NEW BOOKS, ETC.

A HAND BOOK OF GENERAL INSTRUCTIONS FOR MECHANICS. Containing Useful Rules and Memorandum for Practical Men. New York: D. Van Nostrand Company, 1909. 12mo.; 328 pp. Price, $1.50.

The primary object of the author in writing this book is to give the mechanic, who has not had educational advantages, a text-book explaining established rules for calculating in a clear, simple, and concise way, making him familiar with the various technical terms and their meaning, and to be in general such a course of instruction as to impart in a simple manner the required knowledge to enable him to read understandingly more advanced works. The plan of the book is excellent, and the illustrations and examples are particularly clear. There is hardly anyone who has much occasion to use figures who would not be benefited by a perusal of parts of this book.

PRECIOUS METALS. Comprising Gold, Silver, and Platinum. By T. Kirke Rose, A.R.S.M., D.Sc. New York: D. Van Nostrand Company, 1909. 12mo.; 295 pp. Price, $2.

This is one of the volumes of the "Westminster Series," which has proved such an excellent collection of technical literature. The present volume deals with the methods of treating gold by the wet and dry process. The extraction of silver, the refining and assaying of gold and silver ores, the assay of gold and silver bullion, minting, the manufacture of gold and silver wires, and a valuable chapter on platinum, together with tables on the production of precious metals. There has been room for a good book on gold and silver for some little time. This book seems to fill the niche admirably.

MOTORMAN'S PRACTICAL AIR BRAKE INSTRUCTOR. By George R. Denehie. Chicago: Frederick J. Drake & Co., 1909. 18mo.; 280 pp., leather back.

This is a concise up-to-date treatise on the construction and operation of the different air-brake equipments used in modern electric transportation. The author has been at considerable pains, therefore, to collect, condense, and compile all the latest available information bearing upon this most important subject of handling an electric car or a train of cars safely and at the same time economically. The diagrams and illustrations are particularly clear. Some of them are reproduced in colors. The get-up of the book, however, is not equal to another book on the same subject which we reviewed a short time since.

LIFE OF SIR CHARLES TILSTON BRIGHT. Civil Engineer. By Charles Bright, F.R.S.E. London: Archibald Constable & Co., Ltd. New York: D. Van Nostrand Company, 1908. 8vo.; 478 pp. Price, $4.50.

In this book is incorporated the story of the Atlantic cable and the first telegraph to India and the colonies. In response to a number of suggestions in view of the fiftieth anniversary of the Atlantic cable, Mr. Bright has brought out an abridged edition of the biography of his father, the original work having been written by Sir Charles Bright's brother and by his son. There is probably no branch of engineering which lends itself so readily to a full sight of the world as that of telegraphy. Therefore, the present volume will appeal to the general reader only in a lesser degree than to the engineer, the student, and the historian. Sir Charles Bright was as much a traveler as a scientist, and even when engaged on the most trying cable venture in unhealthy climates, he invariably kept a neatly written record of the day's performance—of what he had seen and learnt—never retiring to bed without attending to his task. The detail to be drawn upon is very large, and the author has certainly made an excellent selection. The story of the Atlantic cable is one of the most romantic in the history of science, and it is gratifying that the biography of the pioneer should be written by his son.

THE LEAD AND ZINC PIGMENTS. By Clifford Dyer Holley, M.S., Ph.D. New York: John Wiley & Sons, 1909. 12mo.; 340 pp.; 85 figures. Price, $3 net.

New pigments have come into use during the last ten years, new processes have been developed for the manufacture of the older pigments, new combinations of pigments have been worked out that have secured results hitherto unattainable. Yet up to the time mentioned above, except for short articles in some of the trade papers, these improvements and innovations remained practically unnoticed. Since public attention has been directed to the paint industry by the enactment of the various State laws regarding the sale of paint materials, several excellent American works have been written on this subject, but the majority of them have been directed more particularly toward the compiling of analytical methods and data than to the manufacture and uses of the various pigments. In this work the author has attempted to record the progress made in the United States in the manufacture of the more important pigments, and hence but little space has been given to European methods and processes except for comparison, as they have been discussed in detail in various English and European works.

