rection through the other spool, so that one pole is plus at the armature and the other is minus. The same is true of a sounder. 3. I made a wireless telegraph and it works very well except when the tapper should knock the filings apart, and this it will not do. Am I using too much current, or what is the matter? A. Perhaps your coherer needs to be tapped harder to knock the filings apart. Perhaps the ends of the plugs are too near together so that the filings are held too tight. You can easily find if less current will make it work better. 4. How many gallons of water will flow out of a pipe in one day with a pressure of 108 pounds and the hole in the pipe 1-16 inch in diameter? A. The theoretical solution gives about one gallon a minute for the flow from the hole in the water pipe you describe. So much depends upon the thickness of the pipe and the condition of the edges of the hole, etc., that this may be far from the real efflux. This can only be determined with correctness by experiment.

(9603) M. W. H. asks: 1. What is the philosophy of salt causing ice to freeze and unite in summer (as in case of making ice-cream), and causing ice and snow to melt in winter? A. Salt does not cause ice to freeze in summer and melt in winter. That is very loose thinking. The ice and salt in the freezer melt at any time of the year. The cream in the inner can freezes because the heat which melts the ice in the outer box is taken from the cream in the inner can. The ice cannot get heat to melt itself from the outer air because the box in which it is is of wood, which is a non-conductor of heat. The inner can is of metal and so is a conductor of heat. The cream furnishes heat to the ice and is cooled and frozen by the process. Ice and salt will melt in the open air by taking heat from the air at any temperature above 7 deg. F. below zero. Below that temperature they will not melt. 2. Why does frost penetrate solid ground so much deeper (in the same locality) than it does loose, porous ground? A. Solid ground freezes better than porous ground because the porous earth contains air. Air is one of the very best non-conductors of heat, and keeps the heat in the earth. 3. Why does frost penetrate a wall 12 inches thick (solid) sooner than the same thickness of wall with an open space in it, say, for instance, 6-inch wall, 3-inch space, then 6-inch wall, there being no way to moderate the temperature between the two 6-inch walls—or even a 12-inch wall with a 2-inch air space in it? A. The air space in a wall acts just as the air spaces in the porous ground do in the last question. It prevents heat from passing, and thus houses are built with air spaces in the walls to keep them cool in summer and warm in winter. Double windows are used in cold regions for the same purpose. 4. Would the explosion of a compressed-air tank be as dangerous to life and limb as other explosions, say, for instance, steam (outside of being scalded) or other explosives such as powder or dynamite? If there be a difference what is the nature of it? A. Air at the same pressure as dynamite will produce as destructive effects as dynamite. It is difficult to imagine any method by which this can be brought about. 5. As everything in nature has a cause, what causes the wind to blow (hard or easy); also what causes it to change sometimes half a dozen times a day, apparently in the same temperature (hot or cold)? A. Wind is produced by the heat of the sun, and always blows from a place of higher barometric pressure to one of lower pressure. This place may be in the next field in a summer day, and it may be hundreds of miles away. The wind rarely travels in a straight line for any considerable distance, but swerves and changes its direction as you state. 6. At what height in a heated room is the most stagnant air, consequently the most unhealthy and germ-bearing atmosphere? A. No height can be given for the worst air in a room unless it be at the ceiling above. Currents quickly diffuse the bad air to all parts of a room.

(9604) D. F. F. asks: I would like to know, through your query column, how the degrees on the scale of a Baume hydrometer are determined? On an ordinarily marked hydrometer the specific gravity of the liquid under examination may be read directly from the scale; but on a Baume hydrometer the degrees do not give, directly, the specific gravity of the liquid. Now, what I wish to know is, on what are the degrees of the scale based? In other words, what is the zero point, and what other point is used, and how is it found, for determining the length of a degree? A. There are two Baume hydrometers, one for light liquids and the other for heavy liquids. Each has its own scale and the degrees are not the same in both scales. The zero point of the one for heavy liquids is near the top of the tube, and is the point to which it sinks in pure water. It is then placed in a solution of 15 parts salt and 85 parts water; the point to which it sinks is called 15 degrees, and one degree is found from this. The rest of the scale is simply a scale of equal parts in terms of this degree. The hydrometer for light liquids is placed in pure water and marked, and then in a solution of 10 parts salt and 90 parts water, and one degree is found from this. The point to which it sinks in salt and water is zero. The rest of the scale is graduated from the bottom upward, in terms of this degree. The entire scale is arbitrary and has no relation to a specific gravity scale. It is only by means of a table that one scale can be converted into the other. Nor has a Baume degree the same significance in one part of the scale of the same instrument as it has in another part, due to the variable immersion of the instrument.

