standards with the cooperation of an interdepartmental committee organized for the purpose, and in cooperation with the Educational Bureau of the Paint Manufacturers' Association of the United States. Before final approval the specification was submitted to a large number of paint manufacturers, whose suggestions were carefully considered. The specification gives the required composition, methods of sampling, analytical methods for laboratory examination of both paste and ready-mixed paint, and describes acceptable methods of preparing the reagents to be used. (Apr. 21, 1920.) 8 pp.

C94. Recommended Specification for Black Paint, Semipaste and Ready Mixed.

This specification for black paint, semipaste and ready mixed, is one of a series of specifications for paints and paint materials. It was prepared under the auspices of the Bureau of Standards with the cooperation of an interdepartmental committee organized for the purpose, and in cooperation with the Educational Bureau of the Paint Manufacturers' Association of the United States. Before final approval the specification was submitted to a large number of paint manufacturers, whose suggestions were carefully considered. The specification gives the required composition, methods of sampling, analytical methods for laboratory examination of both paste and ready-mixed paint, and describes acceptable methods of preparing the reagents to be used. (Apr. 21, 1920.) 8 pp.

C95. Inks—Their Composition, Manufacture, and Methods of Testing.

This is a circular of general information on the subject of inks. The composition and manufacture are discussed only briefly, but the methods of testing which are in use at the Bureau of Standards are given in sufficient detail to enable any chemist to use them. After a brief introduction on the history of

ink, there are discussions of writing and copying inks, ink tablets and powders, marking, canceling, stamping, duplicating, and sympathetic inks. The methods used for the laboratory examination of all but the last of these kinds of ink are next taken up. Under the analysis of writing inks, for instance, are the following headings: Total solids, ash, iron, sulphuric anhydride, tannin, dye, chromium, penetration, fluidity, keeping quality, and resistance to light and reagents. For the other kinds of ink there is not such a variety of tests necessary. The circular closes with a short bibliography. (June 28, 1920.) 24 pp. Price, 5 cents.

C96. Recommended Specifications for Quicklime and Hydrated Lime for Use in the Cooking of Rags for the Manufacture of Paper.

Lime shall contain not less than 95 per cent CaO. Hydrated lime shall contain not less than 72 per cent CaO. (June 15, 1920.) 5 pp.

C97. Recommended Specifications for Green Paint, Semipaste and Ready Mixed.

This specification for green paint—semipaste and ready mixed—refers to a chrome green paint, either in semipaste pigment ground in linseed oil, or ready mixed. The specification covers the general conditions and the maxima and minima of useful, harmful, or neutral constituents and methods of sampling, and the details as to the laboratory examination and analysis. The detailed methods of preparing the reagents to be used are also given. The standard was prepared under the auspices of the Bureau of Standards and submitted to large numbers of representative paint manufacturers, and also recommended by the United States Interdepartmental Committee on Paint Specification Standardization. (Aug. 23, 1920.) 10 pp.

MISCELLANEOUS PUBLICATIONS

M41. Report of the Twelfth Annual Conference on Weights and Measures.

This publication is a verbatim report of the proceedings of this conference, which is a body composed of State and local officials enforcing weights and measures inspection laws in various jurisdictions throughout the country. Many papers and discussions on topics of interest are included, one of the most important of these being the condition and proper method of regulation of liquid-measuring pumps used in dispensing gasoline, oils, etc., together with a set of specifications and tolerances tentatively adopted for this class of apparatus. The action of this conference in establishing specifications and tolerances is ordinarily followed by their official promulgation in a large number of States. Resolutions expressing the opinion of the conference on various subjects of interest are also included. 226 pp. Price, 20 cents.

LIST OF DEPOSITORY LIBRARIES.

ALABAMA.—Auburn, Alabama Polytechnic Institute Library; Birmingham, Howard College Library; Public Library; Decatur, Carnegie Library; Mobile, Association Public Library; Montgomery, State Capitol Library; State and Supreme Court Library; Talladega, Public Library; Tuskegee Institute Carnegie Library; University, University of Alabama Library.

