ficially, in which Moissan has been the chief experimenter and the most successful one. It may be that Mr. Edison has taken a hand in this line of work, since he has done so in almost every line, but his name has not been publicly associated with the artificial production of diamonds. Your sources of information in the matter may be better than ours. The invention of carborundum is credited to Mr. E. G. Acheson in 1893. Moissan, "Electric Furnace," page 264, says: "I had occasion to find, in 1891, . . . small crystals of a silicide of carbon . . . I did not, however, publish anything on this subject at the time, and the discovery of the crystallized carbon silicide really belongs to Acheson." It is not "diamond in character," as you state, since the diamond is simply crystallized carbon, while carborundum is a compound of silicon and carbon. It is next to the diamond in hardness, or between 9 and 10 on the mineral scale of hardness. Being harder than emery it is a better abrasive, although emery is still preferred by some.

(9745) M. H. asks: 1. What is a range-finder, such as are used on warships? A. A range finder is an instrument for determining the distance and direction of any object. We can send you eleven SUPPLEMENTS containing valuable articles describing various kinds of range finders, at ten cents each. 2. Is it identical with a distance indicator? A. There are many forms of this instrument, some of which may be called distance indicators. 3. About how long, or how much time is usually consumed in finding the range with such an instrument? Has any instrument yet been invented or devised which will show or tell the distance of an object in from five to fifteen seconds of time? A. We do not know how quickly an experienced person could plot the result after the observations are taken. 4. Can a wind gage be made by an amateur mechanic which will record somewhat accurately the velocity of the wind? A. The velocity of the wind is usually measured by revolving cups placed upon arms. The revolving parts actuate gears which communicate motion to hands upon a dial. A skillful amateur could copy such an instrument if he had one at his disposal.

(9746) A. G. says: I think your explanation of the cause of a ball's curving in Question 9680, erroneous. You say: "The rotation of a ball is such that the air pressure is greater on the side toward which the ball rotates, pushing the ball in the opposite direction. Now, while without doubt the ball curves in the opposite direction from its rotation, I don't think you have stated the true cause of its curving. It seems to me that the greater air pressure is not due to the rotation of the ball but to its flight, hence it is always on the same side, namely the front, hence the ball must act upon it, not it upon the ball, to produce a variety of curves. In a word, the rotation of a moving ball gives it the tendency to circumvent, as it were, the resistance of the air, and so force itself more and more from its path. The only rotation that has no curving effect upon a ball's flight is that which has its plane parallel to the plane of the resistance such as is given the rifle projectile. A. We regret that you should not be able to agree with our statement of the curving of a ball, since it is not ours simply, but the conclusion of the highest authorities in mathematical physics. We would refer you to Hasting and Beach, "General Physics," page 135, where you will find the discussion of the subject.

(9747) M. W. S. asks: Is there any difference between a foot square and a square foot? Also, is there any difference between an inch square and a square inch? The last one was answered in a certain paper as follows: "Yes, twelve times the difference." Professors here claim there is no difference. A. There is no difference in area of surface between a square inch and an inch square, between a square foot and a foot square. There is a difference in meaning, however, between the two expressions, which we will illustrate. A piece of paper is an inch square when its corners are all right angles and its sides are all one inch in length. Similarly a board is one foot square when its sides are all equal and exactly one foot long and its corners are all square or right angles. A foot square implies a square whose surface is one foot. On the other hand a board may be of any shape whatever and be a square foot, if its area is one square foot or 144 square inches. A strip one inch wide and 12 feet long would be such a board. It might be irregular in shape and contain a square foot of surface. It would then be a square foot. The answer you quote from a paper is not correct.

(9748) A. W. P. writes: 1. What is a noise? Is it simply the vibrations caused by a moving object, or is it the action of the vibrations on the ear drum? For instance, suppose that a tree in the woods fell with no one near to hear it. Would there be a noise? Psychology teachers claim there would not. A. The word "noise" is used in two senses: in one sense it is the sensation which the mind perceives, in the other it is the physical cause of that sensation. If there were no person present the fall of a tree would not produce any sensation in any one's mind. It would, however, produce the same shock upon the air as if some one were present to hear it. The psychologist would say there was no sound, the physicist would say there was a sound. It is simply a difference in definition of a word. Both are right. The dictionary would give you this statement of the case. Text books of science and psychology usually contain it. 2. What is the complementary color of purple or violet? Is it green or yellow? A. The complementary color of purple is green. 3. Concerning wireless telegraphy, I have read that "the receiving antennæ should be about one-fourth the length of a wave." How may the length of the wave be determined? A. The length of electrical waves is dependent upon the number of oscillations per second of the discharge. With 300,000,000 oscillations the waves are about 3 feet long, since the speed of the waves is about the same as that of light. The mode of securing waves of a particular length is discussed in the several systems in Mayer's "Wireless Telegraphy," price $2. 4. Which is the best battery to use with a small induction coil (spark) for experimental purposes—one that will give a steady current and not annoy one by polarizing every few minutes? A. For experimental purposes you will find the plunging bichromate battery as satisfactory as any. A good form is described in our SUPPLEMENT No. 792, price 10 cents.

