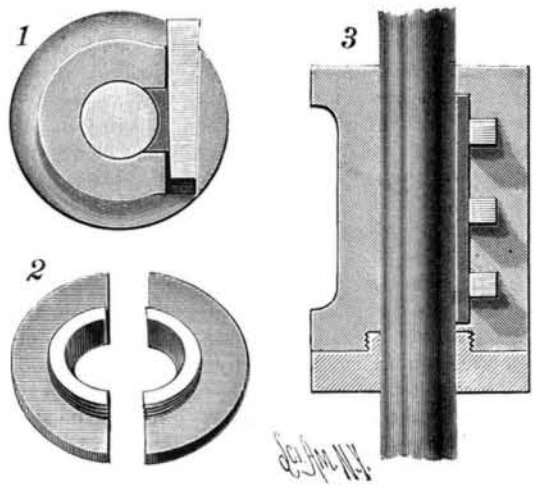
AN IMPROVED TAPPET.

A tappet which is simple and durable in construction, and permits of quickly removing a worn-out face and inserting a new one, is shown in the accompanying illustration, and has been patented by Mr. Walter N. Nolan, of El Oro, Tultenango, Mexico. The body of the tappet is preferably keyed to the stem, as shown in Fig. 3, and in the sectional view, Fig. 1, and on its under side is screwed a face made in ring shape and



NOLAN'S TAPPET.

formed of two or more sections. On the face is a hub, as shown in Fig. 2, with a thread adapted to screw into a corresponding thread on the under side of the tappet body. The thread on the latter is arranged in the direction of the travel of the cam, so that an accidental unscrewing of the face is impossible. When the face is worn out, it is easily unscrewed and a new face screwed on in its place. Old tappets may be thus faced up and fitted with rings, thereby saving expense, and the faces when adjusted form a smooth and level surface for the cams to operate on.

Dry Battery.

The mixture for filling dry cells prepared by Mr. A. V. Meserole consists of the following solid ingredients in the form of powder: Charcoal, 3 parts; mineral carbon or graphite, 1 part; peroxide of manganese, 3 parts; lime hydrate, 1 part; white arsenic (oxide), 1 part; and a mixture of glucose and dextrine or starch, 1 part; all by weight. These are intimately mixed dry and then worked into a paste of proper consistency with a fluid solution composed of equal parts of a saturated solution of chloride of ammonium and chloride of sodium in water, to which is added one tenth volume of a solution of bichloride mercury and an equal volume of hydrochloric acid. The fluid is added gradually and the mass well worked up.

HOW HERON SOLVED IT.

Said Ctesibius to his pupil: "Heron, will you have a glass of soda?"

"I don't care if I do," said Heron.

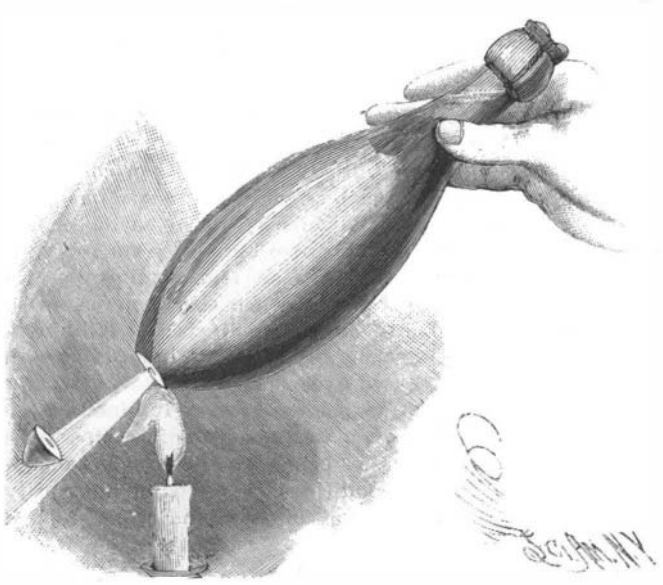
Whereupon Ctesibius produced a quaint glass bottle, having a thick conical bottom, and containing a liquid said to be soda water.

"Heron, my boy," said he, "here is your soda; drink it without removing or perforating the cork or breaking the neck of the bottle."

Heron scratched his head, and revolving the bottle in his hand, while the problem was going through a similar evolution in his brain, said: "As you well know, dear teacher, I am up in mathematics, proficient in mechanics, and not behind the age in pneumatics and hydraulics, but for this problem I have no solution."

