end to receive a pencil; and the invention consists in the special construction of the tubular body in connection with the rubber eraser and the form at the end of the tube which receives the pencil.

WELT-KNIFE.—H. Karpenstein, New York, N. Y. The intention in the present case is to provide an improved knife which embodies means for regulating the depth that the blade may cut into the leather, thus placing the knife more thoroughly under the control of the operator and preventing the implement from injuring the leather or the article by the accidental slipping of the knife.

FISHING AND TRAPPING DEVICE.—R. F. Armstrong, Effingham, Kan. This is a device for catching fish and small animals, but it is particularly adapted for use as a fishing appliance. It relates to that general class in which a tripping or bait hoot is provided in conjunction with a number of impaling hooks, which are spring-actuated and released by the trip-hook to impale the fish when the bait is taken.

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.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Inquiry No. 4400.—For a patented article to manufacture upon royalty,

Inquiry No. 4401.—For machinery to manufacture paper boxes.

Inquiry No. 4402.—For machines for husking corn in the field,

Inquiry No. 4403.—For a pocket cash register in the form of a watch.

Inquiry No. 4404.—For a machinery for making macaroni and spaghetti.

Inquiry No. 4405.—For manufacturers of flexible metallic tubing.

Inquiry No. 4406.—For a ceiling fan operated by clockwork.

Inquiry No. 4407.—For ice-making machines.

Inquiry No. 4408.—For makers of electric furnaces for bakers' use.

Inquiry No. 4409.—For manufacturers of electric light machinery, etc.

Inquiry No. 4410.—For makers of plates for static (Wimshurst) machines.

Inquiry No. 4411.—For makers of fiber machinery for extracting lint from flax straw.

Inquiry No. 4412.—For makers of small stationary engines 1 h. p. and not heavier than 20 pounds for running ice cream freezer or churning butter.

Inquiry No. 4413—For makers of small steam engine castings, also of small, double upright marine engines.

Inquiry No. 4414—For castings and materials for building a one-half horse power dynamo.

Inquiry No. 4415.—For makers of machinery for collapsible tubes.

Inquiry No. 4416.—For the manufacturers of the Pictet ice machine.

Inquiry No. 4417.—For manufacturers of cotton yarn mops.

Inquiry No. 4418.—For makers of telegraph and telephone instruments and supplies.

Inquiry No. 4419.—For makers of die stock cutters.

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.

(9091) E. L. H. says: Do the heat units in gasoline oil differ in different oils at the same specific gravity? That is, has Penn. gasoline and Coli. gasoline the same heat units in gasoline oil of the same specific gravity? A. The heat value per pound of all gasoline is the same, and for practical purposes the heat value of all petroleum products per pound is very nearly a constant quantity, being not far from 19,600 British thermal units per pound. The heating value per gallon will vary with the specific gravity, depending on the number of pounds of oil to the gallon. 2. In breaking the circuit at platinum points, what causes the spark? Is it caused by the burning of an atom of the platinum or is it electricity? A. In breaking the circuit at platinum points, the spark is caused by heating the particles of air between the points to a white heat, caused by the resistance of the air to the passage of the electricity. The air is heated by the electricity in very much the same way that the carbon filament in the incandescent lamp is heated.

(9092) 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. If you will write to the Baldwin Locomotive Works at Philadelphia, Pa., for catalogues of their compound locomotives and information regarding their performance, we think they will give you some valuable information.

(9093) 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.

(9094) 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.

(9095) 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.

