Heating and Lighting.

GRATE FOR BOILER-FURNACES, ETC.—P. S. SPILLER, Austin, Texas. In this instance the invention has reference to an improvement in grate-bars for steam-boiler furnaces, stoves, or any fire where soft coal, lignite, or any other fuel is used which throws off carbon, its object being to produce a higher degree of heat than is obtained by the usual grate-bars.

Household Utilities.

CABINET.—MARION W. RANDOLPH, Seattle, Wash. Mrs. Randolph's invention is intended especially for use by those who live in apartments of a few rooms where there are no housekeeping conveniences and for those cases where there would be objections to odors which commonly result from the use of gas, coal-oil, or alcohol, and the invention also seeks to avoid the objectionable odors experienced in cooking fish, cabbage, onions, or the like.

Machines and Mechanical Devices.

MEASURING AND REGISTERING PUMP. —W. M. DAVISON, Government Road, Port Pirie, South Australia, Australia. The invention comprises a device whereby publicans and others are enabled to accurately measure out quantities of liquids—such as pints, half-pints, and butchers—and at the same time a record is kept of the number of such measures sold. It is especially useful as a check upon bar attendants, the register being so constructed and operated that it cannot be tampered with.

PIANISSIMO DEVICE.—H. METZGER, Castleton, N. Y. When the soft pedal is pressed in ordinary pianos and the hammer-rest rail is swung rearwardly then the hammer-butt moves away from the upper end of the jack, and when the key is subsequently pressed and the jack raised, it moves a distance inactively before reengaging the hammer-butt and imparting movement to the hammer. To compensate or overcome this inaction or lost motion of the jack is the object of this invention.

CHARGING APPARATUS.—T. F. WITHERBEE and J. G. WITHERBEE, Port Henry, N. Y. The invention relates to a charging device especially designed for blast-furnaces, but capable of general use. By charging through the large or the small bell, as conditions may require, perfect control of the distribution of the charge is given to the furnace manager. If more than one kind of fuel be used, or if it is desired to charge some particular kind of ore at some special locality, it can be readily done by use of the invention.

Railways and Their Accessories.

SNOW-PLOW.—J. S. STOUT, Oxford Junction, Iowa. One of the purposes of this improvement is to provide a plow especially adapted for use upon railroads for removing snow and to construct the plow in multiple shovels arranged in a bank one above the other, each shovel being independent in its action, throwing the snow to the rear at each side of the structure.

BRAKE-SHOE ADJUSTER.—J. S. ASHWORTH, East St. Louis, Ill. The object of the inventor is to provide means adapted to automatically compensate for the wear on the brake-shoe and to keep the shoes normally in the same position relatively to the periphery of the wheel, so that the levers operating the brake-shoe will be kept in a state of constant efficiency and remain so until the brake-shoes wear out.

CAR-DOOR.—JOSEPH A. BOURGEOIS and JOHN A. BOURGEOIS, Algiers, La. The invention relates to car-doors; and the object of the invention is to produce a door which may be readily opened and closed and which may be substantially water-tight when in its closed position. On account of the manner in which the edges of the doorway are beveled it is impossible for rain to leak through the door when it is closed.

SAFETY-APPLIANCE RIVET-BOLT.—J. W. CURRAN, Newport, Ky. The object of the invention is to simplify the present methods of applying grab-irons, sill-steps, uncoupling-lever brackets, stake-pockets, air-pipe clamps, retaining-valves, brake-staff stands, etc., to steel freight-cars. The present method when one of the steps, clamps, or the like becomes broken necessitates the moving of the freight inside the car in order to get at the rivets for cutting out the same.

Pertaining to Vehicles.

AXLE.—H. K. BRYSON, Fayetteville, Tenn. A purpose of this invention is to provide a bearing for the hub of a wheel which will not only permit the wheel to turn with a minimum of friction, but which will also provide a cushioned support for the hub, enabling the wheel to have a vertical movement without lost motion, thus tending to render a vehicle to which said axle-spindle is applied easy riding, even upon very rough roads.

HARNESS.—D. A. LEE, Hot Springs, Ark. In the present patent the invention has reference to certain improvements in harnesses for horses whereby the weight of the collar on a horse's neck may be relieved and distributed to other portions of the body to prevent the neck from becoming sore through the chafing of the collar.

Designs.