"Heat! Unequal expansion!" said Ctesibius, impatiently.

Heron, being an apt scholar, needed no further hint. Lighting a candle, he held it under the thick conical end of the bottle, and in less than a minute by the clepsydra, the bottom of the bottle cracked around, the pressure from within blew out the detached piece, and the soda was discharged with a fizz into the tumbler. The rest goes without saying.



DRAWING SODA WITHOUT REMOVING THE CORK OR BREAKING THE NECK OF THE BOTTLE.

The New York Belting and Packing Company.

This well known concern has obtained an English incorporation under the English companies acts, 1862 to 1890, as manufacturers of India rubber goods. They have been established 44 years, and their works or processes have several times been illustrated and described in the SCIENTIFIC AMERICAN. The new organization places them in a position of a stock company, open for subscriptions here and abroad. The subscription lists are in the hands of August Belmont & Co., of this city, and Lee, Higginson & Co., of Boston, Mass. A rate of profit continually increasing is shown for several years; for the five months ending May 31, 1890, the rate exceeded $500,000 per annum. For plant and goods on hand a price of $2,813,000 (£580,000) is asked. The capitalization includes first mortgage bonds $1,091,250 (£225,000), ordinary stock $970,000 (£200,000), preferred stock $1,091,250 (£225,000), and founders' shares $4,850 (£1,000). The preferred stock is entitled to 8 per cent preference of dividends, the ordinary stock to any further dividends up to 12 per cent, the bonds are issued at 6 per cent interest. The balance of profits after providing for a reserve fund and sinking fund go half to the ordinary and half to the founders' shares.

Synthesis of Ammonia.

It was demonstrated long ago, by Bunsen and Playfair, that when charcoal and potassium carbonate are heated to redness in an atmosphere of nitrogen, a certain quantity of cyanide of potassium is formed. Since that time Margueritte and Sourdeval have further shown that barium carbonate may be used instead of the potash, and that the barium cyanide produced may be again decomposed by steam into ammonia and barium carbonate. Theoretically, these reactions afford a continuous process for the conversion of atmospheric nitrogen into ammonia—a process which, if it could only be worked on a large scale commercially, would doubtless be of immense value. Unfortunately, only small proportions of the substances employed appear to enter into the reaction at ordinary pressures, hence the yield is insufficient to render the process economical. Professor Hempel has now shown by means of a simple pressure apparatus that the reaction is very much more complete, and, when potash is used, very energetic, under a pressure attaining sixty atmospheres. His apparatus consists of a solid steel cylinder closed at one end, and stopped with a screw at the other. A connection is made by a pipe from a pressure pump, and a carbon electrode also enters, and is plunged into a mixture of carbon and the alkaline oxide or carbonate. The electrode is made red hot, and nitrogen is forced in until the desired pressure is obtained. This process is not, of course, commercial, but it indicates an advance in the actual synthesis of ammonia compounds.

The Proposed Three Americas Railway.

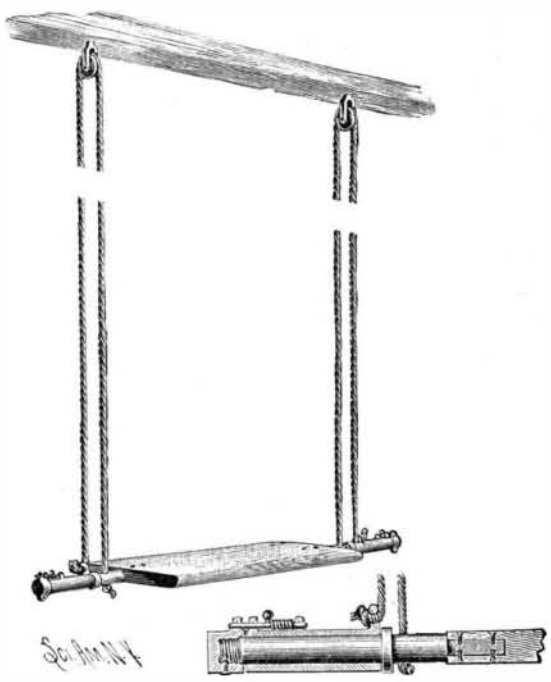
The grand scheme of a continuous intercontinental railway line connecting the countries of North, Central, and South America, which has been occasionally suggested for years past, only to be received by people generally as the dream of enthusiasts and not entitled to serious consideration, has within the last year or so assumed the aspect of a practicable and desirable enterprise of great magnitude, indorsed by the government of all the nations along the proposed route and already about to undergo the inspection of engineering science in order to obtain the necessary data for further action. The international American conference in session in Washington last year, representing eighteen different American governments, passed formal resolutions in favor of the construction of a railway connecting the nations represented, and recommending that each of the governments contribute a share toward the expense of preliminary surveys of the proposed line. The report of the conference on this subject was transmitted to Congress by President Harrison. Thus officially and favorably brought to the attention of the governments and people of the chain of nations along the American continent, the grand idea of an intercontinental railway has excited great and growing interest, and information in regard to it is eagerly received. It is required to build 4,300 miles.