MANUAL OF STEAM ENGINEERING. By W. H. Wakeman. New York and Chicago: New York Belting and Packing Company.

Mr. Wakeman's name is familiar to readers of the SCIENTIFIC AMERICAN SUPPLEMENT, as well as to readers of technical journals in general, as the author of many articles on engineering subjects. In this little book he has presented instructions, suggestions, and illustrations for steam engineers concerning the application to modern daily practice of the approved theory of steam engineering. Although the work is issued no doubt as an advertising pamphlet, it is essentially an engineering reference book containing data that are required in everyday practice, arranged in convenient form and with sufficient explanation to render the matter both interesting and instructive.

Legal Notices

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Home-Made Experimental Apparatus

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If there is any scientific, mechanical, or engineering subject on which special information is desired, some papers will be found in this catalogue, in which it is fully discussed by competent authority.

A few of the many valuable articles on the making of experimental apparatus at home are given in the following list:

ELECTRIC LIGHTING FOR AMATEURS. The article tells how a small and simple experimental installation can be set up at home. Scientific American Supplement 1551.

AN ELECTRIC CHIME AND HOW IT MAY BE CONSTRUCTED AT HOME, is described in Scientific American Supplement 1566.

THE CONSTRUCTION OF AN ELECTRIC THERMOSTAT is explained in Scientific American Supplement 1566.

HOW TO MAKE A 100-MILE WIRELESS TELEGRAPH OUTFIT is told by A. Frederick Collins in Scientific American Supplement 1605.

A SIMPLE TRANSFORMER FOR AMATEUR'S USE is so plainly described in Scientific American Supplement 1572 that anyone can make it.

A ⅛-H.-P. ALTERNATING CURRENT DYNAMO. Scientific American Supplement 1558.

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A SIMPLE CAMERA-SHUTTER MADE OUT OF A PASTEBOARD BOX, PINS, AND A RUBBER BAND is the subject of an article in Scientific American Supplement 1578.

HOW TO MAKE AN AEROPLANE OR GLIDING MACHINE is explained in Scientific American Supplement 1582, with working drawings.

EXPERIMENTS WITH A LAMP CHIMNEY. In this article it is shown how a lamp chimney may serve to indicate the pressure in the interior of a liquid; to explain the meaning of capillary elevation and depression; to serve as a hydraulic tournique, an aspirator, and intermittent siphon; to demonstrate the ascent of liquids in exhaustive tubes; to illustrate the phenomena of the bursting bladder and of the expansive force of gases. Scientific American Supplement 1583.

HOW A TANGENT GALVANOMETER CAN BE USED FOR MAKING ELECTRICAL MEASUREMENTS is described in Scientific American Supplement 1584.

THE CONSTRUCTION OF AN INDEPENDENT INTERRUPTER. Clear diagrams giving actual dimensions are published. Scientific American Supplement 1615.

AN EASILY MADE HIGH FREQUENCY APPARATUS WHICH CAN BE USED TO OBTAIN EITHER D'ARSONVAL OR OUDIN CURRENTS is described in Scientific American Supplement 1618. A plunge battery of six cells, a two-inch spark induction coil, a pair of one-pint Leyden jars, and an inductance coil, and all the apparatus required, most of which can be made at home.

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A CHEAP LATHE UPON WHICH MUCH VALUABLE WORK CAN BE DONE forms the subject of an article contained in Scientific American Supplement 1562.

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CHEMISTRY OF SOLDERING AGENTS.

(*Concluded from page 389.*)

chloride preparations are very convenient in use and very reliable, causing the solder to adhere firmly. Even when the surfaces to be joined are greatly oxidized, a good joint can be made by a skillful workman. In order to prevent the possibility of injurious after effects, it is customary to wash the soldered joint with zinc chloride solution. Cable joints made with the aid of zinc chloride were opened and examined after the same intervals of time that were allowed for the joints made with ammonium chloride. Although the zinc chloride also penetrated between the wires the difference in the result was very great. The wires of the core were covered with a dry, wax-like dark green coating, and a substance resembling pitch was found in places where the other ingredients of the zinc chloride soap had been decomposed by overheating, but junctions which had been traversed by strong currents for long periods showed no appreciable increase in resistance.