(9096) C. W. W. asks: 1. What is the theory of the rotary magnetic field? (I do not find the explanations in Thompson's "Elementary Lessons in Electricity and Magnetism" and "Polyphase Currents" quite clear.) How are the poles shifted so as to cause masses of metal to rotate uniformly in the field? A. The theory of the rotary magnetic field is very mathematical and cannot be worked out in a paper. We must refer you to the books upon mathematical electricity. A rotary field is produced by the phases of the current succeeding each other in turn around the field, thus producing currents in the armature coils, or the coils of the rotary portion of the motor, so that the "rotor," as it is sometimes called, is dragged on after the shifting phases of the current through the stationary portion of the motor. The coils of the rotor are closed and have no connection with the external circuit, thus they do not receive any current from outside. 2. What is an induction motor? What special application has it? A. An induction motor is one whose rotation is produced in the manner described above, by the induction of currents in the body of its rotor, due to the induction of the alternation of the phases of the current through its field or stator. It is used for the same purposes as any other motor. It does not require that the current shall be transformed to a direct current, as an ordinary motor does. A long-distance transmission is by alternating currents, many of them being also polyphase. The induction motor can use these directly, or with only the transformation of the voltage. A direct-current motor requires that a rotary converter shall be used to change the current to a direct current. 3. In wireless telegraphy are the electric waves propagated in *all* directions from the antennæ, or in a given direction only? A. The waves from a wireless telegraph apparatus are transmitted in all directions. 4. Is the incessant sparking sometimes observed between the trolley wire and the wheel especially heavy in rainy weather? A. The sparking from a trolley wire is due to the trolley leaving the wire, producing a gap over which the current arcs. 5. In vacuum tubes why does not the current "jump" across the electrodes by sparking instead of "flowing" (as it were) across? What is the "flow" due to? To the gas molecules? A. In vacuum tubes the particles of gas are driven from the cathode in streams across the tube. The character of the discharge through the tube depends upon the degree of exhaustion of the air. With the highest exhaustion no electricity will pass across the space between the terminals even when they are quite near together. See Thompson's "Elementary Electricity."

(9097) S. H. asks: 1. What is the highest rate per second theoretically that the current flowing through the primary of the large induction coil described in "Experimental Science" could be interrupted and still obtain maximum results from the secondary? A. The question of interrupting the primary current in an induction coil is a practical rather than a theoretical one. Nor are we able to say definitely what the upper limit of interruption may be. With the Wehnelt electrolytic interrupter, as high as from 1,000 to 3,000 times per second have been attained. With mechanical breaks the rate is less. With an alternating current 20,000 alternations per minute are recorded in our data; more may have been used. The effects in this instance are said to have been not as great as with a mechanical break. The rate for any particular case may be determined by comparing the musical note emitted by the interrupter with a tuning fork and determining its pitch. The number of vibrations per second will thus be determined. 2. What is the time required for the magnetism to leave the iron core after the current is broken? A. We have no data for demagnetizing iron. The time should be about the same as the rates of vibration given above, since a coil will not give a maximum spark except with the best demagnetizing effect.

(9098) J. L. asks: 1. I have a 1½ horse power gasoline engine run by dry cell batteries. Would I get more speed if I used wet batteries with a dynamo, and why? A. The kind of battery used with your gasoline will not make any difference to its power. The battery is used to produce a spark to ignite the vapor simply. You can do this by a dynamo after the engine is turning fast enough to bring the dynamo up to full speed. But for a small boat you will not gain anything by the change. 2. Does machinery run better at night than day, and the reason therefor? A. We know of no reason why machinery should run better by night than by day.

(9099) C. R. V. says: If a water pump, plunger type, should be made from a tube having a ½ or ⅝-inch bore, and plunger fitting snugly in same, check valve each side, etc., plunger moving or having a stroke of 4 inches, what would be the limit of revolutions per minute if fastened to a wheel and crank, that it would work satisfactorily? Would it be necessary to decrease the revolutions per minute in ratio to increasing the stroke to gain same results as a smaller or shorter stroke? What is the fixed rule for this? A. The most practical speed for the plunger of all pumps is about 100 linear feet per minute. This speed is irrespective of the size of the plunger and the length of the stroke. If this speed is much exceeded, the valves do not seat properly and the pump does not work smoothly. If the stroke is decreased, the number of revolutions per minute may be increased in the same ratio to keep the piston speed the same.

(9100) 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.

(9101) W. W. R. writes: We have an artesian well here about 1,000 feet deep that is throwing out salt and white sulphur water at the rate of 400 gallons per second. This is correct. I tested it three different times, and made it that or a little over. I am satisfied it will rise in a 6-inch pipe 30 to 50 feet, and probably higher. With say a rise of 30 feet, what horse power will it make with a turbine wheel, and what size wheel will it take to run a flouring mill, or will it do it at all? Our town has a population of 600, and could we light the town with the power from well? Say eight large electric lights and 400 incandescent lights for stores and dwellings. A. Four hundred gallons of water per second at a pressure equal to a head of 30 feet would develop 180 horse power. The number of pounds of water per second, multiplied by the head and divided by 5,500 will give you the theoretical power. If this flow of water could be constantly relied on, from 75 to 80 per cent of the above horse power could be generated by a turbine wheel, which would be sufficient to light your town, with considerable margin to spare. It is very doubtful if your well will continue its present output at the pressure which you mention for a great length of time. We would advise you, therefore, to get an expert's opinion on this point before making any large investment.