The distance from New York to Buenos Ayres by land is about 9,000 miles. More than half of this distance is already covered by railways, and lines aggregating nearly 2,000 miles more are now being surveyed and constructed; so that the undetermined and doubtful portion of the great intercontinental railway seems to be reduced to something like 2,300 miles. As to the real practicability, from both an engineering and financial standpoint, of building such a line nothing can yet be said with positiveness, and the report of the corps of engineers which the different governments will unite in sending out must be awaited. At the best, its construction would mean a prodigious outpouring of money. One rough estimate suggests $300,000,000, or $75,000 per mile. How can the money be provided? Would the railway, if built, ever pay any return on the vast cost, bearing in mind the severe competition of the water routes? These are questions which may tend somewhat to check the enthusiasm which the thought of so wonderful a possible journey as one of 9,000 miles and more unbroken over American soil, through almost a score of nations, tends to inspire.—*Railway Age.*

A SWING READILY ADJUSTABLE FOR HEIGHT.

The illustration shows a swing which may be quickly altered as to its height to adapt the seat board to the use of adults or children. The swing has doubled ropes on each side passed over pendent pulley brackets, as shown, or ring eyes may be substituted for the brackets. To each end of the seat board is secured a short shaft, as shown in the sectional view, a sleeve being loosely held on each shaft, a short distance from the seat board, a collar on the shaft limiting the inward movement of the sleeve. One end of each rope is passed through the shaft, and secured in position by knotting the end, while the other end, the rope being passed over the pulley, is similarly secured to an ear on the sleeve. In ears projecting from the opposite end of each sleeve is a spring-pressed slide bolt adapted to engage lugs on cap nuts at the outer end of each shaft, and, in adjusting the height of the seat, these slide bolts are retracted, permitting the seat to be revolved, when the rope ends attached to the shaft are wound thereon, thus shortening the suspending ropes and raising the seat, which is lowered by reversing this operation.

Further information relative to this invention may



MILLER'S ADJUSTABLE SWING.

be obtained by addressing the patentee thereof, Mr. William K. Miller, Troy, Kansas.

Carbonic Acid in the Air during Fogs.

It is recorded in a local newspaper that recently, on the occasion of a particularly dense fog in Dundee and its neighborhood, a chemist attached to the University College took the opportunity of investigating the amount of carbonic acid in the atmosphere within the college grounds. The test was taken at 8 A. M., when the fog appeared to be at its thickest. At this time the proportion of carbonic acid in the air was 8 volumes in 10,000, or more than double the normal amount in the locality. It is remarked in the report of this experiment that, although the air in fog has often been analyzed before, the circumstance of the high proportion of carbonic acid present in the atmosphere under such conditions appears to be of peculiar interest, and the question is asked whether attention has been called to it. To this, says the *Journal of Gas Lighting*, the answer must be in the affirmative. If the air of a dense fog in Dundee only contains the stated maximum of carbonic acid, the people of this locality are very much better off than those condemned to breathe fogs in London or Manchester, where the maximum of the noxious gas named is at such times much higher. For the rest, an excess of carbonic acid is to be expected under the circumstances, from the stagnation of the air, which hinders the dispersion of the products of combustion and animal respiration.

A PHOTOGRAPHIC study of stellar spectra has been commenced at South Kensington under the direction of Prof. Lockyer, and one of the first results obtained was the discovery that α Lyrae is a binary star of the β Aurigae type.

Curative Use of Charcoal.

