rous sulphate 4 per cent. 2. Common salt 60 per cent, sal-ammoniac 60 per cent, sodium bicarbonate 80 per cent. 3. Sal-ammoniac 100 per cent, sodium sulphate 60 per cent, sodium bicarbonate 40 per cent.

(10558) J. H. writes: Will you please inform me who manufactures the gas ignition pellet for sale? Also what the ingredients are, and in what proportion they are mixed, and how fastened to the mantles which render them self-igniting mantles? A. There is only one substance within our knowledge which can be heated by a stream of gas striking it, so that it will ignite the gas. That substance is spongy platinum. It is used in the Döbereiner lamp, where a stream of hydrogen impinges on a platinum sponge. Platinum in this form is capable of absorbing 800 times its volume of oxygen, which does not enter into combination with it, but is simply condensed into its pores, and is available for combination with other bodies.

(10559) M. H. N. asks: If a raceway measures 2 feet 6 inches deep and 5 feet 8 inches wide, and water flows at the rate of 60 feet per minute, what is the flow per hour, and what is the probable amount of horse-power obtainable from a head of 18 feet? A. A flow of water 2 feet 6 inches deep by 5 feet 8 inches wide at the rate of 60 feet per minute, at a head of 18 feet, is, theoretically, equal to 28.9 horse-power. About 75 or 80 per cent of this could be utilized commercially by a turbine, if the flow of water and head remain constant.

(10560) J. N. R. says: You will do me quite a favor if you will solve the following problem for me: Supposing we have a vessel with a hole in the bottom into which fits a hollow tube closed at both ends and six inches long. We will say this tube fits the hole so that no water could leak through, yet works with perfect ease. Now say we should put into this vessel four inches of water; what would the result be if the tube weighed one-fifth the weight of the water? Would the tube rise, or would it go through, or would it remain stationary? Have submitted this problem to several very "learned" men in this city, but none of them seem to "have time" to work it. They all say they *could* do it if they just had time. By solving the above for me and explaining why, you will confer a great favor. A. If the hole in the bottom of your vessel is round and smooth, and the hollow tube fits it perfectly and without friction, as you say, the tube will fall through the hole, whether there is water in the vessel or not, and it will take just the same force to hold it up when the vessel is full of water as when it is empty. The reason for this is that water exerts a buoyant effect on bodies which are immersed in it, causing an upward pressure on the bottom of them. If your tube is so protected by the hole in the bottom of the vessel that the water cannot get underneath, it can have no buoyant effect. If you fill your vessel sufficiently full of water to have the water cover the upper end of the tube, the water will exert a downward pressure on the top of the tube, which should be added to the weight of the tube, in order to get the total force with which it tends to slide through the hole.

(10561) J. W. H. says: Will you kindly tell me how to rid a house of cockroaches? A. Some years ago we had a cockroach powder analyzed and found it to consist of powdered borax 90 per cent; corn starch 10 per cent, and a little coloring matter. We think this will answer your purpose.

(10562) W. F. N. writes: I wish to elevate 125 miner's inches of water 18 feet, and have a waste flume 30 feet long, 6 feet wide, 12 inches of water deep, running 20 feet in 4 seconds. What is the best way to do this? There is no fall at end of flume, and I wish to utilize the power the water gives. Would it be best to put in an undershot wheel with lifting buckets in each side, or an undershot wheel and work a centrifugal pump or any other kind of pump that is best adapted to the work? A. The flow of waste water in your flume, at the rate of 20 feet in four seconds, corresponds to only about 3-100 of one horse-power. This would lift only about 8-10 of one cubic foot of water to a height of 18 feet per minute, if it could all be utilized. The amount of power available is so small that we do not consider it at all practicable to attempt to use it. A gas engine and a centrifugal pump would probably be your most feasible plan.

(10563) J. N. P. says: Please answer the following questions: 1. How is the horse-power of a river estimated, when the depth, breadth, and fall per mile are known? A. The horse-power of a river is estimated by first finding the number of cubic feet of water that flow per minute when the river is at its lowest. This may be obtained by multiplying by the average velocity of the water per minute. This velocity may be determined approximately by timing rods loaded at one end as they float down stream. It is next necessary to ascertain what head or fall is available for a waterwheel, in case the river is dammed or canals built. The horse-power equals the number of cubic feet per minute multiplied by 62.4, multiplied by the available fall in feet and this product divided by 33,000. 2. How is the horse-power of a pipe estimated when the size of the pipe and the quantity of water delivered per minute are known? A. The horse-power of the pipe is estimated by multiplying the number of cubic feet of water per minute in the pipe by 62.4, multiplying this by the head in feet, and dividing this product by 33,000.