(9102) C. H. M. says: What is the formula for finding the horse power required to run an air compressor, given the following: The internal dimensions of the cylinder, the speed, and the maximum internal pressure, or the pressure at which the air is delivered from the compressor. A. The horse power required to run an air compressor, neglecting friction, equals the area of the cylinder in square inches multiplied by the internal pressure per square inch, multiplied by the number of feet which the piston moves per minute, and the whole divided by 33,000. Taking friction into account, the power necessary would be nearly double this amount. 2. In finding the exact horse power required, would the external pressure be considered? A. In determining the exact horse power, the difference in pressure of the two sides of the piston in pounds per square inch is the figure that should be used. 3. Of what advantage is a several-staged compressor over a single-staged one? A. A several-staged compressor has the following advantages: The air is compressed less in each cylinder, and therefore a larger amount of air can be forced out of each cylinder per stroke. The valves work more satisfactorily, and there is less leakage, because the difference in pressure on the two sides is less. Second, a small amount of leakage does less harm. The increase in temperature due to the compression in each cylinder is less, and the air may be cooled between the various stages of the compression. The work is more uniformly distributed throughout the entire stroke, making the compressor run more smoothly. 4. What would be the formula for finding the horse power required for a two, three, or four stage compressor? A. The horse power of the two, three, or four stage compressor is found by first finding the horse power of each cylinder, by the method already explained, and adding these amounts together. 5. Is there a formula for computing the horse power of a steam turbine, given the steam or air pressure and the number of cubic feet of steam or air delivered per minute at a given pressure? At what pressure will a turbine work most economically? Does a turbine generate as much power with a given amount of steam as a reciprocating engine? A. There is no reliable formula for computing the horse power of the steam turbine. In general, steam turbines will develop about the same horse power for a given amount of steam as reciprocating engines. A small power turbine at 120 pounds steam pressure non-condensing, will require 40 or 45 pounds of steam per horse power per minute. On the other hand, a larger turbine, designed so as to get the full benefit of the expansion of the steam, when working with steam at 180 pounds pressure and condensing, may be operated with about 16 or 18 pounds of steam per horse power per hour. The higher the steam pressure, the more economical will be the turbine.

(9103) H. M. K. says: I wish to thank you for the answer you mailed me and would be pleased to receive an answer to another question that it aroused in my mind. You said there was no capillary seepage through gas pipes in ordinary ground, as the internal pressure would prevent this. In drilling a gas well with 50 pounds pressure, 500 feet of water is cased off. Would there be any seepage through the casing? If so, at what depth, and how much? Also, why does a 2,000-foot gas well with 900 pounds pressure in the summer time freeze shut, and accumulate 2 or 3 inches of frost outside when the gas is being used? Why do the drilling tools freeze fast when the gas is struck in large wells? A. With a water pressure corresponding to a head of 500 feet, it would be difficult to make the joints in the casings sufficiently tight to prevent some leakage. There would not be, however, any seepage through the walls of a wrought-iron pipe. It is impossible to estimate the amount of leakage in the joints; if the workmanship were absolutely perfect there would be none. The frost which accumulates on the inside of a gas well with a high pressure is caused by the condensation and freezing of the moisture which the gas carries with it. The freezing is caused by the low temperature of the gas, due to its sudden expansion when it escapes into the atmosphere. If the well were capped, and the pressure at the bottom of the well was maintained at the outlet, this expansion could not occur, and there would be no fall in temperature. The frost on the outside of the pipe is due to the condensation and freezing of the moisture in the atmosphere. The drills freeze in the well when gas is struck, if the gas is at a sufficiently high pressure to expand enough to lower its temperature below the freezing point.