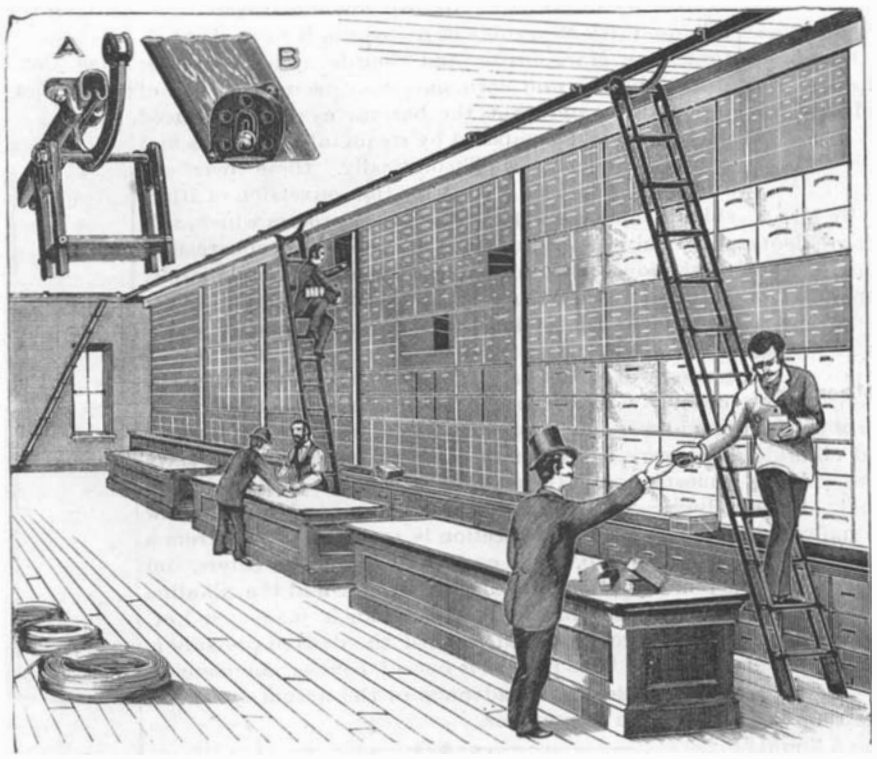
The Boston *Journal of Commerce* discourses thus on the uses of charcoal: Besides being valuable as fuel, it has other uses which make it one of the most serviceable of articles. When laid flat, while cold, on a burn, it causes the pain to abate; by leaving it on for an hour, the burn seems almost healed when the wound is superficial. Tainted meat surrounded with it is sweetened. Strewn over heaps of decomposed pelts or over dead animals, charcoal prevents unpleasant odors. Foul water is purified by it. It is a great disinfectant, and sweetens offensive air if placed in shallow trays around apartments. It is so very porous that it absorbs and condenses gases rapidly. One cubic inch of fresh charcoal will absorb nearly one hundred inches of gaseous ammonia. Charcoal forms an excellent poultice for malignant wounds and sores. In cases of what is called proud flesh it is invaluable. It gives no disagreeable odor, corrodes no metal, hurts no texture, injures no color, is a simple and safe sweetener and disinfectant. A teaspoonful of charcoal in half a glass of water often relieves sick headache. It absorbs the gases and relieves the distended stomach, pressing against the nerves which extend from the stomach to the head.

Headache Caused by Eyeache.