(10564) A. P. says: Will you kindly inform me which is the best way to can sweet corn for further use so it will not spoil, such as the canning factories do? A. Among fruits, etc., green corn is one of the most difficult to preserve by canning. The following is the method in use by many of the large canning establishments: The corn, after removing from the cob, is filled into the clean cans so as to leave no air spaces. These are placed in a large oven or other air-tight vessel, and subjected to hot steam under pressure. The harder the corn, the longer the exposure required to cure it; it is said that in some cases as much as eight hours is requisite, but usually much less than this. A large vessel of boiling water, in which the cans are immersed, may be used instead of the steam oven, but is not so effective. On removal from the oven or water bath, as the case may be, each can (they must be filled to the cover with fruit) has the cap with a very small hole tapped in its center immediately soldered on. As soon thereafter as the can stops blowing, as the escape of steam and air through the vent is termed, the hole is quickly soldered. This must be done before the air begins to enter. Other fruit is cured and canned in like manner; tomatoes rarely require longer than fifteen to twenty minutes steam curing. Where the pits are left in fruit, a longer time is requisite to completely destroy all fermentative germs.

(10565) A. V. B. says: 1. Theoretically what are the most favorable conditions for obtaining the greatest efficiency compound steam engines? A. Theoretically, the highest efficiency with a compound steam engine can be obtained with the highest possible boiler pressure and the most perfect vacuum attainable, and the cut-off in both cylinders arranged so that the steam in each case expands down to the back pressure line. Practical considerations, however, and the influence of the condensation of the steam in the cylinders, materially alter the last half of this statement in practice, and the steam is seldom expanded more than from two to three or three and a half times its original volume in each cylinder of the compound engine. 2. For given stroke, what should be proportionate diameter of cylinders? A. There is no fixed rule governing the proportioning of the diameters of the cylinders of either simple or compound engines. Practice and the judgment of engineers differ widely on this point. You can get a good idea of the proportions that are used in common practice by going over the files of any of the leading power journals and noting the comparative sizes of the cylinders given for the different engines that are described. By making a calculation of such figures from them, you obtain the best rule for cylinder proportions which it is possible to formulate with the present state of our knowledge. 3. Is there any rule for proportioning stroke and diameters of cylinders for given rate of piston speed. A. The piston speed does not materially influence the cylinder proportions, other things being equal, and high piston speed is favorable to good economy, and the best engines have a piston speed varying according to their size and design from 600 feet per minute to 700 or 750 per minute 4. Which do you consider the best type of compound engine now operating on the different railways? A. The experience with compound locomotives has been too short for engineers to decide definitely which is the best type. With stationary engines, the cross compound Corliss engine is conceded to be the most economical. 5. What are the difficulties to be overcome in adapting the compound engine to the locomotive? These answers to be based on the performance of a two-cylinder compound or one high and one low pressure cylinder. Any information along these lines not covered by questions asked will be appreciated. Please give comparative performance of simple and compound engines, same power working under same conditions, relative to cost of performance, consumption of fuel, etc. A. The difficulties that have to be overcome with the compound locomotive are: First, the difficulty in starting on grade or under heavy load. Second, equalizing the work on the two sides of the engine under all conditions of load. Third, the balancing of the reciprocating parts. Fourth, the difficulty of simultaneously varying the cut-off in the two cylinders in such a way as to get the same effect as is obtained by shortening the cut-off in the simple cylinder. Fifth, the increased danger of breakdowns, due to the more complicated mechanism and the difficulty of getting engineers who can intelligently operate and care for the compound engine. With stationary engines a gain of nearly 40 to 50 per cent may be obtained by compounding. With locomotives the decreased fuel consumption is not quite so great, 35 per cent being perhaps an average figure.

(10566) H. E. C. writes: I am seeking information concerning wagons. I feel quite sure that some experiments have been made relative to the size of wheels, size of axle skein proper, location of load, etc., but I am unable to find such matter in published form. I need the information in preparation of an article for an agricultural paper upon farm wagons. Can you help me out in any way? A. Theoretically, the larger the wheel and the smaller the axle the less the friction. Practical considerations of strength and convenience therefore govern the determining of the sizes of wheels and axles used. As a rule, larger wheels are used on the rear axles of wagons. Therefore, a load can be drawn more easily if it is placed near or over the rear axles. The wagon also steers more readily if the load on the front axle is small. These are the only points governing the location of the load. In Vol. XIV., page 1014, of the Transactions of the American Society of Mechanical Engineers, you will find an article by Thomas H. Brigg on the haulage of horses, which may interest you.

NEW BOOKS, ETC.

THE FOOD AND DRUGS ACT. June 30, 1906. A Study with Text of the Act, Annotated, the Rules and Regulations for the Enforcement of the Act, Food Inspection Decisions, and Official Food Standards. By Arthur P. Greeley. Washington, D. C.: John Byrne & Co. 8vo.; cloth; 176 pages. Price, $1.50.

No act has had such a far-reaching effect as the "Food and Drugs Act," and of no other act has the interpretation been so often sought. This volume fills the need for a work embodying a discussion of the law and a description of its provisions. Chapter I contains a treatment of the "General Purposes and Scope of the Act"; Chapter II. "Procedure under the Act," and Chapter III. "Articles to which the Act Applies." Chapter IV. deals with "Adulteration," and Chapter V. with "Mishandling," Chapter VI. discusses "The Guaranty" in its different phases. The last chapter, Chapter VII., consists of miscellaneous notes on the enforcement of the act; stock in hand; labels and similar subjects. The Appendix gives the Standards of Purity for Food Products, as well as much valuable information. The style of the book is clear and the arrangement of the topics convenient.

