acid for bichromate cells (water and acid in cubic centimeters and bichromate in grammes). I have several recipes, but they all differ with regard to proportions of bichromate and acid. A. There are many formulas for the bichromate solution. We cannot say which one is the *best*. Practice now is to use chromic acid directly in place of bichromate of potash. Indeed, bichromate of soda is to be preferred to the potash salt, since it is more easily dissolved and the solution does not throw down crystals, as bichromate of potash does. The idea is to have a saturated solution of the salt and add sulphuric acid to a proportion of about one in ten to one in twelve. If the acid is more than one in ten it will act too strongly on the zincs and the cell will overheat, the liquid "boiling" as it is called.

(10319) W. M. H. asks: 1. May the direction in which the armature of a dynamo or motor revolves be governed at the will of the operator by change of current or other means? A. A dynamo may be run in either direction by placing the brushes so that they lead in the proper direction. A motor is reversed by changing the direction of the current in either the field or the armature, but not in both. 2. What means is employed to change the direction in which a trolley car runs? A. By throwing the reversing switch to change the current as above.

(10320) W. D. S. says: In your "Scientific American Cyclopedia," under the head of "Soaps," is a formula for making "Yellow Soap," the last of the list of soaps. It gives: Tallow, ½ lb.; sal soda, 1½ lb.; resin, 5 to 6 lbs.; stone lime, 28 lbs.; palm oil, 8 oz.; soft water, 28 gal. Surely this is a misprint. Will you kindly give me the correct formula, as I wish to make a soap with sal soda and lime? Also, could you give me the formula for making bisulphide of carbon for killing gophers and weevil? A. For the manufacture of ordinary yellow soaps, the fats used are tallow, palm oil, and resin. These may be used in such varying proportions that a few general facts will be of more value than one specific formula. Fats require from 13½ to 15 per cent of caustic soda for complete saponification. Rosin also requires about 15 per cent. As caustic soda is more expensive than soda ash (carbonate of soda), it is common practice to take soda ash and causticize with lime. An excess of lime is usually used. One hundred parts of soda ash are dissolved and heated to boiling; 75 to 100 parts of lime are then added, and the boiling continued for about one-half hour. It is then allowed to settle, and the clear solution is used for making the soap. In estimating the amount of soda ash required, it may be assumed that 100 parts of soda ash are equivalent to 75 parts of caustic soda. The proportion of rosin used is extremely variable, in some cases equal amounts of fat and rosin are taken, but this is not considered excessive. For a good laundry soap the amount of rosin may vary from 25 per cent to 40 per cent of the fat taken. Carbon bisulphide is now largely being made in the electric furnace. It could not be manufactured on a small scale. It can be purchased in any quantities at reasonable price.

(10321) A. B. S. says: I am using large quantities of soft zinc from which I make small stampings, leaving about 30 per cent that I am obliged to put into scrap. This scrap is worth to me 4 cents a pound, whereas the new material costs me 12 cents. My idea would be to melt down this scrap that I have and reroll, but in trying this I find that the metal becomes so hard that it breaks in rolling. I presume that during the process of melting, one or more of the component parts passes off in the form of a gas, or perhaps my appliance for melting is not what it should be. I am familiar with the melting of copper and with the various alloys of brass, but this matter of remelting zinc and putting it in shape to stamp properly is something I am unfamiliar with. A. Melt the zinc at the least possible temperature, and pour into heated iron molds so that the cooling shall proceed very slowly. Avoid introducing any iron accidentally into the zinc during the melting, as iron causes brittleness. Adding 0.5 per cent lead makes the zinc more malleable. It should be rolled out at a temperature of 150 deg. C. to 200 deg. C., at which zinc is most malleable; at temperatures much above or below these limits, the zinc becomes too brittle to roll.

(10322) D. J. B. wishes to know what the back pressure per square inch would be in the cylinder of an engine operated by compressed air instead of steam, and where the air is allowed to expand fully in the cylinder before the exhaust valve opens. A. The back pressure at the exhaust of an air motor depends entirely upon the cut-off point and the initial pressure as with steam in principle, but does not follow the same ratio. See Hiscox's book on "Compressed Air."

(10323) F. M. wishes to know the best chemical used to purify acetylene gas. A. First wash with water to remove ammonia. To remove the other impurities, chiefly compounds of phosphorus and of sulphur, the following chemicals have been used: 1. Chloride of lime; unless all ammonia has been removed, nitrogen chloride may form. 2. Solution of cuprous chloride; one liter of this solution will purify 14 to 16 cubic meters of gas. 3. Solution of chromic acid in sulphuric acid; 5½ grammes of chromic acid will purify 1 cubic meter of gas. 4. Paraffin oil or other hydrocarbon oils. Solutions 2 and 3 give the best results; 4, used in conjunction with 2 or 3, increases the certainty of the purification.