ALASKA.—Fairbanks, St. Matthews Free Public Library; Juneau, Alaska Historical Society and Museum Library.

ARIZONA.—Phoenix, The Territorial Library; Tucson, Free Public Library, University of Arizona Library.

ARKANSAS.—Conway, Hendrix College Library; Fayetteville, University of Arkansas Library; Little Rock, Arkansas State Library; Pine Bluff, Branch Nor. College Library.

CALIFORNIA.—Berkeley, University of California Library; Eureka, Free Library; Los Angeles, Public Library; Sacramento, California State Library, Free Public Library; San Francisco, Mechanics Mercantile Library, Public Library; Santa Rosa, Free Public Library; Stanford University, Leland Stanford, jr., University Library; Stockton, Free Public Library.

COLORADO.—Boulder, University of Colorado Library; Colorado Springs, Colorado College Coburn Library; Denver, Colorado State Library, Public Library, University of Denver; Fort Collins, Agricultural College Library; Pueblo, McClelland Public Library.

CONNECTICUT.—Bridgeport, Public Library; Hartford, Connecticut State Library, Trinity College Library; Middletown, Wesleyan University Library; New Haven, Yale University Library; New London, Public Library.

DELAWARE.—Dover, Delaware State Library; Newark, Delaware College Library; Newcastle, Newcastle Library Company; Wilmington, Free Library.

DISTRICT OF COLUMBIA.—Washington, Departments of Agriculture, Interior, Justice, Navy, State, Treasury, and War Libraries.

FLORIDA.—Deland, John B. Stetson University Library; Gainesville, University of Florida Library; Tallahassee, Carnegie Library of the Florida State Normal and Industrial School, Florida State Library; Winter Park, Rollins College Library.

GEORGIA.—Athens, University of Georgia Library; Atlanta, Carnegie Library, Georgia State Library; Augusta, Young Men's Library; Dahlonega, Georgia Agricultural College Library; Douglas, Georgia Normal and Business Institute Library; Newnan, Carnegie Library; Oxford, Emery College Library; Savannah, Georgia State Industrial College Library, Public Library.

HAWAII.—Honolulu, College of Hawaii Library.

IDAHO.—Albion, State Normal School Library; Boise, Idaho State Library; Lewiston, State Normal School Library; Moscow, University of Idaho Library; Pocatello, Academy of Idaho Library.

ILLINOIS.—Belleville, Public Library; Bloomington, Illinois Wesleyan University Library; Carbondale, Wheeler Library of Southern Illinois State Normal University; Chicago, John Crerar Library, Newberry Library, Public Library, St. Ignatius College Library, University of Chicago Library; Danville, Library; De Kalb, Haish Library of the Illinois State Normal School; Evanston, Northwestern University; Freeport, Public Library; Galesburg, Free Public Library; Jacksonville, Public Library; Joliet, Public Library; Monmouth, Monmouth College Library; Normal, Illinois State Normal University Library; Olney, Carnegie Public Library; Peoria, Public Library; Rockford, Public Library; Springfield, Illinois State Historical Society Library, Illinois State Library: Urbana, University of Illinois Library.

INDIANA.—Bloomington, Indiana University Library; Crawfordsville, Wabash College Library; Evansville, Willard Library; Fort Wayne, Public Library; Greencastle, De Pauw University Library; Hanover, Hanover College Library; Huntington, City Free Library; Indianapolis, Public Library, Indiana State Library; Jasper, Jasper College Library; Lafayette, Purdue University Library; Merom, Union Christian College Library; Muncie, Public Library; Notre Dame, Lemonnier Library of University of Notre Dame; Richmond, Morrison Reeves Library; Terre Haute, Indiana State Normal School Library; Valparaiso, Valparaiso University Library.