THE HANDY WORLD ATLAS AND GAZETTEER. New York: Frederick Warne Co. 16mo.; cloth; 160 pages, 120 maps. Price, 45 cents postpaid.

A small and convenient atlas consisting of a collection of remarkably clear maps, and an alphabetical list of geographical names with their locations.

THE DESIGN OF WALLS, BINS, AND GRAIN ELEVATORS. By Milo S. Ketchum. New York: The Engineering News Publishing Company. 8vo.; cloth; 393 pages, 260 illustrations in the text, and two folding plates. Price, $4.

With the improved methods of handling grain and other granular materials, it has become necessary to design bins on economical lines. While the problem of bin design differs from the design of retaining walls in many ways, a thorough knowledge of the theory of the retaining wall is necessary to a correct understanding of the problem. Probably no subject with which the civil engineer has to deal has evoked so much discussion as the design of retaining walls. One class of writers has evolved elaborate mathematical theories, while another class has approached the subject from the empirical side. Many of the mathematical enthusiasts have failed to appreciate actual conditions of the wall and filling; while most of the "rule of thumb" writers show an entire lack of knowledge of the fundamental theories underlying a theoretical discussion of the subject. Mr. Ketchum has based his discussion on "Rankine's Theory" in which the filling is assumed to consist of an incompressible, homogeneous, granular mass, without cohesion, in which the particles are held together by friction. Although by no means perfect, this theory gives a working basis on which a system of design can be raised which is quite as scientific as most of those followed in engineering. The discussion is given in three parts: Part I. The Design of Retaining Walls. Part II. The Design of Coal Bins, Ore Bins, etc. Part III. The Design of Grain Bins and Elevators.

THE ENGINEERING INDEX FOR 1906. Compiled from The Engineering Index published monthly in the Engineering Magazine during 1906. New York: The Engineering Magazine, 1907. 8vo.; pp. 395. Price, $2.

The present volume follows closely upon the appearance of Volume IV., recently reviewed in these columns, and practically brings the Index down one year closer to date, as it contains entries which appeared in the monthly installment published in the Engineering Magazine down to the beginning of 1907. This "Annual" retains the classification used in the magazine for the benefit of the specialist who desires to see current literature on this subject assembled in a limited space. While the annual issue does not, of necessity, preclude the publication five years hence of any quinquennial volume on the same model as the others, it is hoped by the publishers that it may prove to be a more serviceable arrangement to the majority of readers. Further, its prompt appearance year by year, while the literature it records is still fresh and timely, may make it superior to the larger volume in serving the interests both of its readers and of the publishers of the technical journals indexed. The Index covers 250 technical and engineering journals in six different languages, about one-quarter of the periodicals indexed being in languages other than English. In every case a brief abstract is given, showing the scope and purport of the article, and in many instances this is sufficient for the purpose of the investigator without further reference.

BIRDCRAFT. A Field Book of Two Hundred Song, Game, and Water Birds. By Mabel Osgood Wright. With 80 full-page plates by Louis Agassiz Fuertes. New York: The Macmillan Company. 12mo.; cloth; 317 pages. Price, $2.

The study of birds is a charming amusement which is within the possibility of everyone, live where he may. Scarcely a spot is to be found in which there is no bird life, or which is not within easy distance of a locality in which bird life abounds. Our great cities, with their parks and museums, afford quite as great opportunities as the country for carrying on this pursuit.

"Birdcraft" contains the very information that all but the most technical students desire. It presents in very attractive form the habits of all the birds of this region, as well, of course, as their names and descriptions. The volume is attractively bound and conveniently assembled.

OUTLINES OF INDUSTRIAL CHEMISTRY. A Text-book for Students. By Frank Hall Thorp, Ph.D. Second Edition. Revised and Enlarged and Including a Chapter on Metallurgy by Charles D. Demond, S.B. New York: The Macmillan Company, 1907. 12mo.; 602 pages, 116 cuts; cloth, $3.75.

This book furnishes an elementary course in industrial chemistry which may serve as a groundwork for an extended study of the subject. It describes the more important chemical processes, but with somewhat less detail than would be fitting in a larger work. In spite of the number of excellent works on metallurgy already in existence, this subject has been given a place, owing to the needs of certain colleges and technical schools. The subject of the coal-tar colors, however, has been condensed to the briefest outline, since it is always included in courses on organic chemistry. The treatment of the various subjects is clear and concise and the ground covered very extensive. An excellent idea of how chemical industries are carried on can be gained from this book, even by the layman.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending June 4, 1907.

AND EACH BEARING THAT DATE

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

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Adding machine, A. R. Jennings.......... 856,157
Aerial vessels, sustaining device for, I. Gruber 855,945
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