DESIGN FOR A BOX.—W. JONES, Lurgan, Ireland. This ornamental design is intended for representation on the top or cover of a box. Three upright frames of simple structure are upheld by the hands of a boy and two girls. Each frame holds a domino poised on its end and showing the face or spot portion of the domino.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(10423) D. C. C. says: Please settle the following dispute through your Notes and Queries column. Suppose two wires to be connected to opposite poles of a battery or other source of an electric current. A claims that as long as the wires are not connected they are not charged, i. e., that there is no current passing over the wires. B claims that the wires are charged continually as long as they are connected to a source of current, whether the wires themselves be connected or not, claiming that if they are not charged why is it that a person taking hold of them receives a shock? A. The two poles of a battery or other source of electromotive force are always charged, as you call it. The wires leading from a dynamo or battery anywhere along their length are at a difference of potential equal to the e.m.f. of the source of energy. And if a connection be made between them, a current will flow. The difference of potential is regarded as the cause of the flow of the current, and is expressed in volts, while the current is expressed in amperes. While the wires are not connected, no amperes are flowing, but the volts between the wires are just as great as possible. B is right in his opinion.

(10424) A. McK. says: A friend of mine got into an argument with me concerning the moon. He said that "every time the moon makes a revolution round the earth it makes one revolution on its *own axis*." I said that "as the same side of the moon was always toward the earth, I cannot understand how it can revolve on its *own axis*." Will you please say which of us is right? A. Because the moon keeps the same face toward the earth it must rotate once on its axis while it goes around the earth once in its orbit. To show this take a ball or an apple or anything round in the hand, and place a lamp on a table in the middle of the room. The ball is to represent the moon, and the lamp the earth. Now carry the ball around the lamp, keeping the same face of the ball always toward the lamp. You will have to rotate the ball as you carry it in such a way that it will turn entirely around on its own axis while it is carried once around the lamp. Try it again in another way. Mark one side of the ball. Begin on the east of the lamp, with the mark toward the lamp. The mark will be on the west side of the ball. Carry the ball around to the north of the lamp, with the mark always toward the west, that is, without rotating the ball on its axis. The mark will not now be directed toward the lamp, which is now south of the ball, and the mark must be turned from west to the south a quarter of a circumference before it is again toward the lamp. Repeat this at each quarter of the way around the lamp and you will have turned the ball through an entire circumference in making the circuit of the lamp and bringing the same face of the ball toward the lamp at each quarter of the circuit of the lamp. The moon does rotate once on its axis during each lunation. So also do Mercury and Venus in each of their revolutions around the sun, and they also keep the same face always toward the sun. Should the earth come into the same relation to the sun, a day will be a year long. Many astronomers think this will be the case at some time in the remote future.

(10425) D. LeM. C. asks: 1. I am contemplating making the large plunge battery described on page 400 of "Experimental Science," and would like to know of whom I can buy the zinc and carbon plates there described. A. You can get the zinc and carbon plates of any size you may wish by addressing dealers in electrical supplies. See our advertising columns. 2. Also, it says to use gutta percha for the lining of the cells. All that I have been able to find in this city is some very thin gutta percha (about like a sheet of paper), and was told that it was used in the repair and manufacture of clothing, something like glue. Is this what the book means? If not, where can I buy what it does mean? A. We think you would do much better to use glass jars for the cells of the plunge battery, but if you prefer hard rubber you can get them from the same company. They can send you a list of such jars as may be on the market. 3. On page 92 of "Experimental Science" it tells how to make an air pump from rubber tubes. Is such a pump durable? Will it crack and leak after being used a few times? I tried to buy the rubber, but was told that it would cost three of four dollars. Please tell me where I can get it for $1.50 as the book says. A. We cannot say that we think you would find an air pump made with rubber tubing of much real service. It might do for amateur work for a short time, but would not be durable. You cannot get much rubber tubing now for $1.50. Prices are much higher than when "Experimental Science" was written eighteen years ago. 4. In the description of the electromagnet on page 458 of "Experimental Science" it gives the width of the soft iron yoke as 2½ inches and the diameter of the wooden spools as 4 inches. According to these dimensions, the spools would be larger and project over the iron yoke. Yet in the engravings the yoke is the largest, and the spools do not project over it. Which is right? Will it decrease the power of the magnet if the walls of the spools are more than 1-16 inch thick? A. The drawing of the yoke of the electromagnet on page 458 does not correspond to the dimensions given in the text. That does not matter, since every one knows that the yoke needs to be at least of the same cross section as the core, and may be as much larger as may be convenient. If it is broad enough to serve as a base for the magnet to stand upon, no harm is done. The walls of the spools do not affect the magnetism. If they are made thicker than necessary, the windings will be so far from the core that the magnetism will be weaker and the magnet will not be strong for it. Make the spools as light as you can and still strong enough to hold the wire.

