pertains to certain improvements in mechanism adapted to be applied to boats, vehicles, and the like, whereby they may be propelled with equal facility over the surface of land or water. The intervention of streams or lakes would in no way impede the progress of a traveler were his vehicle equipped with this device.

CONTRACTIBLE MOLD.—G. GEORGENSON and J. E. HENNEN, Fond du Lac, Wis. This flexible mold is for use in the construction of arches, culverts, sewers, or the like in which a temporary support is required for the cement, brick, or stone employed in the construction. In carrying out the invention what may be termed a "cylinder" is employed, the same being formed of sheet metal and provided interiorly with means for expanding and contracting it.

AIR-SHIP.—J. SHUKWECH, New York, N. Y. The ship has a main deck mounted on a supporting means for sustaining the weight of the ship when on the ground and maintaining it in an upright position when in flight. Wings are pivoted at each side of the ship, connected with suitable means for oscillating them, and propellers are journaled at each side of the bow of the ship and act to direct a current of air under each of the wings in driving the ship forward, which currents tend to force the wings upwardly.

LAWN-CLEANER.—C. H. MOSHER, Salisbury Mills, N. Y. The object of this invention is to produce a machine which is of simple construction and which can be readily moved across a lawn in the manner of a lawn-mower, operating at the same time to pick up any articles which may pass under it and which may be operated by horse or motor power.

FABRIC-TESTER.—R. C. HARRIS, Roselle, N. J. The invention relates to improvements in devices particularly designed for testing the strength of paper, the object being to provide an instrument of this character that will be of comparatively small and compact form, so that it may be carried in a person's pocket and operated by hand pressure.

Prime Movers and Their Accessories.

VALVE.—A. SIMPSON, New York, N. Y. In this instance the invention relates to valves such as used in pipe systems. The valve is intended to be used for water, steam, gas or other fluids. The object is to produce a valve of simple construction which will be well adapted to maintain heavy pressures and which will reduce tendency to leakage.

AUTOMATIC STEAM-TRAP.—W. AUSTIN, Scranton, Pa. The aim of this inventor is to produce a device which may constitute an accessory for a steam pipe system, and which will operate to collect the water of condensation, and expel the same automatically and periodically without allowing any escape of steam

Railways and Their Accessories.

CAR-WHEEL.—R. P. WILLIAMS, Santa Barbara, Cal. The invention consists of a cast metal wheel having the flange thereof so formed that in case it becomes broken the broken part will not become dissevered but will present a ragged edge extending outward at an angle to the normal plane of the wheel, whereby an air valve of the brake system may be operated. The valve is so constructed that should the car wheel become broken the brakes will operate to immediately stop the train.

AIR-BRAKE ATTACHMENT.—R. P. WILLIAMS, Santa Barbara, Cal. This invention relates to improvements in air brakes for railway cars, and more particularly to means for automatically operating the brake in case that the truck of any one of the cars becomes derailed. The object is to provide means whereby any variation in the plane of the car track in respect to the car body will automatically open a valve of the air brake system and cause the instant application of the air brakes throughout the train.

RAILWAY-SWITCH MECHANISM.—O. A. KRUG, Cincinnati, Ohio. In this patent the invention has reference to improvements in railway switch mechanism, the object being the provision of a simple means whereby an open switch may be automatically closed by an approaching train in either direction, thus preventing possible accident.

RAILWAY-TIE AND RAIL-FASTENING.—A. NEWELL, Guadalajara, Mexico. The improvements are in ties for railways and rail fastenings, and the object of the inventor is to provide a metal tie that will be comparatively light, yet strong and serviceable, and further to provide a fastener that may be readily adjusted to the rail and normally hold the same from any lateral movement with relation to the tie.

STANDARD FOR LOGGING-CARS.—C. H. ALLEN, Aycock, Fla. The design in this case is to provide a standard which is to be arranged on the ends of the transverse bolsters of the car to prevent the logs from rolling off when in transit, but which is capable of adjustment to permit the easy loading or unloading of the log.