The assertion that injurious effects are necessarily produced by hydrochloric acid separated by hydrolysis from the hygroscopic zinc chloride was also submitted to the test of experiment. Copper wires less than 1/250 inch in diameter were soldered together and the junctions were covered thickly with the zinc chloride mixture and inserted in an apparatus with which their resistance could be measured while a current was kept flowing through them. In a few days the mixture became moist, but it quickly dried and assumed the wax-like appearance described above. The wires were exposed freely to the air, but observations continued through a long period revealed no deterioration of the joint.

Hence it may be asserted, as the result of exhaustive researches continued for years, that zinc chloride is in every way superior to ammonium chloride as a soldering agent. The inference that ammonium chloride is safe because it is possible to obtain it unmixed with free acid, is a pure delusion, for the injurious action of ammonium chloride on metals is due, not to the comparatively harmless hydrochloric acid, but to the other causes mentioned above.

The extraordinarily good practical effect of zinc chloride preparations, however, still requires explanation.—Zeit. f. Ang. Chemie.

SOUNDING THE OCEAN OF AIR.

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mer, autumn, or winter. Kites and balloons have been sent up from almost every quarter of the earth. Perhaps the most recent of these investigations in an out-of-the-way quarter of the globe is the meteorological expedition to East Africa undertaken by the Royal Prussian Meteorological Observatory. The expedition was conducted by Prof. Berson and Prof. Elias. The chief object was to determine the origin of monsoons, an object which was not altogether attained, but on which much light was thrown. An ultimate aim was the prognosis of the rainy season in East Africa and India. On the coast and from a specially chartered steamer on the lake, *ballons-sondes*, pilot balloons, and kites were sent up. The observations over the equator, in the center of the continent, showed very low temperatures at great heights, as did the expedition of Teisserenc de Bort and Rotch on the equatorial Atlantic, but with the difference that over the African continent there was a trace of the permanent inversion layer. The vertical changes were as follows: adiabatic decrease of temperature to 13,000 meters, between 13,000 and 15,000 meters a small inversion, and above 17,000 meters isothermal conditions. Above the southeast monsoon the wind was south-southwest, and three times a westerly wind was observed between 15,000 and 18,000 meters, above the great equatorial current from the east which is supposed to prevail at all heights.

It was feared that a very large per cent

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of the balloons which fell on land would be lost, because of the nature of the country and the sparseness of the population, but on the contrary an astonishing proportion of them was recovered, owing to the keenness of vision of the natives, to whom a small reward was offered for every one returned.

What has been the result of this international aerial sounding? It has been discovered that all over the earth the air is stratified in three more or less distinct layers. The lowermost of these, the layer in which we live and which extends upward for two miles from the surface of the earth (at which height the freezing point is encountered) is a region of turmoil—warm to-day and cold to-morrow. This is the stratum of capricious winds, cyclones and anti-cyclones, of cool descending currents and warm ascending currents. All our weather forecasting is at present based on what can be learned from the general circulation of the air in this lowermost layer.

Above this first layer, which extends upward for perhaps two miles, begins the second layer, which is about six miles thick, and is less turbulent than the first. In it the air grows steadily colder and drier with increasing height. Temperatures as low as 167 deg. below the Fahrenheit freezing point have been recorded here. Whatever thermal irregularities there may be are caused by temperature changes on the surface of the earth and by the reflection of solar heat from clouds. The wind blows always in the same easterly direction; and the greater the height, the more ferocious is the blast.