(10426) T. H. A. says: 1. Quite often I have to recharge small storage batteries of 6 volts. The only method I have to know when the battery is fully charged is by the solution throwing off quite a lot of gas bubbles. I have been told that I should have a hydrometer to do the storing correctly. What size hydrometer should I get for these 6-volt cells, and where can they be had, and about what is the price? The solution is made of one part of C. P. sulphuric acid to four parts of distilled water. What should the hydrometer read before the solution is charged and when fully charged? In drawing off the solution from the battery while charging to get a hydrometer reading, if the plate is exposed much will it injure the battery? I have been told not to charge a battery up to its full voltage. For example, take a 6-volt cell. I start charging at 5 volts until the cell starts gassing, then cut it down half (2.5 volts) until gassing gets heavy again. Is that proper? A. It is a common way to judge of the charge of a storage battery by the bubbles of gas which are given off from the plates. When the gas comes off freely, the cell is fully charged. The material of the plates is no longer able to take up the oxygen and it appears at the positive pole, as the hydrogen does at the negative pole. The best way of testing the charge is by means of a voltmeter. A battery is in need of charging when the voltmeter shows 1.7 volts per cell. It is fully charged when the voltmeter indicates 2.5 volts per cell, or perhaps a little more than this figure. The hydrometer test consists in floating a glass hydrometer in the liquid of the cell, and charging till the liquid has a density of 1.3 on the scale. When the cell is discharged, the hydrometer will probably indicate about 1.1. 2. A claims that in foggy weather, when the smoke descends to the ground, that the atmosphere is light and will not support the smoke. B claims that it is heavy and will not permit the smoke to ascend. Which is correct? A. When smoke falls toward the ground the air is light, so that the hot smoke is heavier than the air. In fine weather the air is heavier and the smoke rises.

(10427) G. L. H. says: Will some scientific reader kindly enlighten me upon the two following problems, which have been subjects of argument to some of us recently? 1. A body sinks and is swallowed up in a quicksand, the body being actually lighter in specific gravity. Why? A. Light quicksand is not much heavier than water, and the fine particles of sand nearly float in water as a sediment. The sinking of a person in quicksand we have always thought to be due largely to the struggles of that person; the sticky mass holding him as he tries to rise and giving way under him as he treads in it. If we were caught in quicksand we should throw ourselves flat and keep as quiet as possible, spreading ourselves out over as large a surface as possible. 2. How is it that salt (sea) has so bad an effect on a human being when absorbed into the system, producing madness, etc., as in the case of shipwrecked mariners? The human body, in its constituents, is almost the same as sea water. Does the drinking of sea water necessarily produce mania, or could a person under normal circumstances drink salt water without harmful results? A. A person cannot drink sea water without nausea. It also produces most intense thirst. It is, we suppose, from the thirst that the awful condition of men in an open boat at sea without fresh water comes. No person could drink water with ordinary salt in it for any length of time without harmful results; much less could any one drink sea water, which contains other and less agreeable mineral salts.

(10428) A. W. D. says: Will you please inform me if it is possible to electroplate material with aluminium the same as can be done with copper or silver? If such is the case, will you please tell me what SUPPLEMENT will give me an account of the process? A. There have been many processes of plating with aluminium described in papers and in patents. We have never tried any of them, so as to know by actual experience that they are reliable. Watt says of them in the last edition of his "Electro-plating," page 476: "The present writer has never seen any sample of aluminium so deposited, and has never heard of any well-authenticated case of it having been so obtained." His book contains the several methods hot and cold which have been employed for this purpose. We can send you the book for $4.50. Plating with aluminium is perhaps a possibility, but an improbability.

(10429) J. T. W. says: Can a person buy books that would be of as much value to him as a correspondence school course in the study of mechanical electrical engineering? If so, what books do you recommend, and at what price, and where can same be obtained? A. It is not likely that a person unaided can obtain as good a knowledge of electrical engineering by reading as by study with the assistance of a correspondence school. It should also be stated that no school can make a scholar. The scholar makes himself, even in the best school. The books of a correspondence school are usually up-to-date and practical. The assistance of the examination papers and the correction of mistakes are also worth something. Should you wish books we can supply them, the best to be had on the subjects: Sloane's "Handy Book," $3.50, a reference book of facts and principles. Thompson's "Dynamo Machinery," $7.50, Vol. 2, Direct and Alternating. Crocker's "Electric Lighting," $6, two volumes, the best book on the subject. Foster's "Electrical Engineer's Pocket Book," $5, indispensable. Kent's "Mechanical Engineer's Pocket Book," $5, indispensable. Bell's "Electrical Power Transmission," $4. After these come books on railways, telephones, and all the special branches of work which you may wish to follow.