BLOCK-SIGNAL SYSTEM.—J. VAN ZANDWEGHE and L. VIBERTI, Rosario De Sante Fé, Argentina. In this patent the invention refers to block signal systems, the more particular objects being to provide efficient means for stopping trains automatically when they approach each other within certain limits, and also for stopping them if desired when they approach a station.

Pertaining to Recreation.

GAME APPARATUS.—L. J. CASTONGUAY, Thompsonville, Conn. The object in view is to provide in this invention a game apparatus, more especially designed for playing parlor base ball, and arranged to require considerable skill on the part of the players to successfully play the game, and to afford amusement for the players as well as the onlookers.

Pertaining to Vehicles.

WHEEL-HUB.—F. F. UNCKRICH, Galion, Ohio. In the present patent the invention has reference to an improvement in wheel hubs, and it has for its object the provision of a metallic shell and the means for securing the shell in a fixed position upon the hub in a most efficient manner.

VEHICLE RUNNING-GEAR.—P. RICHARDSON, Kennebago Lake, Maine. Withstanding the shock of very rough roads and avoiding its transmission to the occupants, in this case, is accomplished by providing for the yielding in all directions of an upper frame on which the body of the vehicle is mounted, as by a system of springs comprising upright springs for yieldingly maintaining the weight of the body and the occupants and diagonally-extending longitudinal and transverse springs for admitting of a yielding end and side movement of the body, respectively.

TRACTION-ENGINE STEERING-GEAR.—R. RICHARDSON, Yates Center, Kan. The gear is designed particularly for use in connection with traction engines, but applicable in other ways. It may be applied to automobiles and all motor vehicles with equal ease, the shaft being either the crankshaft of the engine or some continuously rotating shaft driven from the engine.

DUST COLLECTOR FOR WHEELED VEHICLES.—J. M. WEAVER, New Oxford, Pa. The invention relates particularly to improvements in attachments for automobiles or similar vehicles for receiving dust rising from the vehicle wheels and discharging the same in a wet or condensed condition, thus obviating the annoyance from the spread of dust incident to such vehicles as ordinarily equipped.

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.

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(10521) O. J. S. says: 1. Which telephone lines do you consider to give the best service in rural districts—ground or metallic? Can you advise me a good book on practical ground line telephony? A. A metallic circuit is best for all telephone lines, but the cost is so much greater that the grounded circuit is usually employed upon rural circuits. Long-distance lines are always metallic. The best book upon the telephone is Miller's "American Telephone Practice," which we send for $4. 2. How do you find the distance between the earth and the sun? Give me a simple formula for calculating that distance. A. It is a long story to tell how the distance of the sun from the earth is found. Consult any college astronomy in the University library. The distance is computed from the parallax of the sun. 3. If the radius of a certain pulley is 4 inches and of another is 12 inches, and the distance between their centers is 6 feet, how would you calculate the length of a belt running around these two pulleys? A. The length of the belt you desire will be given with sufficient exactness by adding to 12 feet one-half the circumference of each of the pulleys. 4. Where, for good ventilation, should a ventilator be situated—near the top or the bottom of a wall? Is it better to have two ventilators one in one corner and another diagonally across? A. There are all sorts of opinions upon the location of ventilators. The usual practice is to place them both at the top and bottom of the room, so that either register may be opened. We do not think one ventilator in one corner and another in a diagonally opposite corner should be preferred. 5. How do you find the horse-power of a common steam engine? A. To find horse-power of a steam engine, multiply the mean effective pressure in pounds per square inch by the length of stroke in feet and by the area of the piston in square inches, and by the number of single strokes per minute. If the piston passes through one end of the cylinder head, subtract one-half of the area of the piston rod from the area of the piston; but if it goes through both ends of the cylinder head, subtract the whole area of the rod from the area of the piston. Divide the product of these numbers by 33,000.