The last of all the layers thus discovered lies above this. Originally revealed by Teisserenc de Bort and Dr Richard Assmann almost simultaneously, it was first known as the "isothermal stratum," because its temperature seemed to be stationary. Later, when it was found that the temperature, instead of remaining fixed, gradually increased, it was rechristened the "permanent inversion layer." The height of the inversion layer has not as yet been determined. It must not be supposed that, because its temperature rises, it is much warmer than in the second layer. As a matter of fact, its temperature must be placed somewhere between 122 deg. and 140 deg. below the Fahrenheit freezing point. This permanent inversion layer is puzzling in the extreme. In passing from the second to the permanent inversion layer, the wind is stilled to a breeze, the velocity decreasing from 25 to 80 per cent. The air blows no longer in a steadily easterly direction, but almost as capriciously as it does at the surface of the earth. Dryness, excessive dryness, is another characteristic of the permanent inversion layer. In summer time, the permanent inversion layer begins at a height of about 7½ miles above the earth; the higher it lies, the colder it is; the lower it lies, the warmer it is. There is no bodily shifting up and down of warm and cold masses of air, so that a current ascending from the lower level spreads out when it encounters the permanent inversion layer, just as hot air which strikes the ceiling of a room.

Up to about 10 kilometers the decrease of temperature is almost adiabatic, then in the next 5 kilometers there is usually a rise in temperature of 8 deg. to 10 deg. C., with isothermal conditions up to at least 26 kilometers. The lower zone Teisserenc de Bort calls the "troposphere," and the upper one the "stratosphere." The former is a region of violent atmospheric disturbances, for it has been shown that cyclones do not extend above the cirrus clouds, though anti-cyclones persist to greater heights, and therefore the stratosphere is lowest in the cyclone and highest in the anti-cyclone, and its level sinks from the equator to the poles. The stratosphere is a region of interlaced currents and small vertical movements.

Up to the height of the permanent inversion layer, the temperature falls at an average of one degree C. per 100

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Mixtures, obtaining intimate, E. Dor-Delattre 939,989

meters (one degree F. per 182 feet). Because of the constant upheavals to which the air is subject in its lower levels, this average rate of temperature reduction as we ascend is not always observed. Sometimes it even happens that for a short distance the thermometer rises instead of falls, but ultimately the temperature drops at a uniform rate until it reaches a point lower than that recorded by any North Pole explorer.

The three layers of air which have been discovered by kites and balloons intermingle but slightly; one floats upon the other as oil floats upon water. Of the great ocean of air at the bottom of which we move and live, three-fourths lies below the permanent inversion layer. All our storms, our clouds or dust are phenomena of the lower two layers.

Treatment of the Eye by X-Rays.

(*Continued from page 394.*)

cyclitous stages, a very moderate application of X-rays does not have an injurious effect upon the ocular tissues and is able, with the aid of local medication, to overcome the disease. In this connection I may cite a personal experience, in which one of my patients was afflicted with a serious ocular traumatism, perforation of the cornea, traumatic cataract, and plastic iridocyclite of fifteen days' standing. The case was brought to me for consultation on the 2d of February, 1907.

The eye was hypotonous, vision was extinct, hardly a sensation of light being preserved. The case seemed to be hopeless, and in despair I made, in the course of one week, four applications of X-rays, extending from the 2nd to the 14th of February, and simply prescribed atropine.

On the 3d of April improvement was apparent, the eye resumed the normal tension, although there still remained perikeratic inflammation and only a very weak luminous perception.

A new radio-therapeutic treatment was effected the same day, and on the 5th of June all traces of the inflammation having completely disappeared a month previously, I was able to extract the cataract with complete success.

It is certain that one single case is not as safe to base conclusions on as is a series of observations on analogous cases. I have always thought, however, as a result of my experience in this case, that I would never have been able to obtain such a rapid improvement and radical cure without X-rays.

Since 1907 I have treated in this manner six cases of iridocyclite and a case of optic neurosis by the continuous rays. In the four initial treatments I have never applied irradiation too strongly, since the very first case (cataract and leucoma) revealed to me the danger of repeated treatments. The treatment has been considerably diminished in duration, and the cure is effected more rapidly than by ordinary medication. Irradiation of neurosis six times in the course of two months did not result in any improvement, but was terminated by optical atrophy.