IOWA.—Ames, Iowa State College Library; Boone, Ericson Free Public Library; Cedar Falls, Public Library; Council Bluffs, Free Public Library; Des Moines, Public Library; Dubuque, Carnegie Stout Free Public Library; East Des Moines, Iowa State Library; Fairfield, Free Library; Fayette, Upper Iowa University Library; Grinnell, Iowa College Library; Iowa City, State University of Iowa Library; Mount Pleasant, Iowa Wesleyan University Library; Mount Vernon, Cornell College Library; Sioux City, Public Library; Tabor, Tabor College Library.

KANSAS.—Baldwin, Baker University; Emporia, Kansas State Normal Library; Hiawatha, Morrill Free Public Library; Lawrence, Spooner Library of University of Kansas; Manhattan, Kansas State Agricultural College Library; Pittsburgh, Public Library; Sterling, Cooper College Library; Topeka, Kansas State Library, Kansas State Historical Society Library; Wichita, Fairmount College Library.

KENTUCKY.—Danville, Centre College of Central University Library; Frankfort, Kentucky State Library; Henderson, Public Library; Lexington, State University Library; Louisville, Free Public Library; Somerset, Carnegie Public Library; Winchester, Kentucky Wesleyan College Library.

LOUISIANA.—Baton Rouge, Hill Memorial Library of State University; Natchitoches, State Normal School Library; New Orleans, Howard Memorial Library, Louisiana State Library, Public Library, Tulane University Library; Ruston, Louisiana Industrial Institute Library.

MAINE.—Augusta, Maine State Library; Bangor, Public Library; Brunswick, Bowdoin College Library, Lewiston, Bates College Library; Orono, University of Maine Library; Portland, Public Library; Saco, Dyer Library Association; Waterville, Colby University Library.

MARYLAND.—Annapolis, Maryland State Library, United States Naval Academy Library; Baltimore, City Library, Enoch Pratt Free Library, Johns Hopkins University Library, Peabody Institute Library; Chestertown, Washington College Library; Frederick, Frederick College Library; Westminster, Western Maryland College Library.

MASSACHUSETTS.—Amherst, Amherst College Library, Massachusetts Agricultural College Library; Boston, Athenaeum Library, Public Library, State Library of Massachusetts; Cambridge, Harvard College Library; Lowell, City Library; Lynn, Public Library; New Bedford, Public Library; Salem, Essex Institute Library; Taunton, Public Library; Tufts College, Tufts College Library; Watertown, Free Public Library; Williamstown, Williams College Library; Worcester, Free Public Library.

MICHIGAN.—Ann Arbor, General Library of University of Michigan; Battle Creek, Public School Library; Bay City, Public Library; Benton Harbor, Public Library; Detroit, Detroit College Library, Public Library; East Lansing, Michigan State Agricultural College Library; Grand Rapids, Public Library; Houghton, Library of the Michigan School of Mines; Kalamazoo, Public Library; Lansing, Michigan State Library; Muskegon, Hackley Public Library; Orchard Lake, Michigan Military Academy Library; Saginaw, Hoyt Public Library.

MINNESOTA.—Duluth, Free Public Library; Faribault, Public Library; Fergus Falls, High School Library; Minneapolis, Public Library, University of Minnesota Library; St. Cloud, State Normal School Library; Stillwater, Public Library; St. Paul, Minnesota Historical Society Library, Minnesota State Library; Winona, State Normal School Library.

MISSISSIPPI.—Agricultural College, Mississippi Agricultural and Mechanical College; Jackson, Carnegie Millsaps Library, Mississippi State Library; Oxford, Mississippi State University Library.

MISSOURI.—Cape Girardeau, St. Vincent's College Library; Carthage, Public School Library; Chillicothe, Hazelton Public School Library; Columbia, College of Agricultural and Mechanical Arts of Missouri State University Library; Fulton, Westminster College Library; Hannibal, Free Public Library; Jefferson City, Missouri State Library; Kansas City, Public Library; Liberty, William Jewell College Library; Perryville, Public School Library; Rolla, Missouri School of Mines Library; Springfield, Drury College Library; St. Joseph, Free Public Library; St. Louis, Christian Brothers College Library, Public Library, St. Louis University Library, Washington University Library.