(10324) C. F. H. asks: Can you give me any information as to the mixture used in binding coal screenings together that are made into briquettes? A. The best material for binding coal fines into briquettes, and the one most largely used, is pitch. Asphalt has had a limited use. Starch paste, residues from starch manufacture, dextrine, molasses, etc., have been used from time to time experimentally, but are not practicable. Various mineral substances, such as clays, lime, water-glass, etc., have also been proposed, but naturally have the drawback of adding just so much ash. Occasionally, oxidizing materials, such as niter, are added, when it is desired to produce a very quickly burning briquette for the rapid generation of high temperatures.

(10325) M. G. M. asks: 1. With a current of 20 volts and where bare copper wire is used, is there any waste of same current where nothing but dry pine is used for insulation? A. There is always some leakage of current when bare wire is in contact with wood, and even over insulators, especially in wet weather. But in the case above there would not be much leakage so long as the wood is dry. 2. How many feet of No. 36 tinned iron wire like the inclosed has a resistance of 10 ohms? A. Iron has very nearly six times the resistance of copper. No. 36 copper wire has 2.408 feet per ohm. Ten ohms of No. 36 iron wire would be 4.02 feet long.

(10326) S. R. asks for a good receipt for making a reliable fire extinguisher in powder form, one that is easy to prepare. A. For a cheap, dry powder fire extinguisher, bicarbonate of soda will serve; it may advantageously be mixed with 5 per cent to 10 per cent in some powdered mineral, as flint, tripoli, chalk, etc., to prevent caking in damp air. A mixture of *dry* bicarbonate of soda with *dry* sal-ammoniac, and kept in a *dry* place, will do better, as it would yield both carbonic acid and ammonia. In a confined space fire extinguishers of a type similar to gunpowder have proved effective; the object being to fill the room with carbon dioxide, sulphur dioxide, and nitrogen gases, and thus choke the fire. A good formula for this type of extinguisher is niter, 60 parts; sulphur, 36 parts; charcoal, 4 parts.

(10327) W. R. asks what the different gases are which, if introduced into an inclosed arc lamp will turn the color red, green, yellow, blue, etc. A. Colored electric lights are ordinarily produced by coating the globe with an aniline dye, made in alcoholic solution, and mixed with a little varnish. We do not know any gas which could withstand the heat of the arc for any time and which could color the arc. Some color can be imparted to the arc by soaking the carbons in solutions of sodium chloride, strontium chloride, or lithium chloride, and drying them thoroughly before using. The light of the arc itself is so intense that it is very difficult to overcome it with any other colored light.

(10328) H. M. asks: Can you give me information as to what a transformer is and what it is used for? I have been informed that it is much on the scale of an induction coil. If so, can you give me some scale by which to transform a 110-volt current into amperes? A. A transformer changes an alternating current from one voltage to another and from one current strength to another. It cannot change volts into amperes. In that respect they resemble induction coils. An induction coil is a particular sort of transformer, provided with a condenser, interrupter, etc. It is used almost entirely for raising the voltage. 2. Also, please tell me how many volts it will take to each ampere, and a scale of how it should be wound, what size wire to use, and if the fine wire should be used outside or in? A. It is impossible to change amperes into volts. And as to the winding, each one is wound for the work it is to do. There is no general winding.

(10329) G. W. L. asks: 1. What is the most economical method of generating carbonic acid gas—not necessarily pure—in large quantities? A. The commercial sources of carbonic acid, on a manufacturing scale, are as follows: 1. By the burning of limestone. 2. By the action of acids in limestone (calcium carbonate), magnesite (magnesium carbonate), or dolomite (calcium magnesium carbonate). The acid used is sulphuric. This method is used by the manufacturers of bottled effervescing waters. 3. By collecting the carbonic acid gas generated in the fermentation vats of large breweries. This source is largely used in Germany. In addition, the gas coming from many of the natural springs is collected. This practice is also largely used in Germany. 2. Are there any known chemicals, or other substances, that will decompose water, aside from the alkaline metals? A. Besides the alkaline metals, water is decomposed by many of the hydrides and carbides of the different metals. Thus calcium carbides decompose water with the formation of lime and acetylene. Also, vapor of water passed through red-hot tubes of different metals is decomposed into its constituents. Vapor of water passed through red-hot coal is decomposed, with formation of carbon monoxide and dioxide, hydrogen, marsh gas (CH_4) and other hydrocarbons: this is the basis of the industrial manufacture of water gas, which has displaced coal gas in most cities.