(10430) J. R. says: 1. What is spontaneous combustion? A. Spontaneous combustion is the setting on fire of a material by heat which is generated in itself by the contact with the oxygen of the air. 2. What is the cause of same? A. The drying oils used in paints, linseed oil chiefly, dry by absorbing oxygen from the air. The combination of the oil and oxygen is a slow combustion. If this goes on in a confined space where the heat cannot easily be radiated, the temperature will rise high enough to ignite cotton rags. Such oily rags often are the causes of setting a building on fire. 3. What degree of heat causes it? A. The temperature necessary to set an article on fire varies with the material.

(10431) J. L. P. says: In your answer to question 10342, January 26, you state that two spheres of the same size will fall with the same velocity under the action of gravity in the air. If the specific gravity of one of the spheres was less than that of the atmosphere it would rise, and if just a little more it would fall very slowly. Therefore it must follow that the greater the specific gravity of a body the more rapidly it will overcome the friction of the air, and consequently will fall faster than a body of the same size and shape but of a less specific gravity. Would that not be the case? A. You misconstrue the answer to Query No. 10342 by overlooking the fact that the query was specifically about lead and aluminium spheres. These will fall as stated for a limited distance with equal velocities. The fault with the answer is that this distance is not stated, an omission for which we are not able to account. This distance is placed by Wood in his "Mechanics" at from 100 feet to 200 feet, a distance which we have not verified. Aluminium is 2,000 times as heavy as air, and lead is about 9,000 times as heavy as air. The power of aluminium to overcome the resistance of the air is only one-fourth as much as that of lead, but it is 2,000 times as much as that of the ball which you assume.

(10432) J. M. P. says: 1. I am constructing a Wimshurst machine with two plates. How far apart should the plates be? How many sectors should be on each plate? The plates are 16 inches in diameter. A. The plates of a Wimshurst machine should be run as near to each other as they can be made to do without touching. You may be able to bring them about a quarter of an inch apart. 2. Would a large test tube be all right to make a Leyden jar with? How can I coat the inside of the jars, and how high up should the tinfoil come? A. The Leyden jars should be about 2 inches in diameter and 6 inches high. Use rather stout glass free from lead. Cut the tinfoil into strips an inch wide for the inside, and after the paste is applied put them inside the jar and with a paper cutter, and perhaps a brush, smooth them into their places. A little practice and handiness will enable you to make a good job of it.

(10433) E. E. L. says: Is there any difference in the energy of a boiling liquid in different latitudes, the atmospheric pressure being the same for each place? What is the intensity of an ordinary saturated steel magnet as compared with the earth's magnetism for any given locality? A. The boiling point of a liquid is independent of the latitude, and the energy of the steam is the same for all places where the temperature of boiling is the same. The temperature of boiling is the same for all places which have the same barometer reading, wherever they may be on the earth's surface. The magnetic intensity of a steel bar magnet is, according to the tables given in Thompson's "Electro-magnet," from 14,000 to 16,000 lines per square inch.

(10434) J. T. says: 1. What is the cause of the large ring which appears around the moon in threatening weather? A. The lunar and other halos are produced by the action of the drops of moisture or ice crystals in the air upon the light as it comes toward the eye. 2. Why does not the atmospheric pressure, 15 pounds to the square inch, crush the small incandescent electric lights, which are supposed to be exhausted of air, or any other glass vacuum? A. An incandescent lamp bulb is not crushed by the pressure of the air upon it because it is strong enough to hold up 15 pounds per square inch. An empty eggshell will hold a pressure of 675 pounds per square inch on its end. 3. Why does not the upward motion of a bird's wing completely neutralize the effect of the downward motion? A. The up stroke of a bird's wing is executed so as to take the air at a different angle from the down stroke. The feathers do not return upward so as to present the same resistance to the air as they did when they were struck downward. 4. Why is the power of a telescope or microscope limited? A. The magnifying power of a microscope is limited by the indistinctness of the image in the extreme powers. The telescope is limited by the faintness of the light at great dispersion, and more by atmospheric conditions.

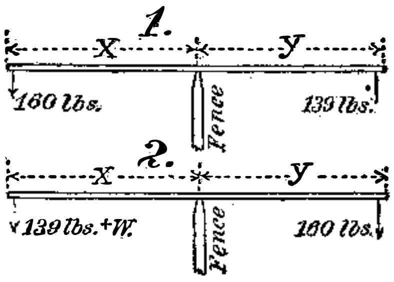
(10435) B. D. M. says: 1. Is it possible to generate light without heat? If so, give illustrations. A. It may be possible to generate light without heat, but it has not yet been done. It is one of the *ignes fatui* of inventors, like the utilization of tidal power and of the heat of the sun's rays. 2. Give proof that ice freezes at the underside, after a layer has formed, and not at the top. A. The proof that ice forms from the underside is that water is in contact with that surface of the ice and the upper surface is at the same time dry. The ice increases very rapidly in thickness to the extent of several inches on a severe night. The only other source of moisture is the vapor of the atmosphere, and that is not sufficient in quantity to supply the amount of ice which forms in a few hours. If the ice came from the air, the rapidity of its precipitation would exceed that of a heavy rainstorm.