(10522) E. B. S. says: To render theaters safe from fire, a policeman should be on the stage near the curtain, having in his hands or close by one hose containing water under pressure and another hose with carbonic-acid gas under pressure. Either one can be instantly used if necessary. A scientific book says one quart of water resolved into its elements gives 1,200 quarts of hydrogen and 600 quarts of oxygen. Is it correct? If not, how much gas will result of each kind? A. With reference to the suggestion you make that a policeman should be in a theater to guard against fire, we would say that in all New York theaters firemen are on duty all the time when an audience is in the building, ready to turn on the water and use the appliances for extinguishing a fire. A fireproof curtain would be dropped in an instant, and a rope cut, which would open large scuttles above the stage, so that any smoke upon the stage would be drawn up as by a chimney into the open air, and no fire or smoke would or could be drawn out into the house where the audience is seated. The statement is correct that two quarts of water contain 1,200 quarts of hydrogen and 600 quarts of oxygen, when the barometer is at 30 inches and the thermometer is at the freezing point, or 32 deg. Fahr. Unless the pressure and temperature are stated, any statement of quantity of the gases is meaningless.

(10523) L. A. C. asks: Why does not a submarine boat sink all the way to the bottom of the ocean? I understand the method used in plunging submarines is to admit water into tanks, so as to give the boat more weight, weight enough to cause the boat to sink only 50 or 60 feet. It sinks at the surface. Why does it not sink to the bottom? Would a hollow steel ball weighing 65 pounds and having a displacement of one cubic foot (when under a pressure of 4,600 pounds per square inch) sink to the bottom of the ocean, where a cubic foot of water weighs 66.56 pounds (27,366 feet below surface)? I should say that such a ball would sink to a depth of approximately 10,300 feet and there remain suspended. Am I right or wrong? What is the principle involved in the toy known to schoolboys as "the devil in the bottle"? This toy is a bottle filled with water, in which is contained a small hollow image, which image can be made to sink or float in the water, or even to remain suspended half way between the surface of the liquid and the bottom, by manipulating a diaphragm closing over the neck of the bottle. A recent controversy leads me to these questions. A. The submarine and the "devil in a bottle" are instances of the application of Archimedes's principle. The little imp in the bottle is known in science by the name "Cartesian diver." Archimedes stated the principle that a body immersed in a liquid loses as much weight as the weight of the liquid it displaces. If the liquid displaced weighs less than the body, the body sinks; if it weighs more than the body, the body rises and floats partly out of the liquid; if it weighs the same as the body, the body neither sinks nor rises, but remains just where the weight of the displaced liquid is exactly equal to the weight of the body. The Cartesian diver has a little opening into the lower part of its body. When pressure is put upon the air in the top of the bottle, that pressure is transmitted through the water in the bottle to the air in the imp, and compresses the air so that water flows into the imp and makes it heavier. It then sinks. By relaxing the pressure, the imp may be stopped at some point and kept there. If the pressure is however maintained as at first, the imp sinks to the bottom without stopping, since the water has the same density in all parts of the bottle. The submarine is intended to act upon exactly the same principle in the same manner. They usually do so, but once in a while one continues to the bottom, with disastrous results to all on board. The steel ball, which you suppose, would do exactly the same as you state, if it could retain its volume unchanged, and displace a cubic foot of water at a depth such that its weight were exactly the same as that cubic foot of water. But this is not possible. Under the pressure of the water as it sinks the steel will be compressed more than the water, as we showed, even if it were solid, and when it reached the theoretical depth its volume would be less than a cubic foot and it would sink still farther, and be compressed still more till it reached the bottom. There is no place such as you suppose. There is still another impossibility. A steel ball whose volume is one cubic foot and whose weight is 65 pounds must be made of steel plate about a third of an inch thick. This would be in worse shape than the proverbial "cocked hat" long before it reached a depth of 10,000 feet, by the pressure of the water.

NEW BOOKS, ETC.

THE STONE IMPLEMENTS OF SOUTH AFRICA. By J. P. Johnson. 258 illustrations. New York: Longmans, Green & Co. 8vo.; cloth. Price, $2.50.