(9104) W. M. says: I wish to experiment with compressed air, and desire a little information on that subject. Air compressed to a density of 50 pounds to the square inch and admitted to a cylinder 3 inches in diameter for a distance of 2 inches, how far will the piston travel before losing all its expansive force? Also, at 100 and 200 pounds to the square inch? A. When air expands, its *absolute pressure* decreases in the same proportion that its volume increases, so long as the temperature remains constant. The absolute pressure is found by adding 15 pounds—the atmospheric pressure—to the pressure which is shown by the gage. Thus, if one cubic foot of air at 50 pounds pressure expands to two cubic feet, the absolute pressure after expansion will be $50 + 15 \div 2 = 32.5$. This equals a pressure of $32.5 - 15 = 17.5$ pounds above the atmosphere. In the same way, if the volume were increased to 3 cubic feet, the final pressure would be $50 + 15 \div 3 = 21.6$. This equals a pressure of 6.6 pounds above the atmosphere. This rule can be applied to any pressure and to any change in volume, so long as the temperature remains constant. The rule does not exactly apply to compressed air in the cylinder, because the temperature of the air decreases when the air expands, and this decrease in temperature decreases the pressure somewhat by the figures given by the above rule. Where the expansion is not carried too far, however, the above rule gives results which are approximately correct. If the fall in temperature is known, the final pressure, as determined by the above rule, may be corrected by multiplying it by the following formula:

$$\frac{460 + t1}{460 + t2}$$

where $t1$ equals the temperature of the air in degrees Fahrenheit at the end of the expansion, and $t2$ equals the temperature of the air in degrees Fahrenheit at the beginning of the expansion.

(9105) R. H. says: 1. Would you please inform me where I can find in some paper a good article on the three-phase system as used in traction? A. We have not printed anything upon this special subject, though there have been paragraphs here and there in articles upon power plants on the Pacific coast and other places. Some traction plants in Italy and Switzerland in which high potential motors are employed have been described in American journals. For articles upon the three-phase system in electric traction, you should follow the engineering journals, such as the Electrical World. 2. I tried to make a storage battery with lead plates and dilute sulphuric acid. I took 16 parts water to 1 of acid. Is that the right proportion? I mixed some red oxide of lead with some glycerine and put it on the positive plate. As soon as I put the plate in the acid water, the red oxide dropped off. What was the trouble? A. The paste made with glycerine and red lead was worthless for a storage cell, since the glycerine was destroyed by the sulphuric acid almost immediately upon coming into contact with it. It probably turned black very soon, owing to the decomposition of the glycerine. The strength of electrolyte employed varies in different forms of cells, but is generally from 1 in 3 parts to 1 in 4 parts of acid in water. The red lead is mixed with the electrolyte and the paste spread upon the lead plate. The details can be learned from a book on storage batteries. Treadwell's is a good one, price $1.75 by mail. 3. How can I tell when the storage battery is fully charged? A. A storage cell is fully charged when the voltmeter shows 2.5 volts. The only certain way to determine full charge is by the voltmeter. Rapid boiling, or escape of bubbles, is a rough way of telling when the cell is charged. 4. I have three cells in the battery, and when I charge them in series small bubbles come up from the plates, and when I charge them parallel there are no bubbles. I can get, however, the same amount of current in both cases. The dynamo runs easier when I charge them parallel. What is the cause of this? A. The bubbles which come off the plates are oxygen from the plate connected to the positive pole and hydrogen from the negative pole of the charging current. They result from the decomposition of water, and when the charge approaches completion the current decomposes more water than at first. 5. Where is the electric light placed in an electric fountain? A. The electric light in an electric fountain is placed so that the beam of light is sent up into the air, and strikes the ascending stream of water. It thus becomes visible. The part of the beam which does not meet water goes on out into space and is not seen.