(10436) J. L. B. says: On page 199 of the SCIENTIFIC AMERICAN of March 2, 1907, in the Notes and Queries department, No. 10409, you say a vessel sinking will always go to the bottom, because the water pressure will tend to make it heavier with reference to the water. Why will it be made heavier than the water? I can understand the water compressing it to a given extent, but not to such an extent as to make it heavier than the water. You also say that "at greater depths it will be able to sink faster, since the water is not compressed to any extent at greater depths than it is near the surface." Some years ago Dr. Dall, of the Smithsonian Institution, showed that the compression of water on the ocean bottom was about two tons to the square inch, and higher up about half a ton. Would a vessel be compressed to such an extent in sinking? It seems to me that this would mean that a vessel weighing two tons would need to be compressed *more* than enough to occupy a square inch at bottom to cause it to sink. Since you say it would reach the bottom, I am willing to take your word for it, but I can't understand it. Again, I read in a scientific periodical called The Lens (date of publication unfortunately forgotten) that although the ocean bottom had been sounded for several miles deep, bottom had never been found in Lake Tahoe, because (as explained) the water pressure prevented the weight used from sinking more than several miles, at which point the temperature of the water was considerably below freezing, but on account of the great density of the water it was unable to congeal. I fail to understand how water is able to compress an object to a greater extent than the water itself is compressed, and when both are compressed to the same extent, the object hangs suspended in the water without moving in either direction. The periodical above referred to reasons from this that the bodies of the people drowned in this lake (none of which have ever been recovered) are compressed to the size of a new baby, and are suspended, frozen stiff, about two miles below the surface. A. A vessel which is lighter than the water will not sink in water; a vessel in order that it may sink must be heavier than water at the start. All iron ships are heavier than water. So are wooden ships when ballasted. Such a vessel will sink if filled with water. If it sinks at all it will go to the bottom, since water is compressed but little by the pressure it sustains, and iron, wood, etc., are compressed more than water by the same pressure. Dr. Dall showed that the pressure at the bottom of the ocean was two tons to the square inch, not as you say, the compression of the water. Water is not compressed a very great deal by a pressure of two tons to the square inch, not so much as a stone would be. Water is compressed about 1-75 part by that pressure, that is 75 cubic inches would become 74 cubic inches, and not, as you say, to 1 cubic inch. With reference to what you quote from a paper about Lake Tahoe, we can say that it is impossible. Water cannot be cooled below freezing by any possibility and remain water in an open lake. And water must be colder on top if the temperature of any part of the water is at the freezing point. Dead bodies are not frozen in water down deep below the surface. Nor is water ever dense enough to prevent lead from sinking in it.

(10437) C. B. R. asks: Will you kindly explain who has the advantage in the following case, and why? In shooting at flying targets thrown from the traps, I shoot with both eyes open. My friend claims I should close one eye, as I could get a better alinement of the gun. My claim is that I can get a better and quicker sight at my target by using both eyes. Please explain what part the left eye plays while shooting right-handed. Do I shoot crossways, look crossways of the gun barrel, or do I unconsciously sight with one eye, while both are open? Give the theory of aiming a gun with both eyes open. A. If you can shoot with both eyes open and hit, it must be that you aim with the right eye and disregard the line of sight from the left eye to the target. You can test this by looking along the gun without shooting with both eyes open. You can determine whether the sights are in line with the right or with the left eye. We do not know any theory of aiming with both eyes open. Most people use but one eye at a time when both eyes are open. Some habitually use the right and others the left eye at their ordinary work.

(10438) J. O. B. says: I find that upon holding an electric light incandescent lamp by the glass and applying the metal to an idler on the main belt of the dynamo (which gives about 15-inch spark) and taking it away, I can get a powerful charge by placing my other hand on the metal. Can you explain? I also find the lamp "burned out," but it still gives the above results. A. By holding the incandescent lamp as you describe you charge it as a Leyden jar is charged, and upon touching the metal which is connected to the inside of the jar you receive the shock of the discharge. The metal and the filament are the inside coating, and your hand holding the bulb is the outside coating. The charge is a charge of static electricity.