This personal experience corroborates the conclusions of Cook and of Coover regarding the discontinuous effects of X-rays. The observations reported by the latter apply to *intermittent* X-rays, which seem, in those cases where they have been utilized, to have a particular efficacy upon processes of cellular regeneration.

The cases treated by Coover related to four ulcerous corneas, two iridocyclites, and three optical atrophies. The ulcers and the iridocyclites were cured in a few treatments; and as for the atrophies of the optic nerve, an improvement was achieved in one case after four treatments, in another after three treatments, and in the last case after seven treatments.

These really striking results, especially in cases as grave as optic atrophy, lead

(*Concluded on page 403.*)

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Storm shield, C. F. Wensinger	940,413
Stove attachment, cook, O. Deschamps	940,238
Stove regulator, gas, A. M. Johnson	940,391

us to hope that in a not far distant time we shall be able to cure this redoubtable affection, or may at least be able to prevent its evolution from the moment that the diagnosis has been made.

Time alone will assure that the cures related by Coover are permanent. The results so far achieved, however, deserve, in my estimation, our serious consideration.—Cosmos.

Test of an American Helicopter.

In the recent Berliner-Williams helicopter trials at Washington, D. C., on the farm of Mr. Emile Berliner, the two revolving-cylinder motors of Mr. Berliner rested upon the platform of the machine, each being connected by its own countershaft to the main gear-wheels of the oppositely revolving propeller shafts, which are tubular and concentric. Mr. Williams also stood upon the platform, on the opposite side of the shaft from the motors. The total weight lifted in this trial, including Mr. Williams, was 610 pounds. The weight of the complete helicopter without him was 460 pounds; and the two motors, with countershafts, pinions, connections, etc., weighed 248 pounds.

In previous trials each of the motors, installed singly, had lifted the machine, with a little added weight upon an outrigger, for balance; the thrust, or lift, being about 350 pounds, which compares favorably with previous experiments made by Mr. Berliner last fall, when, with a single propeller of somewhat greater diameter and area, he got about the same results.

The two motors, which are duplicates, are of the star-shaped, 5-cylinder, revolving type of 36 rated horse-power. They were built specially for Mr. Berliner, and they had been overhauled, tested, and worked into good running shape at Mr. Berliner's laboratory.

The helicopter, built by Mr. J. Newton Williams, of Darby, Conn., about two years ago, was first tried with a motor that proved to be too small for the work. It was then connected by flexible shafting to the factory power, to test the thrust of the propellers, which in a series of trials with from 13 to 19 measured B. H. P. lifted from 250 to 430 pounds, and in a final trial, in which the horse-power was not measured, a thrust was obtained of 560 pounds. The machine was later taken to Hammondsport, N. Y., where an 8-cylinder 40 horse-power Curtiss motor was installed, and a number of trials made, the motor lifting the machine with added weight, totaling from 410 to 485 pounds, but not being equal to lifting the weight of an average-sized man.

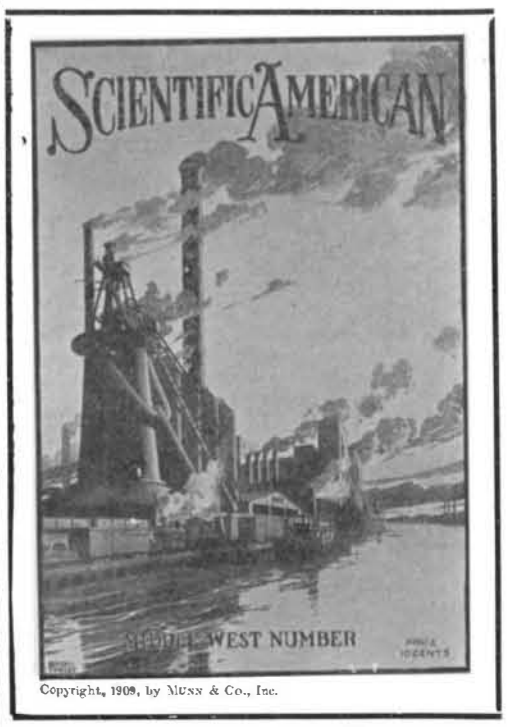
In this last trial at Washington the blades of the propellers had been enlarged, increasing their diameter from 16 feet 8 inches to 18 feet 8 inches, and increasing their area from 64 to 80 square feet. This increase of superficial area of the propellers increased the general efficiency of the machine, as the greater lifting surface gave a greater resultant lift per unit of horse-power, and the reduced revolution speed of the propellers, due to increased resistance, gave a reduced revolution speed to the motors, which, with the transmission used, seemed to give them greater efficiency.