NEW BOOKS, ETC.

Species and Varieties. Their Origin by Mutation. Lectures delivered at the University of California by Hugo de Vries, Professor of Botany in the University of Amsterdam. Edited by Daniel Trembly MacDougal, Assistant Director of the New York Botanical Garden. Chicago: The Open Court Publishing Company. London: Kegan Paul, Trench, Trübner & Co., Ltd. Pp. xxiii; 830; 8vo., cloth, gilt top. Price, postpaid, $5.

Prof. De Vries may well be regarded as the foremost advocate of experimental evolution, the man, moreover, who gave us the mutation theory of organic evolution. The volume before us is a splendid scientific plea for the experimental study of organic life. Working hand in hand with such investigators as Johanssen, Overton, Wilson, Loeb, Delage, and Davenport, all of whom have experimented with life in some form or other. Prof. De Vries has confined himself to the study of those forms of plants that suddenly make their appearance from time to time. It was his good fortune to discover a wild plant (Lamarck's evening primrose) which may still be considered in a condition of mutability. At frequent intervals it is observed to produce an entirely new and permanent species, although the stock itself is not altered by the process, nor even noticeably diminished. This is, perhaps, the most striking instance of experimental mutation to which Prof. De Vries can point, an instance, moreover, which shows that sudden sports are the prevailing rule, and probably the exclusive manner of originating new varieties. Mutation, of course, cannot be assumed to be a special feature of evening primroses. They must occur elsewhere, and these must be sought. The œnothera was one of a lot of nearly one hundred species tested as to their constancy. It proved to be the only changeable form among them. By testing one hundred species of the same forms, it seems probable that one or two instances of mutability may be detected. The chief object of Prof. De Vries's inquiry has naturally been the study of the mutable strain itself. Some of its seeds yield new species, while others are more conservative. It is probable that the degree of mutability, or in other words, the yield of mutating seeds, is more or less dependent upon external life conditions.

The Elements of Plane and Solid Analytical Geometry. By Albert L. Candy, Ph.D. Boston: D. C. Heath & Co., 1904. 12mo.; pp. 247. Price, $1.50.

The author has recognized the interdependence of algebra, geometry, analytics, and calculus in mathematics, and the present work is prepared with this idea in mind, so that the student is led step by step up to the higher branches. It is a well-known fact that calculus proves a stumbling block to many students, because they have not been thoroughly trained in analytic geometry and shown its connection therewith. To avoid this, the present work is treated in an original manner, matter not ordinarily found in text books being introduced. The problems are dealt with in a very graphical manner and very freely explained.

Homophonic Vocabulary in Ten Languages. By Charles B. Waite, A.M. Chicago: C. V. Waite & Co., 1904. 8vo.; pp. 162. Price, $2.

In the preparation of this work, which is the result of more than three years' labor, Mr. Waite has taken the first step toward a universal language. Starting with ten languages, namely, English, French, Spanish, Portuguese, Italian, German, Dutch, Danish Norwegian, Swedish, and Russian, the author expected to find but a few hundred words which had similar sounds and significance in each tongue. He has finally been able, however, to find more than two thousand words, nearly all of them in common use. This list, which has been carefully revised and corrected, is intended to serve as a basis for common root words, upon which to found a common language for the Indo-Germanic family. The words are arranged in alphabetical order, in ten columns, occupying two pages each. An explanatory introductory article is printed in all ten languages, as is also the title page. A special feature of the volume is a complete family tree of the Indo-Germanic family of languages. The book is interesting as showing the possibilities in the way of a universal language.

Boiler-Room Chart. By George L. Fowler. New York: Norman W. Henley Publishing Company, 1904. Size 14 x 28 inches. Price, 25 cents.

This chart, which is intended to show at a glance any part of a boiler-room equipment, is a large drawing in isometric perspective, illustrating water-tube boilers, ordinary grates, and mechanical stokers, feed-water heaters, and pumps. The various parts of the different mechanisms are shown broken away, so that the internal construction may be readily seen. Reference numbers of the different parts refer to the list of these parts at the side of the chart.

AMERICAN TOOL MAKING AND INTERCHANGEABLE MANUFACTURING. By Joseph V. Woodworth. New York: The Norman W. Henley Publishing Company, 1904. 8vo.; pp. 400; 970 illustrations. Price, $4.

This work is intended for the practical draftsman, machinist, and tool maker. In it the author has endeavored to give accurate and concise descriptions of the fundamental principles, methods, and processes by which the greatest accuracy and highest efficiency may be attained in the production of repetition parts in metal at the minimum of cost. The construction of a large number of special tools and their use is gone into fully, and complete directions for making various tools, jigs, etc., are given. Tools for working various metals are described in detail, as are all the processes by which these various metals are worked. The book is very complete, being illustrated by over 600 drawings, and it should be found in the library of every machinist and tool maker.