(10439) P. A. O. says: Will you be kind enough to give the answer to the following problem, which has agitated the best mathematicians of our town recently: A farmer and his wife desired to weigh a pig, and had no scales. The man weighed 160 pounds and his wife 139 pounds. They put a board across a fence so that when they sat upon each end of the board it exactly balanced. Then they changed places, the wife taking the pig in her lap, just balancing the board again. How much did the pig weigh? A. Your problem may be solved in the following manner: Referring to



accompanying sketch No. 1: x = distance from the first position of the man to the fence. y = distance from the first position of the wife to the fence. Let w equal weight of the pig. Then $160x = 139y$. 160 pounds = weight of the man. 139 pounds = weight of his wife. In sketch No. 2 the man and his wife exchange places, and the wife takes the pig in her lap, and they again balance as in the first position.

Therefore:

$$(139 + w)x = 160y.$$

Also from sketch No. 1:

$$160\,x = 139y$$

$$\therefore x = \frac{160y}{139 + w}$$

$$x = \frac{139y}{160}$$

$$\therefore \frac{160y}{139 + w} = \frac{139y}{160}$$

$$160^2 = 139(139 + w). \quad w = 45 + \text{pounds.}$$

Therefore the pig weighs approximately 45 pounds.

NEW BOOKS, ETC.

ARTILLERY AND EXPLOSIVES. By Sir Andrew Nobel, Bart., K.C.B. New York: E. P. Dutton & Co., 1906. Large 8vo.; pp. 548. Price, $6.

The fact that this work consists of a series of essays and lectures written and delivered at various times by the author, detracts nothing from its value. Indeed, had it been planned and written as a co-ordinated whole, instead of being a compilation of separate essays, etc., it must still have been recommended for what it is, namely, a reference work to which the student of artillery and explosives will turn for information on subjects upon which correct information is only too scarce. The great value of this work will be at once evident, when it is stated that it consists largely of a record of the experimental work done by the author throughout the long period covered by his industrious professional life of nearly half a century. When Sir Andrew Nobel entered the service, the line-of-battle ships in the British navy were all sailing vessels, and their armaments and appliances differed but little, except as regards size, from those used in the days of Henry VIII. and Queen Elizabeth. The spirit of conservatism pervaded both services, and the introduction of rifled ordnance was received with the greatest distrust. It is impossible to speak in any detail of a work of this magnitude; but the chapters on the Tension of Fired Gunpowders, on Friction in the Bores of Rifled Guns, and those dealing with the Tension of Gases Expanded Without Doing Work, will be read with the deepest interest at the present time, when the subject of erosion of guns is so much in the public mind. There is probably no one who has had wider experimental knowledge of the subject treated in this volume than its celebrated author. When he first took up the examination of gunpowder, knowledge on the subject has been described as "simply chaotic"; and the description of the investigation made by Sir Andrew Nobel and his associates of the action of powders when fired in completely inclosed vessels, makes extremely interesting and profitable reading.

POOR'S MANUAL OF THE RAILROADS OF THE UNITED STATES. Street Railway and Traction Companies, Industrial and Other Corporations, and Statements of the Debts of the United States, the Several States, Municipalities, etc. New York: Poor's Railroad Manual Company, 1906. Large 8vo.; pp. 1808. Price, $10.

With its 1,808 pages and its well-earned reputation for accuracy and voluminous information, this number continues to hold for the Manual the high place which it won among railroad men and the public generally many years ago. The following important features, heretofore published separately in the Railroad Manual Appendix, have been incorporated; namely, first, all data embraced in Poor's Ready Reference Bond List; second, Table of Annual Meetings, Transfer Agencies, etc.; third, Table of Dividends paid for eight years. By the addition of the new features referred to, and the natural expansion of the regular departments of the book, the work this year has increased in text 192 pages, the statements for no less than 120 industrial corporations having been procured and incorporated in this new issue. Attention is also directed to the improvement in the index pages and to the great increase in the number of railroad and other maps.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

March 5, 1907.

