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.

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 This is for our information and not for publication.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 Coll. 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