(9106) T. H. D. asks: 1. Given a number of 16 c. p. incandescent lights, when first operated they may measure up to 16 c. p., but the light given from them gradually decreases until they give out entirely. What is the cause of the decrease in the amount of light given? A. The cause of the decrease of light from an incandescent lamp as it becomes old is an increase in resistance, which cuts down the current which can flow through the lamp with the voltage of the circuit. This increase is due to a decrease in the size of the filament. By the action of the current the carbon of the filament is driven away to the inner surface of the bulb, and can be seen there as a black deposit. This deposit itself also cuts off light. 2. If these lights are sold at so much per kilowatt, will it cost the consumer more to get the same illumination (if possible) from them after having been used, say, three months, than it did when they were first put to work? If so, why? A. Yes; since the current must be brought up by increasing the voltage of the circuit, the watts consumed are increased. After a time it is not possible to bring such a lamp up to full candle power. 3. If the same amount of current is supplied constantly to the meter, will that instrument register a greater or lesser quantity of electricity consumed as the age of the incandescent lights increases? A. If the same amount of current at the same voltage is supplied to a wattmeter, it will register the same number of kilowatts independent of the condition of the lamps. The resistance of the lamps increases with age, and it becomes very wasteful to use them after a certain time, since the light decreases more rapidly than the resistance increases. A reasonable limit for life of a lamp is 500 hours. 4. Is the resistance the same in a new and an old light? A. This topic is treated very completely in Crocker's "Electric Lighting," which we can supply for $6 by mail.

(9107) W. E. H. asks: Can you tell me if there is any machine invented or patented (or in use) to produce power by any of what are called the mechanical powers, such as the wedge, the screw or lever, as a motor solely without any other agent whatever, such as air, water, electricity, heat in any form or chemicals; simply a mechanical motor to drive or operate machinery? I do not mean the perpetual motion fiend business, but something to push and pull with for something. A. We do not know any motor as a generator of power such as you call for, but a lever or any other of the mechanical powers, by the aid of a weight, acting under gravity, will generate power and comes within the limits of your question. They do not use air, water, heat, electricity, or chemicals, but only gravity. They may drive machinery also, but the weight will have to be wound up again after it has run down to its limit. A clock is a machine so driven, and comes well within your requirements. Nor is it a perpetual motion machine.

(9108) L. J. T. says: 1. Will you kindly answer the following in your Notes and Queries: Supposing a hole to be bored through the center of the earth and to the surface on the opposite side, or in the same direction of the diameter of a circle, now if an iron ball was dropped in the hole, where would it stop? A. The ball would stop finally at the center of the earth, if the air is supposed to remain in the hole through the earth, and the rotation of the earth be disregarded. The resistance of the air will ultimately bring the ball to rest. 2. Now, if a vacuum could be created in that hole and the same ball be dropped from the surface in that vacuum, where would the ball stop, the rotation of the earth not to be considered? A. In a vacuum the ball should oscillate to and fro on either side of the earth's center forever, since there is nothing to stop the motion. 3. In the latter case would the ball act like a pendulum swinging in a vacuum and be eventually stopped by the attraction of the earth? A. The attraction of the earth cannot bring the ball to rest, since it acts only to accelerate the motion of the ball as it falls toward the center of the earth on either side of the center, and equally to retard its motion after the ball has passed the center of the earth. The ball will not be stopped by inertia nor by gravity, and would move forever.

(9109) W. B. K. asks: 1. Does the moon have any known effect upon the weather? We are continually hearing about what the weather will do when the moon changes. A. The opinion that the moon controls the weather is firmly fixed in the minds of sailors and unscientific people generally. The authorities of the Weather Bureau have stated that their records of the weather and its changes show absolutely no connection between the changes of the moon and changes of the weather. 2. Please inform me how I shall hold my watch in order to find the north when the sun is shining? I was told to stand facing the sun, to point the hour-hand at the sun, and one-half way from the hour hand to the XII. on the rim of the watch was south. I could not make this come right, but found that one-half way between the hour-hand and the minute hand would give me south. Which is correct, and what is the explanation that makes the watch designate the north? I understand, of course, that the above is only an approximate method of finding the north? A. Your statement regarding the manner of holding a watch to determine the south point of the horizon is correct. The south point is half way between the position of the sun and the twelve-hour mark when the hour-hand is pointed toward the point of the horizon directly below the sun. The explanation is simple. At noon the hour-hand and XII. are together, and both point to the sun, which is then in the south. At one hour from noon the hour-hand is one-twelfth of a circumference, or 30 degs. from XII., and the sun is 15 degs. from the south point, or half way between the place of the hour-hand and XII. The sun moves 15 degs. an hour; the hour-hand moves 30 degs. an hour, or twice as fast. The same reasoning applies to any other hour of the day.