AND EACH BEARING THAT DATE

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

Accounting appliance, credit, R. D. Pardee 846,136
Acid, purification of sulphuric, Driffield & Wright 846,288
Acousticon, Turner & Johnston........ 846,068
Adding machines, book holder for, Z. Crain 846,012
Adhesive compound, glue, etc., M. R. Isaacs 845,791
Advertising device, J. E. Rainwater....... 845,893
Advertising device operating mechanism, Wadsworth & Appleby........ 845,986
Air and gases, thermic compressor for, E. Gobbe 846,302
Air brake setting device and alarm, combined, R. E. Adreon........ 845,736
Air purifying water screen, W. J. Rafferty. 846,344
Alarm signal, R. J. Zorge........ 845,991
Alloy of iron and steel, self hardening, J. Churchward 845,756
Alloy of steel, self hardening, J. Churchward 845,757
Alloys to alter their composition, treatment of, I. L. Roberts........ 845,819
Alumina and alkali compounds of sulfur, manufacture of, A. Clemm........ 845,854
Ammonia from gas, recovery of, H. Koppers 846,035
Amusement device, I. S. Moscovitz........ 845,967
Animal trap, J. C. Barker........ 845,921
Arch plate, T. Schillinger........ 846,247
Article of manufacture, J. A. Shinn....... 845,825
Auger, W. Hallinan 846,200
Auger handle, extension, J. Blackburn..... 846,389
Augers, manufacture of single spiral, A. Krieger 846,113
Automatic switch, Dohrmann & Waite... 846,096
Automatic switch, G. Schmitz........ 846,147
Automobile, E. Temple 845,983
Awl, sewing, A. M. Parker........ 846,242
Axle lubricating mechanism, H. W. Sanford 846,056
Bag-turning machines, bag-holding mechanism for, S. T. Lockwood........ 846,118
Bag turning machines, turning arm actuating mechanism for, S. T. Lockwood.... 846,119
Baling press, J. W. Graves........ 846,199
Bank lock, savings, O. Pfleger........ 845,815
Bank, pocket savings, E. Vaughn........ 845,908
Barrel, metallic, C. L. Coffin........ 845,760
Bath. See Steel tempering bath.
Bearing, ball, A. C. Hachfield........ 845,778
Bearing, rotary shaft, F. Ogden........ 846,341
Bedstead, N. B. Noble........ 846,236
Beehive frame, Calvert & Marbach........ 846,396
Bellows, pressure regulator, P. Wuest, Jr. 845,841
Bill head, duplicate, label, receipt, and envelop, combination, J. Souder........ 846,064
Billiard cue, W. H. Thomas........ 846,166
Binder, temporary, H. J. Reuter........ 845,818
Binder, temporary, L. M. Morden........ 845,883
Binders, hinged post for loose leaf, L. M. Morden 846,230
Bird cage, A. B. Hendryx........ 845,785
Blank cutting machines, counting device for, E. G. Souther 846,153
Boiler attachment, steam, B. A. Estep..... 846,100
Boiler cleaner, J. A. Ray........ 846,051
Boiler fire box, C. W. Hullings........ 846,310
Bolts, pins, etc., machine for making, J. F. Lober 846,117
Book cover or protector, Flohr & Miller... 846,195
Book, triplicate manifolding sales, E. K. Bottle 846,002
Boot cleaning and polishing outfit, A. J. Brooks 845,928
Boot machinery, W. Heaton 846,028
Bottle, J. C. Anderson 846,177
Bottle capping machine, G. Kirkegaard.... 846,218
Bottle carrier, C. B. Hall........ 845,947
Bottle filling machine, M. Hamburger..... 845,779
Bottle filling machine, cased, T. L. Valerius 846,169
Bottle, non-refillable, C. Medley 846,333
Bottle, nursing, H. D. Singer........ 845,981
Bottle protector, milk, J. Grossman........ 845,777
Bottle washer, G. K. Watson 846,269
Bowling pin, F. M. Wood et al........ 846,372
Box fastener, G. A. Prather 846,246
Box lid holder, J. C. Feldman 846,021
Box making machine, F. R. Harris........ 846,410
Box opener, J. Marshall 846,438
Bracket, A. A. Ficener 846,022
Brewing apparatus, C. B. Davis........ 846,187
Brick machine, H. L. Hix........ 845,872
Brick machine, H. Armstrong 846,277
Brickmaking machine, E. R. Sutcliffe..... 846,258
Bridge and bridge guard or railing, S. Richardson 845,897
Brooder, N. C. Sprague 846,155
Brush, T. Brantley 846,003
Brush, H. Delle 846,287
Brush making machine, W. G. Liebig..... 845,959
Brush, scrubbing, J. Rich........ 846,346
Bucket making machine, J. A. Watt....... 846,270
Building foundation, P. Seiler 846,249
Burial robe, W. J. Worden........ 845,840
Button and drawers supporter, combined trousers, J. T. Lane........ 846,321
Button machine, wire, F. Marggraff 846,330
Cabinet, merchandise, L. Matthews, Jr.... 846,121
Cabinet table, kitchen, Z. Knapp........ 846,319
Calculating machine, W. R. Bonham...... 845,747