(9749) G. R. M. asks: Will you kindly answer the following through the columns of notes and queries in your valuable paper, and oblige a faithful reader: 1. What causes the changes of the moon? A. The phases of the moon are produced by the moon's revolution around the earth. The sun shines upon the moon all the time. When the moon in its motion around the earth comes between the sun and the earth, the sun is shining upon the side of the moon which is farthest from the earth. The dark half of the moon is toward the earth. That is the time of new moon. About two weeks later the moon has traveled around so that it is farther from the sun than the earth is, and the earth is between the moon and the sun. The lighted side of the moon is toward the earth. That is full moon. As the moon has changed from showing no lighted surface to the earth to showing the entire lighted surface to the earth, there was a time when she showed half her lighted surface to the earth, That was first quarter. Similarly there will be a time between full and new moon, when she will show half her lighted surface to the earth. That is last, or third quarter. If you will look up this matter in astronomies in your city library, you can read about it, and see the illustrations of it in the books, which will give you a much better idea than mere description in words. Ask the librarian about it. 2. Why does the mercury in the barometer stay higher when storms come from an easterly direction than it does when they come from any other direction? I have noticed this time and again and some of our largest and worst storms come from the east, and still the mercury will stay away up. I have wondered if the ocean had anything to do with it. As regards the power of a télescope, what is meant when manufacturers say they magnify 20, 33, or 50 diameters, A. We were not aware that a storm coming with an easterly wind was characterized by a higher barometer than one which comes with the wind from a southerly quarter. Storms always travel from west to east around the world. In crossing our country the paths curve considerably because of the mountain ranges, plains, and rivers. In the storm the wind blows inward toward the center, and the storm as a whole rotates from east to north, west and south, as we say, opposite to the hands of a clock in the northern hemisphere. This causes the northeast winds in the northern front quarter of such a storm. The ocean has little influence on these storms as far west as Ohio. The storm does not come from an easterly direction, but from the west, and the wind in its whirling in the storm blows from an easterly quarter in the front, and from a westerly quarter in the rear of the storm as it goes away. It clears off with a westerly wind, as you have observed.

(9750) E. C. asks: If the following problem can be solved, please give the solution in your inquiry column of the SCIENTIFIC AMERICAN. You will note that no rate of speed or length of time is given. A column of soldiers twenty-five miles long are on the march. A courier is dispatched from the rear to deliver a message at the head of the column. He delivers the message and returns to the rear, when he notices that the rear of the column is at the same point at which the head of the column was when he started. How far did he ride? A. The problem is possible of solution without having the rate of speed of either the soldiers or couriers given and without having the time known. The solution is as follows: Let Y = the number of miles traveled per hour by the courier. Let X = the number of miles traveled per hour by the soldiers. Then $\frac{25}{Y-X}$ = the time required to reach the front, and $\frac{25}{Y+X}$ = the time required for the courier to reach the rear of the column again. The sum of the two above quantities equals the time required for the soldiers to march 25 miles; therefore,

$$\frac{25}{Y-X}+\frac{25}{Y+X}=\frac{25}{X}$$

Solving this equation we find that X equals 0.41 Y or Y equals 2.41.

The soldiers traveled 25 miles. The courier went 2.41 times as fast and traveled for the same length of time, therefore he traveled 2.41 × 25 miles or about 60.25 miles. This solution is based on the assumption that both the soldiers and the couriers are traveling at a uniform rate.

(9751) A. W. asks: 1. What is meant by "polyphase" as applied to electric engines; and by "cycle" as applied to gas engines? A. A cycle is a series of changes through which a varying quantity passes, including all its values, and it fluctuates through these changes periodically. Thus a cycle of an alternating current of electricity is the successive values of the E. M. F. through one series of changes from zero to its highest value, and down through zero to the lowest and back again to zero. This succession of values the current will have as many times per second as there are cycles, ordinarily 30, 60, or 120. Polyphase currents are those whose E. M. F.'s differ from each other by a fraction of a phase. Thus three currents a third of a cycle apart will furnish a three-phase current in the lines with which it is connected. See Sloane's "Electrician's Handy Book," price $3.50. A cycle is like a complete succession of the heights of one tide in about twelve hours at the seashore. A phase is any single value or height of the water. If two or three tides come together by different channels in the same place or bay we have a two-phase or three-phase current of the tide. 2. What is meant by jibing a sail-boat? A. A sailing vessel is tacked when in changing from one course on the wind to another it presents its bow to the wind; it is jibed when it is turned in the opposite direction so that it presents its stern to the wind. In a high wind the latter is always a difficult and sometimes a dangerous operation. 3. Is a catboat so called because the mast stands straight up at one end of the boat like a cat's tail from its body? A. We are certain that a catboat is not so called because its mast stands straight up like a cat's tail. The mast is at the front end of the boat, and so far as we have observed cats have their tails set at the stern end. We do not know the derivation of the name catboat, but think it far more likely that it was given because of the quickness with which these boats will come about. 4. Does an electric motor differ in structure from a dynamo? Can they be interchanged? A. There is no theoretical difference between a dynamo and a motor. In general, each may be used for either service. There are, however, many structural differences between the two classes of machines, so that it can be easily told to which class any particular machine belongs. 5. How can a steady, effective current proceed from a dynamo giving an alternating current? The current changes polarity each instant, as understood. A. A steady current is not produced by an alternator. An alternating current can, however, be changed to a steady direct current by means of a rotary converter. 6. What light form of motor would you recommend for driving a dirigible balloon? A. Probably some form of gasoline motor is best adapted for use in a dirigible balloon.