NEW BOOKS, ETC.

L'AIR LIQUIDE. Sa Production, Ses Propriétés, Ses Applications. Par Georges Claude, avec une préface de M. d'Arsonval, membre de l'Institut. Un vol. grand in 8vo, avec photographies d'appareils et instantanés d'expériences. Vve. Ch. Dunod, éditeur, 49, quai des Grands-Augustins, Paris, 6e. Price, $1.00.

Georges Claude is a popular scientific writer best known in France for his "L'Électricité à la Portée de Tout le Monde." This last work, on liquid air, presents in a popular way the most noteworthy achievements in the liquefaction of the so-called permanent gases, and particularly of the liquefaction of air. The first chapter considers first theoretical matters, and secondly the liquefaction of air. In the second chapter the difficult problem of preserving liquid air is presented. Subsequent chapters treat of the properties and physical effects of liquid air, its physical and chemical applications, and the chemistry of low temperatures.

A MANUAL OF CORPORATE MANAGEMENT. Containing Forms, Directions and Information for the use of Lawyers and Corporation Officials. By Thomas Conyington, of the New York Bar. New York: The Ronald Press. 1903. Pp. 331.

Mr. Conyington's volume, although intended for lawyers and corporation officials, has not for its purpose the discussion of corporation statutes, or the law of corporations. The object of the work, as its title indicates, is to present in logical order, something of the details of corporate procedure and of corporate management. Perhaps the most valuable portions of the book are the collated forms which cover almost the entire range of ordinary corporate procedure and are those approved by the leading corporation attorneys. Mr. Conyington has prepared a work which may be regarded as the fullest of its kind on the particular subject which it discusses.

THE BOOK OF CORN. For Farmers, Dealers, Manufacturers, and Others. A Comprehensive Manual upon the Production, Sale, Use, and Commerce of the World's Greatest Crop. Illustrated. New York and Chicago: Orange Judd Company. 12mo. Pp. ix, 368. Price, $1.50.

Despite the great importance of maize, practically no book has as yet been published in which it is adequately discussed. For that reason "The Book of Corn" may be said to supply the proverbial long-felt want. While authoritative both as a practical manual and scientific treatise, the "Book of Corn" is of value to the business man.

STORAGE BATTERY ENGINEERING. A Practical Treatise for Engineers. By Lamar Lyndon, B.E., M.E. New York: McGraw Publishing Co. 1903. 8vo. Pp. 382. Price, $3.00.

This book is intended to assist the practical engineer in designing, installing and maintaining battery equipments and to guide him in the selection of types of batteries and auxiliary apparatus best suited to the service which they are to perform, and at the same time impress upon the technical public both the advantage and limitations of the storage battery in practice.

COTTON MACHINERY SKETCHES. By William Scott Taggart. London and New York: Macmillan & Co. 1903. 8vo. Pp. 104. Price, 60 cents.

The drawings of which this book is comprised are reproductions of illustrations selected from the author's work on cotton spinning. The book is intended for the use of such teachers who desire to present a sketch to their pupils and to explain the sketch in the particular way they have found to be most desirable for their purpose. Students may use the work for practice in sketching and for the purpose of developing their own descriptive powers in explaining a machine, without being influenced by the description associated with the drawing in a text book.

YEAR BOOK OF THE AMERICAN POWER BOAT ASSOCIATION. New York: The Rudder Publishing Co. 1903. Pp. 46. Price, 25 cents.

The rapid growth of interest in power boats and the remarkable strides made by the industry of late years is one of the signs of the times in the yachting world. A recent development is the attention that is being attracted to power-boat racing which promises to obtain a hold upon the yachting man and the general public second only to that of the sailing yacht. The American Power-Boat Association was formed to promote the use of power boats and the improvement of their design, etc., and formulate rules for racing. This small volume contains full information regarding the organization, jurisdiction, etc., of the Association; the racing rules, 27 in number, and a table of time allowances.

LLOYD'S REGISTER OF AMERICAN YACHTS FOR 1903-4. New York: Lloyd's Register of Shipping. 1903. Pp. 450. 42 pages of flags and signals. Price, $7.50.

The large and rapid increase in recent years in the fleet of American yachts has called for a separate register of them. The book con-