Calendar, R. C. & P. Sellers........ 846,250
Caliper gage, combination, B. J. Roehm... 845,899
Camera, C. I. Flory........ 845,864
Can. See Display can.
Can jackets or other receptacles, handle for sheet metal, G. W. Weber........ 846,076
Cans, forming covers for sheet metal, J. Brenzinger 845,751
Canopy standards, guiding and supporting mechanism for, P. F. Swart........ 845,906
Car construction, E. I. Dodds........ 845,933
Car coupling, S. Morris........ 846,128
Car door, J. Montgomery........ 846,126
Car door fastener, R. Mobley........ 846,125
Car draft and buffing gear, I. O. Wright.. 846,374
Car, dumping, F. Peteler........ 846,137
Car, motor, H. O. Carter........ 845,850
Car operating mechanism, dumping, H. F. Ball 845,920
Car platform, vestibule, C. W. Bremken... 845,750
Car replacer, W. A. Hutson........ 846,311
Car side bearing, W. W. Wooll........ 845,839
Car stake, gondola, Moody & Simms....... 846,127
Car standard, G. W. Du Bes........ 846,289
Car standards, self clearing chain stay for, G. W. Du Bes........ 846,290
Car, tank, T. R. Brown........ 845,752, 846,392
Car underframe structure, transverse, E. I. Dodds 845,934
Car ventilator, J. H. Elward 846,098
Cars, carline for railway, C. A. Lindstrom, 845,960, 845,961
Cars, etc., guard or gate for street, G. A. Metcalf 845,880
Carriage top attachment, W. C. Willitts.. 846,172
Cash register, P. Meyer........ 846,124
Casket holder, P. Wallrath 846,073
Catch, H. R. Baker........ 846,179
Centrifugal machine, single shaft, W. L. D'Olier 846,403
Chain making machine, H. Lysholm 845,877
Chaining device, H. B. Arden........ 846,383
Chair head rest, D. Sarason 845,822
Chamber, slop jar, and the like, Meinecke & Hogan 846,224
Check, draft, and similar instrument, M. Berardini 845,923
Chimney cowl, E. S. Egy........ 845,862
Chuck, drill, L. T. Gauss........ 845,773
Churn, H. Garbutt........ 845,940
Cleaning and separating machine, A. T. Hedfeldt 845,870
Clock, watchman's, O. E. Hausburg....... 845,951
Clutch, W. R. May 845,879
Clutch, M. H. Avery 846,178
Clutch, centrifugal, J. Fellows........ 846,193
Clutch, friction, W. F. Rothe........ 846,350
Coal screening and grading apparatus, J. Rapp 846,140
Coal washer, J. Rapp 846,141
Cock, safety, J. C. Stratiff........ 846,257
Coffee and tea flask, J. Garrigan........ 846,299
Coffee pot, H. M. Murray 845,968
Coffee urn, W. F. Stubinger........ 846,163
Comb, C. Schmidt 846,058
Combustion, promoting, P. J. McNamara.. 846,338
Commutator brush for dynamo electric machines, R. N. Baylis........ 845,740
Compasses, oval, C. Schreiber........ 845,824
Composition of matter, Voller & Thalberg. 846,265
Concrete construction, reinforced, W. Curlett 845,763
Concrete dam, reinforced, H. L. Coburn... 845,855
Concrete foundation piers, constructing, G. W. Jackson 846,108
Concrete metal construction, E. Flad...... 845,938
Concrete mixer feeding device, R. Wilcox.. 845,990
Concrete structural work, metallic reinforcement in, C. Horix........ 845,787
Condenser, Ambrose & Schwartz........ 846,380
Condenser, steam, Ambrose & Schwartz.... 846,379
Conveyer, J. F. Doehle........ 846,402
Cooking vessel, M. J. Corbell........ 846,010
Cooling board head rest, adjustable, A. N. Wise 845,916
Core forming and holding device, sand, B. F. Hobert 845,786
Cork and making the same, artificial, J. Serra (y Carbo) 846,251
Corn husking machine, J. H. Leidel...... 845,957
Corn husking machine feeding mechanism, J. W. Paige 846,423
Corn picker, J. H. Leidel 845,958
Corn picker and husker, C. Pearson....... 846,049
Corn shock loader and unloader, F. Johnson 845,955
Corner bead, J. M. Coleman........ 846,398
Cotton cleaner and gin feeder, M. E. & J. L. Norris 846,421
Cotton from its impurities, machine for cleaning and separating, J. S. Lyle... 846,329
Cotton, plant for storing baled, D. Breck... 845,926
Cotton separator, W. A. Patterson........ 845,976
Coupling device, V. D. Gaa........ 846,409
Coupling pin and compound tool, combined, J. Patterson 845,975
Crank hanger, F. M. Osborne........ 846,239
Crossing, movable point, W. M. Henderson. 846,029
Cultivator, W. M. Stamps........ 846,156
Curling iron, G. F. Shields 846,354
Current generators, voltage regulator for alternating, F. R. Keller 846,214
Current machine with commutators and with compensating windings, alternating, R. Richter 846,427
Curtain and shade fixture, combination, Dolson & Moxley 845,935
Curtain fixture, I. L. Hotaling........ 845,788