MONTANA.—Bozeman, Montana Agricultural College Library; Butte, Montana State School of Mines Library; Helena, Historical Department of Montana State Library, Public Library; Missoula, University of Montana.

NEBRASKA.—Fremont, Public Library; Grand Island, Carnegie Library; Kearney, Public Library; Lincoln, Library of the University of Nebraska, Nebraska State Library; Omaha, Public Library; South Omaha, Public Library.

NEVADA.—Carson City, Nevada State Library; Reno, University of Nevada Library.

NEW HAMPSHIRE.—Concord, New Hampshire State Library; Dover, Public Library; Durham, Hamilton Smith Public Library; Hanover, Dartmouth College Library; Laconia, Public Library; Manchester, City Library.

NEW JERSEY.—Atlantic City, Free Public Library; Bayonne, Free Public Library; Camden, Free Public Library; Elizabeth, Public Library and Reading Room; Jersey City, Free Public Library; Newark, Free Public Library, New Jersey Historical Society Library; New Brunswick, Free Public Library, Rutgers College Library; Orange, Free Library; Paterson, Free Public Library; Princeton, Princeton University Library; Trenton, Free Public Library, New Jersey State Library.

NEW MEXICO.—Agricultural College, General Library of New Mexico College of Agricultural and Mechanical Arts; Albuquerque, University of New Mexico; Santa Fe Territorial Library.

NEW YORK.—Albany, New York State Library; Brooklyn, Public Library, Long Island Historical Society Library, Pratt Institute Library; Buffalo, Grosvenor Library, Public Library; Canton, St. Lawrence University Library; Glens Falls, Crandall Free Library; Hamilton, Colgate University Library; Ithaca, Cornell University Library; Keuka Park, Keuka College Public Library; Newburgh, Free Library; New York, Astor Branch of New York Public Library, College of the City of New York Library, Columbia University Library, Cooper Union for Advancement of Science and Art Library, General Library of New York University, Lenox Branch of New York Public Library, New York Law Institute Library, The World Library, Young Men's Hebrew Association Library; Oswego, Normal School Library; Poughkeepsie, Adriance Memorial Library; Rochester, Rochester University Library; Schenectady, Union College Library; Syracuse, Syracuse University Library; Troy, Public Library; Utica, Public Library; West Point, United States Military Academy Library.

NORTH CAROLINA.—Buies Creek, Buies Creek Academy Library; Chapel Hill, University of North Carolina Library; Davidson, Union Library of Davidson College; Durham, Trinity College Library; Greensboro, Colored Agricultural and Mechanical College Library; Newton, Catawba College Library; Raleigh, North Carolina State Library; Wake Forest, Wake Forest College Library; Washington, Public Schools Library.

NORTH DAKOTA.—Bismarck, North Dakota State Library, State Historical Society Library; Fargo, North Dakota Agricultural College Library; Grand Forks, Public Library; University, State University of North Dakota Library.

OHIO.—Alliance, Mount Union Library; Athens, Carnegie Library; Bucyrus, Public Library; Cincinnati, Public Library; Cleveland, Case Library, Public Library; Columbus, Ohio State Library, Ohio State University Library, Public Library; Dayton, Public Library and Museum; Delaware, Charles Slocum Library of Ohio Wesleyan University; Gambier, Kenyon College Library; Granville, Denison University Library; Hiram, Hiram College Library; Lebanon, Public Library; Marietta, Marietta College Library; Oberlin, Oberlin College Library; Oxford, Miami University Library; Portsmouth, Free Public Library; Sidney, Public Library; Springfield, Warder Public Library; Steubenville, Carnegie Library; Toledo, Public Library; Van Wert, Brumback Library of Van Wert County.