THE MECHANICAL ENGINEERING OF COLLIERIES. By T. Campbell Futers. London: The Chichester Press, 1905. 4to.; pp. 128. Price, $3.

The present book is the first of two volumes on this subject, and it deals with boring, sinking, surface arrangements, headgears, and shafts. The book gives all the latest information of value to the colliery engineer, and it is profusely illustrated with numerous half-tone plates and line drawings to the total number of 294. All the most recent improvements—both electrical and mechanical—in mine-boring and shaft-sinking machinery are described, and the work will no doubt be highly appreciated by all mining men.

ELEMENTARY COURSE IN MECHANICAL DRAWING. Part I. By Arthur W. Chase, B.S. Chicago: Howland Speakman, 1904. Size, 7 x 9 inches; pp. 189; 97 illustrations. Price, $1.50.

This book is a simple, untechnical work on the subject of mechanical drawing. All plates required in the course are omitted from the book, thus preventing the copying of such plates by the student. The course contains a brief drill of a few fundamental geometrical problems. Orthographic projection is studied from models, thus giving the student a concrete instead of an abstract conception. Specifications are given for each problem, so that the pupil may have a drill similar to what he would experience in practical work.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending March 28, 1905

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Advertising coloring materials, paints, etc., method of and device for, J. F. Gould.. 786,210
Advertising device, Farnsworth & Martin.. 786,018
Aeroplane, A. P. Criswell 785,717
Aeroplane covering, I. Lancaster 785,740
Air and gas motor, compressed, M. E. Clark 785,713
Air brake control, F. B. Corey 786,008
Air brake system, automatic, F. B. Corey. 786,007
Air compressor, hydraulic, C. R. Jones 785,889
Air separator, C. H. Lane 785,811
Alimentary composition, B. Gollwitzer 786,111
Aluminium or other metals, extracting, H. S. Blackmore 786,244
Amusement apparatus, S. Miyata 786,229
Animal colics or gripes, apparatus for treating, A. Hepnar 786,215
Animal dipping apparatus, E. W. Bennett. 786,089
Antiseptic mats, manufacture of sanitary, J. P. Suter 785,838
Armatures, commutating device for alternating current machine, M. Deri 786,010
Awl, sewing, M. R. Botkin 786,000
Awning and frame, folding, J. A. Peltock.. 785,915
Axle skein, G. U. Rounds 786,159
Bag fastener, A. F. Fuller 785,870
Bale tie, E. L. Pence 786,147
Ball, appliance for playing table foot, M. Gillett 786,206
Bandage dressings, preparing, M. Cohn..... 786,004
Bar fixture, C. C. Finch 785,942
Bath brush and connection, spray, A. W. Nichells 785,824
Bathing apparatus, C. H. C. Jordan 786,127
Bearing, roller, W. C. Fownes, Jr......... 785,944
Bedstead construction, A. Taylor 786,173
Belt stud tool, J. Stocker 786,065
Binder frame, W. J. Watters 785,924
Binder, loose leaf, P. Montgomery 785,750
Binder, temporary, F. L. Nold 785,911
Bit. See Drill bit.
Blotter, A. N. Sill 785,836
Blower, H. E. Parson 786,234
Bobbin carrier, G. Dingendahl 785,718
Boiler flue scraper, W. G. Bolus 786,092
Boiler tube tightening device, F. J. E. Johansson 785,888
Boiler tubes, tool for operating upon, J. L. Smith 786,064
Book, scrap, A. M. Pettengill 786,235
Boron by electrolysis, production of, Lyons & Broadwell 785,962
Bottle, R. J. Modespacher 786,134
Bottle corks or like stoppers, means for securing, J. J. Chavasse 785,859
Bottle or the like receptacle, milk, F. Hammond 786,212
Branding iron, self heating, Parker & Garnett 785,827
Brick or tile cutting machine, C. R. Codding 786,003
Bricks from coal or coke refuse, manufacturing, J. Hammerschlag et al......... 786,028
Broom handle attachment, L. Shaffner..... 786,166
Brooms into bundles, device for assembling, A. P. Longdon 786,228
Buckle, suspender, M. L. Rothschild 785,920
Buggy top brace, P. W. & D. D. Meyer... 786,138, 786,139
Building block, J. F. Dunham 786,250
Burner, H. K. Hess 786,123
Butter cutter, C. P. Ross 785,978
Butter tray, A. C. Hummer 785,952