Eye strain should be the first throught suggested by any complaint of headache, says an intelligent writer in the *Times and Register*, for in our day and civilization it is by far the most common cause of that symptom. It enters as a factor into the causation of nearly all headaches not due to pyrexia, toxæmia or diseases of the brain or its membranes. The simple existence of headache, therefore, should suggest eye strain, but frequently a careful inquiry as to the manner and time of occurrence of the attack and the location of the severest pain will he almost conclusive as to the origin of the trouble. Often it comes on whenever the eyes are used, and is absent when the eyes have had a proper season of rest. The occasions of most severe requirement in the direction of eye work are the doing of anything requiring accurate near vision, taxing both the accommodation and the convergence, or traveling, shopping, attending at public gatherings, which entail more use of the eyes than the patient is at the time conscious of, and often under unfavorable conditions. In hyperopia in young people, the accommodation is in excessive use so long as the eyes are open and the attention fixed on any visible object, and hyperopia is the most common cause of constant headache. The writer was formerly subject to a constant headache whenever confined to the house, and regarded it as caused by breathing vitiated air, until it was quite cured by the correction of his hyperopic astigmatism. Many persons have the same idea as to the causation of the headaches they always experience when attending the theater or other places of public amusement, and which are really due to eye strain. Others ascribe these headaches, and those experienced in traveling and shopping, to exhaustion. This is nearer the truth, only they commonly have in mind a condition of general exhaustion, whereas it is largely one of local exhaustion of the special nervous apparatus concerned in the act of seeing. Congestion, irritability, or inflammation of the eyes and their appendages should always suggest the suspicion of eye strain. A single attack or manifestation of this kind has no special significance, but repeated attacks of inflammation, or prolonged congestion, or irritability are exceedingly suggestive of a continuing cause, and the most common of these is the one now under discussion. No case of chronic inflammation of the margins of the lids, or of recurring conjunctivitis, or repeated sties, has justice done to it until it has been carefully investigated for eye strain. Persons at the period when they begin to feel the effects of the loss of accommodation in presbyopia or absolute hyperopia suffer from repeated attacks of conjunctivitis, which they commonly ascribe to "taking cold in the eye," but which are cut short by use of the appropriate lenses, and which, if unchecked, would tend to establish a chronic catarrhal condition, which is a chief discomfort in the lives of many people. I should like, also, adds the editor of the *Times and Register*, in a recent issue, to call attention to car sickness in connection with eye strain. I have had eight or nine cases of this kind, all of which were relieved by glasses. One case was that of a gentleman who on every journey had car sickness. While he had the mydriatic in his eyes he went to Washington, and suffered no inconvenience whatever. Subsequently, after he had glasses, he made a trip to St. Paul without any of the former trouble. Recently I have had two cases—one that of a girl who could not ride a short distance in the street cars without vomiting. I found a decided degree of hyperopic astigmatism. With the mydriatic in her eyes she rode home without her usual trouble. A strange thing with reference to eye strain is that it often exists to an exceptional degree without showing any symptoms in the eye. The patient will often say that the eyes are perfectly good and have never caused any irritation. The reflexes seem to have settled in some other place. This is an interesting pathological and physiological question. Another writer says: "Sleep, if taken at the right moment, will prevent an attack of nervous headache. If the subjects of such headache will watch the symptoms of its coming, they can notice that it begins with a feeling of weariness or heaviness. This is the time that a sleep of an hour, or even two, as nature guides, will effectually prevent the headache. If not taken just then it will be too late, for after the attack is fairly under way it is impossible to get sleep till far into the night, perhaps. It is so common in these days for doctors to forbid having their patients waked to take medicine if they are asleep when the hour comes round, that the people have learned the lesson pretty well, and they generally know that sleep is better for the sick than medicine. But it is not so well known that sleep is a wonderful preventive of disease—better than tonic regulators and stimulants." Now if this scientific writer had only given us an infallible recipe for inducing this much desired sleep, what a boon he would have conferred on suffering millions!

A DEVICE FOR REACHING HIGH SHELVING.

A convenient manner of arranging a rolling step ladder, whereby high shelving is made accessible, is shown in the accompanying illustration. Attached to the steps at the top is a trolley having two small wheels adapted to run in a track secured to ceiling strips, as shown at A, the steps resting on the floor on rollers, whereby they may be easily propelled either way by one using them without coming down to the floor. The steps thus arranged are at the same distance from the shelves at both top and bottom, and can be raised from the floor and carried over obstacles when desired. The track is made in sections which can be easily put up by any one, and all the appliances for this patent store-step service are made by the Coburn Trolley Track Manufacturing Co., of Worcester, Mass. For further information and catalogue address A. L. D. Buxton, treasurer, Worcester, Mass.



THE COBURN TROLLEY TRACK FOR STEP LADDERS.

Natural History Notes.

Function of Tannin in Plants.—Dr. K. Bauer (in *Oesterr. Bot. Zeitsch.*) describes in detail the mode of occurrence of tannin in the following plants, chiefly in leaves, stem, root, and rhizome: *Iris pseudacorus*, *I. sibirica*, *Marica northiana*, *Ficus elastica*, *Ficus australis*, *Cyperus papyrus*, *Saururus cernuus*. It may occur either in the ordinary cells of the tissue or in specially formed cells—idioblasts. In the former case, it is often accompanied with starch or chlorophyl; in the latter case, it is always the sole content of the cell. As for the function of the tannin, it is clear that, in many cases, especially when stored up in the testa of the seeds, it serves to protect the part against the attacks of animals, and also as an antiseptic agent. The immense quantities in which it is stored up in the rhizome of *Iris pseudacorus* and *sibirica*, and especially in the spots where adventitious roots are about to be formed, appears to indicate that it is, at least in these cases, something more than a mere product of excretion, and is used up again in the process of metastasis.