The propeller speed was 120 R. P. M., while the speed of the motor was 900 R. P. M.

Mr. Williams expects to have a 7-cylinder motor built of the same revolving type, and of 50 per cent more power, and will also build a helicopter on about the same lines, but of larger size and lighter construction.

The completed machine will have a parachute to retard the fall in an emergency, and its dirigibility is assured by very simple controlling devices, which are now being patented.

It is regrettable that the Lighthouse Board has changed the name of the buoy marking the historic spot where the ironclad "Merrimac" went down after her defeat by the "Monitor." "Merrimac wreck buoy 28" will now be called "Channel buoy 28."



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The Middle West Number of the SCIENTIFIC AMERICAN

On December 11th, 1909, the Scientific American will issue a number devoted entirely to the wonderful Middle West region of the United States, a number which will set forth broadly and lucidly not only the agricultural interests of that region, but also those larger engineering undertakings which are destined to transform the Middle West, in part at least, into a manufacturing territory.

With that object in view the Middle West Number will publish articles on the following subjects:

I. The Chicago and Gulf Waterway.—An illustrated description of Chicago's drainage canal, an engineering work which stands without a parallel in the world.

II. Chicago as a Railroad Center.—Chicago is the greatest railroad center in the world.

III. The Wonderful Grain Trade of Chicago.—Chicago is an enormous wheat bin, into which much of the grain raised in the middle West is poured.

IV. Shipping on the Great Lakes.—Most of the iron ore that is now smelted in Pennsylvania is mined in the middle West. To transport it to the blast furnaces of the East at a cost which will enable American steel makers to compete with foreign steel makers, it has been necessary to devise a new kind of lake transportation. Ships of 10,000 and 12,000 tons burden have been constructed which convey ore at small cost through the Great Lakes, and which are without a counterpart anywhere in the world.

V. The Handling and Shipment of Iron Ore.—The above-mentioned fact that iron ore is mined in the middle West and smelted in the East has necessitated not only the construction of special freight-carrying steamers, but also the designing of special machinery for loading and unloading the ore from the steamers.

VI. Freighting on the Mississippi.—Freighting on the Mississippi is a more important industry than most of us may realize.

VII. The Steel Industry.—One of the greatest steel plants in the world is that which has been built at Gary.

VIII. The Freight Subway System of Chicago.—Chicago can boast of a rational system of handling freight by means of subways.

IX. The Water Supply of Chicago.—Chicago's source of water is Lake Michigan. The city is supplied with water by means of a tunnel which extends two miles out into the lake.

X. Reclaiming Arid Lands.—The United States Government has under way many irrigation projects for the purpose of reclaiming lands which are arid, but which will blossom if properly watered.

XI. Harvesting the Grain of the Middle West.—Farms that cover not acres but square miles, crops that aggregate not simply bushels, but car-loads, have rendered it necessary to plant and harvest on an unprecedented scale in the middle West. The ingenious agricultural machinery which has been designed to cope with these peculiar conditions is described and illustrated.

The Middle West Number will be more than twice the size of the regular SCIENTIFIC AMERICAN. It will be lavishly illustrated. It will be contained in a colored cover which strikingly depicts Chicago's grain elevators at work. Order from your newsdealer or from

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