There is much work to be done in investigating the prehistoric races of South Africa, and in fixing them in their proper places as regards their advancement. Mr. Johnson has collected some interesting material, but it is to be hoped that he will find opportunity to investigate more thoroughly the ground that he has broken. However, his reasoning is quite in accordance with the facts, and places his finds beyond doubt in the periods to which they belong.

A POCKET-BOOK OF MECHANICAL ENGINEERING. Tables, Data, Formulas, Theory, and Examples for Engineers and Students. By Charles M. Sames. Revised and enlarged. Published by the author at 542 Bramhall Avenue, Jersey City, N. J. 195 pages, 41 figures; flexible leather. Price, $2.

The author has increased the scope of his first edition, adding much valuable matter, without adding materially to the bulk of the book. As a pocket reference book it cannot be too highly recommended. The field covered is extensive and closely covered, yet there are no unnecessary facts to hinder the practical worker.

THE COAST MANUAL OF LETTERING AND DESIGNS. Los Angeles, Cal.: The Coast Manual Publishing Company. Quarto; cloth; 106 pages. Price, $5.

Now that advertising is accepted without hesitation as a vital part of commercial routine, a book of letterings and designs, selected especially for their value to the "display artist," will find the readiest appreciation. The handbook published by Fred Knopf and J. M. Mahaffey is full of successful combinations that will be found most serviceable in their promptings to the experienced designer as well as to the novice.

MODERN AMERICAN MACHINE TOOLS. By C. H. Benjamin. New York: E. P. Dutton & Co. 8vo.; cloth; 134 illustrations, 320 pages. Price, $5.

The object of this treatise is to show to the buyer and user the prominent characteristics of modern machine tools as now manufactured in the United States, the various points in which they differ, and some recent data as to their capacity and performance.

To the buyer in Great Britain or on the Continent, this work should be a help, as it brings together in one volume facts from a variety of sources and furnishes information which might otherwise need to be sought at much expenditure of time and trouble.

While the present work is in no sense an advertising medium, it illustrates as large a variety of machines and of makes as the space allows, giving the reader as comprehensive a view as possible, and in all cases allowing an uninfluenced opinion to be formed.

ALTERNATING CURRENTS. A Text-Book for Students of Engineering. By C. G. Lamb. New York: Longmans, Green & Co. London: Edward Arnold. 8vo.; cloth; 325 pages, illustrated. Price, $3.

Many treatises on this subject have been written, but Mr. Lamb's work fills the need for a text-book for beginners that without being too cumbersome covers the subject of alternating currents in all its aspects.

The treatment of the question is based largely on the use of vectors, supplemented by simple analytical methods when it is desired to obtain numerical results. The symbolic treatment does not appeal to students, and has for that reason not been used. Also no attempt has been made to distinguish in the formulæ whether absolute or practical units are employed, since the unwieldy results are perplexing to beginners.

SPACE AND GEOMETRY IN THE LIGHT OF PHYSIOLOGICAL, PSYCHOLOGICAL, AND PHYSICAL INQUIRY. By Dr. Ernst Mach. From the German by Thomas J. McCormack. Chicago: The Open Court Publishing Co. London: Kegan Paul, Trench, Trübner & Co., Ltd. 12mo.; cloth; 148 pages. Price, $1.

The three essays which form the present volume were written for the Monist some four years ago. Last year they were in great part incorporated in their original German in Prof. Mach's latest published work, "Erkenntniss und Irrthum; Skizzen zur Psychologie der Forschung." In them Prof. Mach discusses the questions of the nature, origin, and development of our concepts of space from the three points of view of the physiology and psychology of the senses, of history, and of physics, in all of which departments his profound researches have gained for him a most exalted position.

SMALL ELECTRICAL MEASURING INSTRUMENTS. How to Make and Use Them. By Percival Marshall. New York: Spon & Chamberlain. 12mo.; paper covers, 90 pages, illustrated. Price, 25 cents.

A clearly-written and freely-illustrated handbook for the experimenter and investigator. By its use many instruments of equal efficiency to those sold by the regular makers can be made at very low cost.