(9752) O. E. G. asks: 1. Is the speed of radiant heat (whose medium is the same as light) the same as light and electricity? A. The latest science does not make any such distinction as between radiant heat, light, electricity, etc. They are all the same radiation. If the waves are of a length to affect the proper nerves we feel them as heat; if they can affect the eye we see light. 2. Is the difference between light, electricity, and radiant heat due to the difference in wave-length? A. The sole difference between the several effects is due to wave-length. See the "New Knowledge," by Prof. Duncan, price $2. 3. If light moves in transversal waves, how can it move forward? A. In all vibratory motions it is the wave form simply which travels. A wind moving over a field of grain is the very best illustration of this one can have remote from the ocean. Water waves on the ocean are good illustrations of a transverse wave with an onward motion of the wave form. It is not light which moves, but a wave form. The matter which vibrates moves to and fro, the wave advances. 4. Please explain wave-length. A. Wave-length is the distance from a particle moving in a certain direction to the next particle in exactly the same condition of motion. In a water wave, the wave-length is from a drop on the crest, for example, to the next drop exactly on the crest, also. 5. What is the wave-length of electricity, and does it vary with the amperage? A. There are all sorts of wave-lengths of electricity down to very short waves, but not so short as those which produce light. Those used in wireless telegraphy with a single wire as an aerial are very closely four times as long as the height of aerial wire from which they are radiated into space. When a capacity is in the circuit this affects the wave-length. The wave-length varies with the rapidity of the oscillations of the discharge. 6. Does a heated conductor of electricity retard the current? A. A hot metal has more resistance than it has at a lower temperature, and so reduces the current which flows through it. Carbon, however, has a much greater electrical resistance when cold than when hot.

(9753) F. W. M. says: I have a house to wire for burglar alarms, closed-circuit system. Kindly tell me where I can get a cheap book or instruction paper on the subject, as to how to connect up the battery (bluestone) and run the wires from windows to battery and then to annunciator. A. We recommend and can supply you with Lorstmann and Tousley's "Modern Wiring Diagrams," price $1.50, which gives a good variety of modes of wiring for burglar alarms, showing all connections.

NEW BOOKS, ETC.

SUCTION GAS. By Oswald H. Haenssgen. Cincinnati: Gas Engine Publishing Company, 1905. 16mo.; pp. 88. Price, $1.

The economy of the gas producer for furnishing fuel for a gas engine has led to its rapid introduction and adoption in this country for many large installations. That a gas producer of the suction type can be made to supply fuel gas almost as economically for a small-sized engine of 3 or 4 horse-power as for a much larger plant, will perhaps be surprising to our readers. Such a producer, however, is described in this little volume, which also gives considerable useful information, together with numerous valuable figures upon suction gas.

WHEEL GEARING. With Tables of Pitch-Line Diameters of Wheels, Proportions and Strengths of Teeth, etc. By Alfred Wildgoose and Andrew J. Orr. New York: Spon & Chamberlain, 1904. Pocket size; pp. 175. Price, $1.

This small handbook should save engineers, draftsmen, and others engaged in making calculations relating to gear wheels, much valuable time. It contains a large number of tables giving the pitch-line diameters, etc., of gears of different sizes. The pitch-line diameters are given with a degree of accuracy sufficient for all ordinary purposes, the diameters being expressed in inches and decimals and fractions of an inch. The proportions of wheel teeth given are those generally adopted by engineers, and the various dimensions for each pitch will be found tabulated in a convenient form.

REPORT OF PROGRESS OF STREAM MEASURE FOR THE CALENDAR YEAR 1903. By John C. Hoyt. Washington: Government Printing Office, 1904.

This book, which forms Paper No. 100 on Water Supply and Irrigation, is issued under the auspices of the United States Geological Survey. It forms Part IV. of the series and has to do with interior basin, Pacific, and Hudson Bay drainage. Besides the regular measurement of the flow of streams made during the year 1903, and reported herein, a considerable amount of other special information that will be of use in general hydrographic studies has been included. Reconnaissances of many of the important rivers in different parts of the country have been made, and these have resulted in a collection of much valuable data with regard to flood, water-powers, river profiles, etc. The number of regular stations for stream measurements is steadily increasing, and at present systematic measurements are taken at over 500 stations, distributed so as to best cover the needs of the various States and Territories. The expansion of the work is the result of the greatly increasing demand from the general and engineering public for stream data collected by the Survey.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending August 22, 1905

AND EACH BEARING THAT DATE

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