OKLAHOMA.—Alva, Northwestern State Normal School Library; Enid, Public Library; Guthrie, Oklahoma State Library; Langston, Colored Agricultural and Normal University Library; Muskogee, High School Library; Norman, University of Oklahoma Library; Stillwater, Oklahoma Agricultural and Mechanical College Library.

OREGON.—Corvallis, Oregon Agricultural College Library; Eugene, University of Oregon Library; Forest Grove, Tualatin Academy and Pacific University Library; Portland, Library Association; Salem, Oregon State Library.

PENNSYLVANIA.—Bradford, Carnegie Public Library; Erie, Public Library; Gettysburg, Pennsylvania College Library; Harrisburg, Pennsylvania State Library; Haverford, Haverford College Library; Huntington, Juniata College Library; Lancaster, Watts De Peyster Library of F. and M. College; Meadville, Allegheny College Library; Norristown, William McCann Library; Philadelphia, Free

Library, Historical Society of Pennsylvania Library, Library Company of Philadelphia, Mercantile Library, Philadelphia Museum Library, University of Pennsylvania Library; Pittsburgh, Carnegie Library; Scranton, Public Library; South Bethlehem, Lehigh University Library; State College, Carnegie Library of Pennsylvania State College; Reading, Reading Library; Warren, Public Library; Washington, Memorial Library of Washington and Jefferson College; Waynesburg, Waynesburg College; Library; Wilkes-Barre, Wyoming Historical and Geological Society Library.

PHILIPPINE ISLANDS.—Manila, Library of Philippine Government.

RHODE ISLAND.—Kingston, Rhode Island College of Agricultural and Mechanical Arts Library; Providence, Brown University Library, Public Library, Rhode Island State Library; Westerly, Public Library.

TEXAS.—Austin, Texas State Library, University of Texas Library; Clarendon, Clarendon College Library; College Station, Agricultural and Mechanical College of Texas Library; Dallas, Public Library; El Paso, Public Library; Fort Worth, Carnegie Library; Galveston, Rosenberg Library; Georgetown, Southwestern University Library; Houston, Lyceum and Carnegie Library; Jasper, Southeast Texas College Library; San Antonio, Carnegie Library; Waco, Baylor Library.

UTAH.—Logan, Agricultural College Library; Ogden, Carnegie Free Library; Provo, Brigham Young University Library; Salt Lake City, University of Utah Library.

VERMONT.—Burlington, Fletcher Free Library, University of Vermont Library; Middlebury, Middlebury College Library; Montpelier, Vermont State Library; Northfield, Carnegie Library of Norwich University.

VIRGINIA.—Blacksburg, Virginia Agricultural and Mechanical College and Polytechnic Institute Library Bridgewater, Bridgewater College Library; Emory, Emory and Henry College Library; Hampden Sidney, Hampden Sidney College Library; Lexington, Virginia Military Institute Library; Norfolk Public Library; Richmond, Richmond College Library, Virginia State Library; Salem, Roanoke College Library.

WASHINGTON.—Olympia, Washington State Library; Pullman, State College of Washington Library; Seattle, Public Library, University of Washington Library; Tacoma, Public Library; Walla Walla, Whitman College Library.

WEST VIRGINIA.—Buckhannon, West Virginia Wesleyan College Library; Charleston, Department of Archives and History State Library; Fairmont, Normal School Library; Huntington, Public Library; Institute, West Virginia Colored Institute Library; Keyser, Preparatory Branch of West Virginia University Library; Morgantown, West Virginia University Library.

WISCONSIN.—Appleton, Lawrence University Library; Beloit, Beloit College Library; Eau Claire, Public Library; Fond du Lac, Public Library; La Crosse, Public Library; Madison, State Historical Society Library, State Library; Merrill, T. B. Scott Free Library; Milwaukee, Public Library; Platteville, State Normal School Library; Racine, Public Library; Superior, Public Library.

WYOMING.—Cheyenne, Wyoming State Library; Laramie, University of Wyoming Library.

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