Change of Flowers to Tubers.—Mr. C. A. Barber, in the *Annals of Botany*, describes a plant of *Nymphæa lotus* which shows great abnormality in the formation of its flowers. While the first formed flower buds were developing into the normal flowers, a further and very large development of buds took place; and these buds, which were of slow growth, were found to be curiously deformed. The sepals, which appeared as usual, were not followed in due course by petals and stamens, but were found to enfold a number of green leaves, with occasional buds in their axils, separated from one another, and almost concealed from view by a dense mass of long white hairs. This formation of foliage, instead of floral leaves, accompanied as it was with a swelling of the end of the axis of the flower, may be briefly described by saying that tubers were developed instead of flowers. The author characterizes the deformity as a case of chloranthy.

Sense of Smell in Star Fishes.—Mr. Pronho has made a number of experiments with one of the star fishes—*Asterias glacialis*. Some of these have shown him that when the animal is excited by a desire for food, the sensations which it obeys are perceived by the extremity of the arms; but others show that it is the sense of smell and not of sight that guides it to its food. The tentacles near the eye-like spot, which are useless for locomotion, were removed from a star fish, which, for a month or more afterward, never showed the least excitement in the presence of either living or dead food; the retention of the ocular spot makes no difference. It is clear, then, that the sense of smell is not diffused in star fishes, but is localized in the ambulacral tubes, which are unsuitable for locomotion, and are situated behind the eye spot.

Production of Spines in Dry Air.—In the *Bull. Soc. Bot. de France*, M. Lathelier gives the results of some experiments made to ascertain the conditions under which thorns and spines are produced. He grew young plants of *Berberis* and *Cratægus* in dry air and in moist air under otherwise similar conditions. He found that dry air, which retards the development of the soft tissues, promotes the growth of the hard tissues of which spines and thorns are formed.

Phosphorescent Centipedes.—That there are luminous myriopods has been known for many years, as also the fact that they occur only among the family *Geophilidæ* of the chilopod myriopoda. Both sexes are luminous, sometimes quite intensely so, and the luminosity spreads out over the whole ventral surface of the animal. If one of these geophilids is taken up, the luminous matter communicates to the hand of the observer, or to anything else with which the specimen comes into contact.

There is considerable dispute regarding the origin of this phosphorescent matter. According to Dr. R. Dubois, it is contained in the epithelial cell of the digestive tube, and the emission of the light depends on the moulting of the digestive tube. Mr. Mace, on the contrary, contends that the luminous matter is a glandular excretion, and that these glands (*glandes preanales*) are situated on the last two segments of the animal. Mr. J. Gazagnaire has satisfied himself that the luminous matter is secreted from glands situated on the sternal and episternal plates. Upon pressure these glands excrete a yellowish, viscous substance, having a peculiar odor, and which is highly phosphorescent.

In a more recent article (*Mem. de la Soc. Zool. de France*, v. iii., 1890, pp. 136–146), Mr. Gazagnaire reviews all previous observations on luminous geophilids, and finds that, so far as the European fauna is concerned, luminous specimens were found only between the end of September and beginning of November. The luminosity appears, therefore, only at a certain epoch in the life history of these myriopods. Further, in all more carefully recorded cases, luminous specimens were never found singly, but always in pairs or companies of three or more specimens. The few and fragmentary observations that have hitherto been made on the mode of reproduction in these animals seem to prove that the fecundation of the female takes place in autumn, or just at the time when the luminous specimens are found, and Mr. Gazagnaire is thus fully justified in connecting the appearance of luminosity with the excitement caused by sexual instinct.

In Algiers, Mr. Gazagnaire observed luminous specimens of *Orya barbarica* in the month of April, and he concludes that in other countries and in consequence of altered climatic conditions the period of luminosity probably differs from that observed in Europe.—*Insect Life.*

A TORPEDO net constructed of interlocking steel rings is soon to be put to a practical test.