(10330) I. D. asks for a formula for bluing iron and steel without heating. A. 1. From our Cyclopedia of Receipts, Notes and Queries: Scour the steel with a small quantity of a strong aqueous solution of soda, rinse in ¼ of an ounce chloride of iron, dissolved in 5 ounces of water, and let it dry; then apply in the same manner a solution of 1-5 of an ounce pyrogallic acid in 1 ounce of water, dry, and brush. Does not wear well without lacquering. 2. The blue oxide is sometimes imitated by using a thin alcoholic shellac varnish, colored with aniline blue or Prussian blue. 3. To blue steel without heat, mix finely-powdered Prussian blue with rather thin shellac; gently heat the steel and apply the varnish. 4. Iron and Steel to Blue Without Heat—Solution of potassium ferricyanide and water, 1:200; solution of ferric chloride, 1:200. Mix the two solutions and dip. 5. Antimony trichloride, 25 parts; nitric acid, fuming, 25 parts; and hydrochloric acid, 50 parts. Apply with a rag and rub until the proper color is obtained with a piece of green oak.

NEW BOOKS, ETC.

MANUAL OF WIRELESS TELEGRAPHY. By A. Frederick Collins. New York: John Wiley & Sons, 1906. 10 chapters; pp. 232; 90 illustrations; 1 chart. Price, $1.50.

This book combines theory and practice, and while instructive to the general reader, is intended more especially for the use of telegraph operators and engineers interested in wireless telegraphy. It is written in plain and simple words, and is for the most part free from mathematics and technical terms. It gives explicit instructions for the wiring of stations both ashore and on shipboard, and for the maintenance and arrangement of apparatus used in the principal systems. The author defines the attitude of the army and navy with reference to the employment of wireless telegraph operators, and outlines the nature of the work expected and the compensation therefor. A glossary of terms used in wireless telegraphy is included. The book contains little or no historical matter, and deals strictly with the present stage of development.

SWITCHBOARDS. By William Baxter, Jr. New York: The Derry-Collard Company, 1906. 8vo.; pp. 192. Price, $1.50.

This volume deals with switchboards for both direct and alternating current, and includes an excellent section on circuit-breakers. It is intended primarily for the use of engineers and others who have to do with switchboards in practice. The illustrations, both from photographs and diagram drawings, excellently supplement the text.

ANIMAL MICROLOGY. By Michael F. Guyer, Ph.D. Chicago: The University of Chicago Press, 1906. 12mo.; pp. 240. Price, $1.75 net.

Dr. Guyer's book will be found to be a valuable elementary treatise for the beginners in the study of microscopic science. It gives greater attention to the details of procedure than to the discriminations between reagents or the review of special processes. As the author explains, the book attempts to familiarize the student with the little "tricks" of technique which are commonly left out of books and methods, but which are of such great importance in securing good results. The Appendix includes a brief non-technical account of the principles of the microscope, as well as the formulæ for a number of the most widely-used reagents. A concise table of a large number of tissues and organs, with directions for preparing them properly for microscopic investigations, is also included. The Appendix concludes with valuable directions for collecting and preparing material for an elementary course in zoology.

MARINE ENGINEERS. By E. G. Constantine. 12mo.; pp. 332. Price, $2.

One purpose of the author of this book, as explained in the Preface, is an unusual one, namely, to furnish information to various classes of readers, including parents and guardians, who may have some intention of educating their sons to become engineers. Obscure technicalities have been carefully avoided and basic principles have been lightly dealt with, so as to indicate only the course best calculated to secure that acquisition of knowledge of the science of engineering and its branches which is the essential characteristic of the engineer.

AIR COMPRESSOR AND BLOWING ENGINES. By Charles H. Innes, M.A. London: The Technical Publishing Company, Ltd., 1906. 12mo.; pp. 290. Price, $2.

Compressed air has become of such great importance in engineering activity that the literature discussing and treating of the subject has grown to considerable proportions. Notwithstanding this, the book in question here will be welcomed by engineers interested in this phase of the profession. The text is a reprint of a series of articles which originally appeared in The Practical Engineer. The discussion includes the properties of air, calculations of the work necessary for compression under various circumstances, experiments with compressors, calculations of efficiencies, theories of valves for the equalization of pressure, construction of blowing engines, and descriptions of air compressors. The book is very fully illustrated.

DER NACHWEISS VON SCHRIFTFÄLSCHUNGEN, BLUT, SPERMA, U.S.W. By Prof. Dr. M. Dennstedt and Dr. F. Voigtländer. Braunschweig: Druck und Verlag von Friedrich Vieweg und Sohn, 1906. 12mo.; pp. 248.

It is unfortunate that at the present time there is in existence no translation of this extremely interesting and well-written German volume. It deals with the science of a certain phase of crime detection, and as is so often the case in the investigations of German experts, it is carried out with the greatest possible degree of accuracy and attention to detail. The illustrations, comprising mainly photographs of actual examples from German criminal records, are splendid. The book deals with the detection of forgeries, the recognition of blood stains, etc., and is treated in accordance with the rules of pure science, bringing into play very largely the use of photography.

THE COPPER HANDBOOK. A Manual of the Copper Industry of the World. Vol. VI. Houghton, Mich.: Compiled and published by Horace J. Stevens, 1906. 8vo.; pp. 1,116. Price, $5.

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